

PROJECT MANUAL
INCLUDING CONSTRUCTION SPECIFICATIONS

for

BP-S00195
TERMINAL C, PHASE 1X – AIRSIDE CONCOURSE

CONTRACT DOCUMENTS

Volume 2 OF 7
(Divisions 02 – 08)

ORLANDO INTERNATIONAL AIRPORT

Orlando, Florida 32827



GREATER ORLANDO AVIATION AUTHORITY

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 73 29 "Cutting and Patching" for cutting and patching procedures.
 - 3. Section 01 74 19 "LEED v4 Construction Waste Management and Disposal" for demolition waste disposal.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Engineering Survey: Submit engineering survey of condition of building.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection and for dust control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

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

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

- d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least six hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "LEED v4 Construction Waste Management and Disposal".
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 74 19 "LEED v4 Construction Waste Management and Disposal".
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 01 74 19017419 "LEED v4 Construction Waste Management and Disposal".
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- B. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

END OF SECTION 02 41 19

SECTION 03 15 13 - WATERSTOPS

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 provides for an expanding hydrophilic waterstop as specified herein, illustrated on project drawings, or as required to complete the work to comply with waterproofing warranty requirements.
- B. System Description:
 - 1. Waterstop Strip: A non-Bentonite hydrophilic waterstop with a minimum swell as per Section 2.02
 - 2. Accessories for complete waterstop application
- C. Related Requirements:
 - 1. Section 03 30 00 "Cast-In-Place Concrete"
 - 2. Section 07 13 26 "Self-Adhering Sheet Waterproofing"

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.
- B. Shop drawings showing locations and extent of waterstop.
- C. Written documentation demonstrating Installers qualifications under the "Quality Assurance" article including reference projects of a similar scope.
- D. Samples: Submit representative sample of actual product.
- E. Warranty: Submit a sample warranty identifying the terms and conditions stated in Section 1.7.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Waterstop systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of building materials. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Installer Qualifications: A firm which has at least three (3) years experience in work for the type required by this section.

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- C. Material: Waterstop shall be by single source manufacturer and shall be specially engineered to be a swellable and conformable polyurethane/butyl blended rubber free of sodium bentonite that expands when in contact with water.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of surface preparation, installation procedures, special details, inspection, protection, and repair procedures.
- E. Concrete: Concrete shall be normal weight structural concrete and provide a minimum cover of 3" around waterstop.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in the original, unopened containers with seals unbroken, labeled with the manufacturer's name, product brand name and type, date of manufacture and directions for storage and use.
- B. Store and handle materials in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1. Store material off ground and keep dry.
 - 2. Provide cover for material to protect top and sides.
- C. Sequence deliveries to avoid delays, but minimize on-site storage.

1.6 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive waterstop.
- C. Do not allow waste products (i.e. petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, acids, etc.) to come into contact with the waterstop. Any exposure to foreign materials or chemical discharges must be presented to the Membrane Manufacturer to determine the impact on the waterstop performance.
- D. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- E. Construction Manager shall assure adequate protection during and after the application of the waterstop.

1.7 WARRANTY

- A. Provide written watertight warranty from the manufacturer that includes both labor and material for the below grade walls and the under slab waterproofing. The warranty to be issued by the membrane manufacturer upon completion of the work.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Refer to Section 07 13 26 "Self-Adhering Sheet Waterproofing" for additional warranty information.

PART 2 - PRODUCTS

2.1 WATERSTOPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies, Inc., Grace Adcor or comparable product by one of the following manufacturers.
 - 1. Henry Company
 - 2. JP Specialties, Inc.
 - 3. Sika Corporation
 - 4.

2.2 MATERIALS

- 1. Hydrophilic Waterstop Strip: swellable, conformable polyurethane/butyl blended rubber based material free of sodium bentonite.
- 2. Waterstop Physical Properties:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Examine conditions of substrates and other conditions under which this work is to be performed and notify the Architect, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not install waterstop onto any substrates with standing water.

3.3 INSTALLATION

- A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:

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1. Construction Joint:
 - a. On irregular concrete faces, apply a ½ in. Adhesive as bedding.
 - b. Secure waterstop using masonry nails 1½ in. - 2 in. (40 mm – 50 mm) long with a washer ¾ in. (20 mm) in diameter. Hilti EM6-20-12 FP8 shot fired fixings with ¼ in. (6 mm) nuts and ¾ in. (20 mm) diameter washers may also be used. Fixings should be spaced at a maximum of 12 in. (300 mm) centers with a minimum spacing that ensures proper contact to substrate.
 - c. waterstop joints should overlap a minimum of 4 in. (100 mm), ensuring full contact between jointed pieces.
 - d. waterstops can be bent around corners; however on complex geometry use manufacturer's approved Adhesive to fill any gaps.
 - e. Any damaged sections should be removed and repaired with a new section of waterstop.
 - f. Keep waterstop dry prior to pouring concrete.
2. Pipe Penetration:
 - a. Waterstop Adhesive must be applied to dry substrates only. Apply by brush to the substrate. Wait until surface is dry to touch, and then press waterstop firmly into place.
 - b. Waterstop joints should overlap a minimum of 4 in. (100 mm), ensuring full contact between jointed pieces.
 - c. Keep waterstop dry prior to pouring concrete.

3.4 CLEANING AND PROTECTION

- A. Protect membrane in accordance with manufacturer's recommendations until placement of concrete.
- B. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer's recommendations.

END OF SECTION 03 15 13

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. All cast-in-place concrete, incidental construction, and miscellaneous structural concrete items, in accordance with the Contract Documents.
 - 2. Providing services of testing laboratory to design concrete mixes.
 - 3. Furnishing, erecting, and removing forms, falsework, shoring, and bracing required for work under this Section.
 - 4. Furnishing, fabricating, and placing reinforcing bars and wire mesh reinforcing.
 - 5. Furnishing and placing joint materials.
 - 6. Furnishing and placing inserts required to be installed under this Specification Section and other Specification Sections.
 - 7. Finishing, saw cutting, and concrete repairs.
 - 8. Curing concrete.
 - 9. Cleaning concrete.
- B. Related Work Specified Elsewhere:
 - 1. Section 05 12 00 "Structural Steel"
 - 2. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.4 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- B. General: Submit the following in accordance with the Contract Provisions:
 1. Product Data: Submit product data for proprietary materials and items, including reinforcement, forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, vapor retarders and others as requested by the Architect.
 2. Include descriptive data, catalog cuts, laboratory test reports, and any other information necessary to show acceptable materials and confirm Contract compliance.
 3. Annotate data to show specific products to be used.
- C. Coordination Drawings: Submit original coordination drawings that identify the type and location of embeds, penetrations or other provisions required to execute the work of structural, architectural, plumbing, electrical or other trades. These items shall be located both by plan dimension and proposed elevation. Do not finalize shop drawings for reinforcement or formwork until the coordination drawings have been approved.
- D. Shop Drawings for Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
 1. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".
 2. Show bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.

- E. Shop Drawings for Formwork: Submit shop drawings for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that visually affect exposed concrete.
 - 1. Submit complete and accurate shop drawings as required to adequately illustrate and control the finished work. Show all dimensions, kind, type, and quality of all materials, applicable specification references, and all other information as may be necessary to detail finished construction of the work covered. Reproductions of the Contract Drawings are not acceptable as shop drawings.
 - 2. Shop drawings shall show walls in elevation and cross-section. Shop drawings shall show clear cover over reinforcing bars and interface with all columns, walls and beam/slab reinforcement.
 - 3. Shop drawings shall show locations of all embedded items.
 - 4. Submit details indicating contraction joints and joint sealers.
 - 5. Indicate materials utilized for sealing formwork joints and as a form release agent for coordination of subsequent coverings.
- F. Setting Drawings: Provide setting drawings and templates showing the location of all anchorage items that are to be cast into concrete.
- G. Concrete Mix Design Data: Not less than four weeks prior to the first concrete placement submit concrete mix design data to the Architect for review and approval. Mix designs shall be calculated and certified by the testing laboratory, and shall indicate the weight of each ingredient of the mixture, aggregate gradation, slump, air content, water-cement ratio and 7 day and 28-day compressive strength test results. Include a complete list of materials including admixtures and applicable reference specifications.
- H. Test and Inspection Reports: Provide reports as necessary to ensure that the tests and inspections specified have been executed.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates of Compliance: Submit manufacturer's certificates of compliance for the following materials showing that the named material conforms to the requirements of the Contract Documents. The manufacturer's certifications shall name the appropriate materials, the publication or publications specified as controlling the quality of that item, and shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificate of compliance, and having legal authority to bind the manufacturer. Furnishing certificates of compliance shall not provide relief of responsibility for providing materials that conform to the requirements of the Contract Documents.
 - 1. Aggregates.
 - 2. Admixtures.
 - 3. Reinforcement
 - 4. Cement.

1.6 QUALITY ASSURANCE

- A. Testing Service and Quality Control Testing During Construction: The **Contractor** will retain the services of a testing services to provide, plant testing, field sampling, in-place testing, and quality control testing required under the Contract Documents.
- B. The following requirements are intended to supplement GOAA's speciation 01 4529 Structural Testing and Inspection. Where conflict exist specification 01 4529 Structural Testing and Inspection shall govern.
- C. Materials' Laboratories: All mix design testing and material evaluation tests of the work specified in this Section shall be performed by independent, commercial testing laboratories employed under this Section and accepted by the Architect. The basis of acceptance includes the following:
 - 1. Laboratories performing work in connection with concrete materials shall conform to the requirements of ASTM E 329 and ASTM E 699.
 - 2. Provide proof that the laboratory satisfies the requirements of the American Council of Independent Testing Laboratories' Recommended Requirements for Independent Laboratory Qualification.
- D. Control of Material Uniformity: All cast-in-place concrete which is exposed to view shall not have the respective sources, brands, types, and/or grades of fine aggregate (sand), coarse aggregate, cement, and admixtures changed or switched after acceptance design mixes. Obtain concrete materials from one manufacturer for each cementitious component and from one source and producer for each aggregate component. Procure and store on site sufficient quantities of materials to cover all exposed concrete work to ensure color and texture match. If any doubt exists as to the timely availability of any material from designated sources, the Engineer shall be immediately informed, in writing, of the potential problem and of the action to be taken to guaranty the availability of such uniformly sourced materials.
 - 1. Cement and aggregate used for all surfaces exposed to public view shall be obtained from a single source and in such quantities to ensure sufficient materials are available to complete the entire project. Uniformity of color and texture for all concrete exposed to public view is a mandatory project requirement.
 - 2. Changes in the sources, types of materials, and/or proportions of materials shall not be made during construction until accepted and until the requirements for verification as specified herein have been satisfied and accepted by the Architect.
 - 3. Sampling of materials shall be performed in accordance with the standard methods of ACI, AASHTO, and ASTM.
 - 4. Materials shall be inspected at the original or intermediate source of supply. Inspection shall not diminish the responsibility to furnish materials that conform to the Specifications. The laboratory representative shall have ready access to all parts of any processing plant furnishing material for the Project. Access for

sampling and inspecting materials or plant equipment shall include secure, sturdy platforms conforming to local, state, and federal safety regulations.

E. Applicable Publications: The following publications listed below form a part of this Specification to the extent referenced.

1. American Association of State Highway and Transportation Officials (AASHTO) Publications:

M 182 Burlap Cloth Made From Jute or Kenaf

T 103 Soundness of Aggregates by Freezing and Thawing

2. American Concrete Institute (ACI) Publications:

207.1R Guide to Mass Concrete

211.1 Selecting Proportions for Normal, Heavy Weight, and Mass Concrete

211.2 Selecting Proportions for Structural Lightweight Concrete

213R Guide for Structural Lightweight Aggregate Concrete

214 Recommended Practice for Evaluation of Strength Test Results of Concrete

301 Specifications for Structural Concrete for Buildings

302.1R Guide for Concrete Floor and Slab Construction

304R Guide for Measuring, Mixing, Transporting and Placing Concrete

304.2R Placing Concrete by Pumping Methods

305R Hot Weather Concreting

308 Standard Practice for Curing Concrete

309R Guide for Consolidation of Concrete

315 Manual of Standard Practice for Detailing Reinforced Concrete Structures

318 Building Code Requirements for Reinforced Concrete

347R Guide to Formwork for Concrete

3. American Society for Testing and Materials (ASTM) Publications:

A 36 Structural Steel

A 185 Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement

A 307 Carbon Steel Bolts and Studs

A 563 Carbon and Alloy Steel Nuts

A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A 775 Epoxy Coated Reinforcing Bars

B 633 Electrodeposited Coatings of Zinc on Iron and Steel

C 31 Making and Curing Concrete Test Specimens in the Field

C 33 Concrete Aggregates

C 39 Compressive Strength of Cylindrical Concrete Specimens

C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C 78 Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C 94 Ready-Mixed Concrete
C 143 Slump of Portland Cement Concrete
C 150 Portland Cement
C 171 Sheet Materials for Curing Concrete
C 172 Sampling Freshly Mixed Concrete
C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method
C 192 Making and Curing Concrete Test Specimen in the Laboratory
C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations
C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
C 260 Air-Entraining Admixtures for Concrete
C 494 Chemical Admixtures for Concrete
C 496 Splitting Tensile Strength of Cylindrical Concrete Specimens
C 567 Unit Weight of Structural Lightweight Concrete
C 641 Test Method for Staining Materials in Lightweight Concrete Aggregates
C 881 Epoxy-Resin-Base Bonding Systems for Concrete
D 1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D 1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
E 154 Methods of Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces
E 329 Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction
E 699 Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance and Evaluation Building Components in Accordance with the Test Methods Promulgated by ASTM Committee E-6

4. American Welding Society (AWS) Publications:

- a. D1.1 Structural Welding Code--Steel
- b. D1.4 Structural Welding Code--Reinforcing Steel

5. Concrete Reinforcing Steel Institute (CRSI) Publication:

F. Placing Reinforcing Bars

1. Federal Specification (FS) Publication:

FF-S-325 Shield Expansion, Nail Expansion, and Nail, Drive Screw (Devices Anchoring, Masonry)

2. U.S. Army Corps of Engineers (COE) Waterways Experiment Station Publications:

CRD-C-572 Corps of Engineers Specification for Polyvinyl Water-stops

CRD-C-621 Handbook for Concrete and Cement, Specification for Nonshrink Grout, Volume II (1949 Ed.)

3. U.S. Department of Commerce Product Standard (PS):
PS 1 Construction and Industrial Plywood
4. The Florida Building Code latest edition
- G. Modification of Applicable Publications: In the ACI and other publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had substituted for "should" wherever it appears; reference to the "authority having jurisdiction", "Building Official", the "Structural Engineer", and the "Architect/Engineer" shall be interpreted to mean the Architect.
- H. Mock-up: Mockups: Before casting concrete in above grade column construct a mockup to illustrate color and finish of work that will be exposed to public view. Build mockup to comply with the following requirements, using materials indicated for the completed Work: Also refer to specification 01 4339 Visual Mock-up Requirements.
 1. Mockup shall consist of a 3'-0"x3'-0"x10" panel located within 10 feet of the proposed column. (LST, east side)
 2. Mockup shall be completed not less than 45 days prior to the proposed date for placement of concrete column.
 3. Mockup shall be finished to a class A finish as specified elsewhere in this section.
 4. Concrete for the mockup shall be placed with sufficient time for curing to allow the concrete to reach specified minimum compressive strength before applying the abrasive blast finish.
 5. Do not proceed with placement of concrete for column until the mockup has been approved by the architect.
 6. The accepted mockups shall become the standard for judging acceptability of all concrete surfaces that will be exposed to public view.
 7. Following acceptance of the finished column by the architect, remove the mockup from the project site and legally dispose of it.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project Site in original unopened and undamaged containers plainly labeled with manufacturer's name, product name and designation, expiration period for use, mixing instructions for multi-component materials, and other pertinent data. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, and other causes.
- B. Product handling shall comply with the applicable requirements of ACI 301, Chapter 2, Paragraph 2.5. Reinforcing bars and accessories shall be stored above the ground on

platforms, skids, or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration.

- C. Damaged or non-conforming materials shall be removed from the Project site and replaced with new materials satisfactory to the Architect at no additional cost to the Owner.

1.8 ENVIRONMENTAL CONDITIONS

- A. Hot Weather Concreting: Comply with ACI 305R.
- B. Inclement Weather: Under conditions of rain, the placing of concrete shall not commence unless adequate protection is provided to prevent damage to the surface mortar or damaging flow or wash of the concrete surface. During inclement weather conditions concrete shall be provided with adequate protection to prevent damage.

1.9 PROJECT CONDITIONS

- A. Protection Against Spatter: Protect adjacent work, construction, and materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. General: Furnish all forms required or necessary to ensure that completed work is in accordance with the Contract Documents.
 - 1. Responsibility for selection of proper form materials, for acceptable construction, alignment, and support of forms, and for proper wetting and precoating of forms, shall rest with Contractor.
 - 2. Forms shall be furnished in the largest practicable sizes to minimize the number of joints and to conform to the joint system shown on the Contract Drawings or accepted on the approved shop drawings.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings or accepted on approved shop drawings.
 - 1. Plywood Form Material: Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

- D. Form Release: Provide commercial formulation form-release compounds with a maximum VOC of 350 mg/l that shall not bond with, stain, or adversely affect concrete surfaces.
- E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. For securing forms where surfaces will be exposed in the finished work, use tie screws with removable plastic cones, removable bolts, special removable ties, or series 300 stainless steel snap ties. For all other forms, use bolts or other approved ties.
 - 1. Provide units that shall not leave any metal closer than 1-1/2 inches to finished exposed surface.
 - 2. Provide ties that, when removed, shall not leave holes larger than 1-inch diameter in concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars:

- 1. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- 2. Reinforcing Bars: ASTM A 615, Grade 60
 - a. Fabrication tolerances shall conform to ACI 315, Paragraph 4.3.
- 3. For slab reinforcement, AASHTO M 31 M grade 420, epoxy coated.
- 4. Welded Wire Fabric: ASTM A 185, for interior; and ASTM A 884, Class A for exterior concrete.
- 5. Supports for Reinforcement: Provide bolsters, chairs, spacers, and other devices required for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.
 - a. Use wire bar type supports complying with CRSI specifications.
 - b. Provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2), for exposed to view concrete surfaces, where legs of support are in contact with forms.

B. Fiber Reinforcement:

- 1. Synthetic Fiber: Provide fiber reinforcement for composite slab and wearing surface Fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C1116, Type III, 1" to 2" long. Provide one of the following or approved equal:
 - a. "Tuf-strand SF"; (Euclid Chemical Company)
 - b. "Fibermesh 650"; (Propex Operating Company)
 - c. "Grace Fibers"; (WR Grace & Co.)

2.3 CONCRETE MATERIALS

- A. **Regional Materials:** Concrete shall be manufactured within 100 miles of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. **Cementitious Materials**
1. **Portland Cement:** ASTM C 150, Type I or II.
 - a. Use one brand of cement throughout Project, unless otherwise acceptable to the Architect. The alkali content shall not exceed 0.6 percent unless the manufacturer certifies that no alkali reactivity is produced with the proposed combination of materials when tested in accordance with ASTM C 227.
 - b. Cement shall be a standard brand and shall meet the approval of the Architect.
 - c. Cement, to be acceptable, shall be of a well-known brand which has been in successful use for large engineering works in the United States of America for at least 10 years, and which has an established reputation for uniform character, and which, by their records, show a tendency to maintain high strength of mortar with increased age.
 2. **Fly Ash:** ASTM C 618, Class F, 20% maximum by weight.
 3. **Slag Cement:** ASTM C 989/C 989M, Grade 100 or 120, 25% maximum by weight.
 4. The contractor shall provide a minimum of 10% by weight fly ash or slag in all concrete mix designs.
- C. **Normal Weight Aggregates:** Unprocessed pit-run or naturally mixed aggregates will not be permitted. Naturally mixed aggregates must in every case be screened and washed, and all fine and coarse aggregates shall be stored and handled as specified herein. Use aggregate from the same source for all Class A concrete to ensure consistency in color.
1. **Fine Aggregate** shall be natural sand or stone screenings, or a combination thereof. All fine aggregate shall conform to the requirements of ASTM C 33, except as modified herein, and shall be graded within the limits specified in Table 1.

TABLE 1 - GRADATION FOR FINE AGGREGATE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
3/8 inch	100
No. 4	95 - 100
No. 16	45 - 80
No. 30	25 - 55
No. 50	10 - 30
No. 100	2 - 10

2. Blending of manufactured sand fractions, manufactured sand and natural sand, or of two natural sands, when required to meet the gradation requirements or to obtain workable mixes, shall be performed at the batch plant.
3. The amount of deleterious substances in fine aggregate, each determined independently on samples complying with the grading requirements, shall not exceed the limits listed in Table 2.

TABLE 2 - DELETERIOUS SUBSTANCES-FINE AGGREGATE

Item	Maximum Percent by Weight
Clay Lumps	1.00
Shale	1.00
Coal and Lignite	.25
Materials Finer than No. 200	3.00
Total Combined Deleterious Substances	5.00

4. In addition to the requirements of ASTM C 88, the sodium sulphate soundness test, provide evidence, satisfactory to the Architect that the fine aggregate has been exposed to natural weathering, either directly or in concrete, for a period of

at least 5 years without appreciable disintegration. In the case where new sources are recently developed, at the option of the Architect, the service requirement may be waived and the aggregate shall be subjected to testing under the provisions of AASHTO T-103, "Soundness of Aggregates by Freezing and Thawing". If the weighed percentage of loss at the end of 50 cycles does not exceed 10 percent, the fine aggregate shall be accepted as pertains to soundness requirements.

5. Coarse Aggregate shall be crushed stone or gravel conforming to the requirements ASTM C 33 size #57 or 67.
 - a. The amount of deleterious substances in coarse aggregate, each determined on independent samples complying with the designated grading requirements, shall not exceed the limits specified in ASTM C 33.
 6. Water: Natural, drinkable, with no pronounced taste, odor, impurities, suspended particles, or dissolved natural salts in quantities detrimental to reinforcing or concrete.
- D. Water-Reducing Admixture: ASTM C 494, Type A, except as modified by applicable local code requirements of the authority having jurisdiction. Structural concrete shall contain a water reducing (plasticizing) admixture. Subject to compliance with requirements, provide one of the following products:
1. "Eucon WR-75" (Euclid Chemical Co.).
 2. "Pozzolith 200N" (Master Builders Co.).
 3. "Plastocrete 161" (Sika Chemical Corp.).
 4. Or approved equal
- E. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions. Subject to compliance with requirements, provide one of the following products:
1. "Daratard-17"; W.R. Grace.
 2. "Plastiment"; Sika Chemical Co.
 3. "Pozzolith Retarder"; Master Builders.
 4. Or approved equal

2.4 RELATED MATERIALS

- A. Concrete Topping Materials: Where applied concrete slopes to drain are indicated provide one of the following products or approved equal. Mixing and application shall be in strict accordance with manufacturer's written instructions. Products may be extended if permitted by the manufacturer.
1. SikaTop 122 Plus, Sika Corporation
 2. Master Emaco t 302, BASF Corporation
 3. TammsPatch II, Euclid Chemical Company

- B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- C. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. Polyethylene-coated burlap.
- D. Expansion/Contraction Joint Filler: ASTM D 1751 or ASTM D 1752, 1/2-inch thick, unless otherwise indicated.
- E. Expansion Anchors: Expansion anchors shall be stud type with a single piece three-section wedge and zinc plated in accordance with ASTM B 633. Anchors shall meet the description requirements indicated in Federal Specification FF-S-325, Group II, Type 4, Class I for concrete expansion anchors.
 - 1. Anchors shall be Hilti Kwik Bolt TZ as supplied by Hilti Fastening Systems or approved equal.
 - 2. Anchors shall be installed in holes drilled with Hilti, or approved equal, carbide tipped drill bits.
 - 3. Anchors shall be installed per manufacturer's recommendations.
- F. Nuts and Washers: ASTM A 563.
 - 1. Nut heads shall be hexagonal.
- G. Non-Shrink, Non-Metallic Grout: Factory pre-mixed grout product complying with U.S. Army Corps of Engineers Handbook CRD-C-621. Subject to compliance with requirements, provide one of the following:
 - 1. "Euco-NS"; Euclid Chemical Co.
 - 2. "Five Star Grout"; U.S. Grout Corp.
 - 3. "Set Grout"; Master Builders.
 - 4. Or approved equal
- H. Chemical Dustproofers and Hardeners: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicate per gallon. Subject to compliance with requirements, provide one of the following products:
 - 1. "Burk-O-Lith"; The Burke Company
 - 2. "Masterplate 200"; Master Builders
 - 3. "Lapidolith"; Sonneborne-Rexcord.
- I. Epoxy Bonding Compound: ASTM C 881, Type V for load bearing applications, Grade 1, Class A (if placement temperature is below 40 degrees F); Class B (if placement temperature is between 40 and 60 degrees F); or Class C (if placement temperature is above 60 degrees F). Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces.
- J. Steel plates shall conform to ASTM A36.

- K. Stud welding shall conform AWS D1.1.
- L. VAPOR RETARDERS
 - 1. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 MIL. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 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) Poly-America, L.P.
 - 2) Stego Industries, LLC.
 - 3) W. R. Meadows, Inc.

2.5 PROPORTIONING AND DESIGN OF MIXES

- A. Preparation of Design Mixes: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
- B. Mix Design Reports: Submit written reports to the Architect of each proposed mix for each class of concrete at least 28 days prior to the first concrete placement. Do not begin concrete production until proposed mix designs have been reviewed by the Architect. Review by the Architect shall not be deemed to relieve any obligation to provide cast-in-place concrete in accordance with the Contract Documents.
- C. Design of Mixes: Design mixes to produce concrete of proper workability, durability, strength, maximum density, minimum shrinkage, and permeability. Assume full responsibility for the strength, consistency, water-cement ratio, and handling of concrete.
 - 1. Design mixes to have minimum water content per cubic yard of concrete, cement content corresponding to appropriate water-cement ratio, largest permissible maximum size specified of coarse aggregate available, and optimum percentage of fine aggregate.
 - 2. Use water-cement ratio in accordance with ACI 211.1 and ACI 211.2 as determined by type of structure and exposure conditions, or 0.45 by weight, whichever is less, as approved and supplemented or modified as specified herein.
 - a. Water-cement ratio shall not exceed 0.40 by weight for concrete to receive a Class A finish.
 - 3. Trial mixtures shall be made based on at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified below. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. For

each strength of concrete the maximum allowable water-cement ratio shall be that shown by these curves to produce the strength specified.

4. The concrete used in the work shall be produced using a water-cement ratio corresponding to a point on the strength vs. water-cement ratio curve representing a strength, at the design slump, in accordance with ACI 318 or at least 25 percent higher than that indicated or specified, whichever is greater. When the Contractor demonstrates to the satisfaction of the Architect that his quality control warrants a change in the 25 percent factor, a change will be permitted. However, in no case shall the concrete strength used in construction be less than 15 percent higher than that specified or indicated.
5. The approved laboratory prepared mix design proportions shall govern during the progress of the work. If concrete having the required consistency cannot be produced without exceeding the maximum allowable water-cement ratio, the cement content shall be increased so the maximum allowable water-cement ratio is not exceeded.
6. Use approved chemical admixtures, air-entraining admixtures or suitable combinations thereof to improve workability, as well as to reduce water and cement content or minimize shrinkage and permeability of concrete, provided such admixtures do not adversely affect other specified properties of concrete.
7. Admixtures shall be added within a limit of accuracy of 3 percent and dispensed to the mixing water by means of an approved, graduated, transparent measuring device before they are introduced into the mixer. If more than one admixture is to be used, they shall be released into the mixing water in sequence rather than at the same instant. Once established, the sequence of dispensing admixtures shall not be altered. Admixtures shall be used in accordance with the manufacturer's recommendations. However, when the amount of admixture required to give the specified results deviates appreciably from the manufacturer's recommended dosage, use of the material shall be discontinued.
8. Adjust the consistency of concrete mixes to allow for specific placing conditions. Measure materials for concrete by weighing. Separately weigh cement and each size of aggregate, each accurate within 1%. Cement in sacks of ninety-four pounds need not be weighted. Weigh bulk cement and fractional packages. Measure mixing water by volume, and within 1 percent of quantity required.

D. Design Mixes:

1. Concrete for Cast in Place Concrete Pile Caps, Grade Beams and Slabs on Grade: Design mixes to provide normal weight concrete with a minimum of 4000 psi compressive strength at 28 days.
2. Lightweight Concrete: Proportioning, mixing, transporting, placing, finishing, and curing of lightweight concrete shall conform to the applicable requirements for normal weight concrete, together with the additions and modifications specified herein.
 - 1) Use lightweight aggregates for lightweight concrete in accordance with ACI Standards 211.2. and 213 R.
 - 2) Concrete on metal decking shall be lightweight concrete having a minimum compressive strength of 4000 psi at 28 days and shall have 5 lbs/cy

- fiber reinforcement. Maximum unit weight at 28 days shall be 115 lbs/cf. Air content shall be 4%-7%.
- 3) Proportioning, mixing, transporting, placing, finishing, and curing shall be as recommended by the lightweight concrete producer.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by the Architect.
1. Laboratory test data for revised mix design and strength results shall be submitted to and accepted by the Architect before using in work.
- F. Admixtures: Use water-reducing admixture in concrete as required for placement and workability.
1. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
2. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
3. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits.
4. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Slabs and Sloping Surfaces: 3" +/- inches prior to admixtures.
2. Other Concrete: 4" +/- inches prior to admixtures.

2.6 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, supplemented and amended as specified herein.
1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. Discharge the concrete completely at the site within 1-1/2 hours after the introduction of the cement to the aggregates. Reduce this time limit in hot weather to prevent stiffening of concrete until after it has been placed. Begin the mixing operation within thirty minutes after the cement has been intermingled with the aggregates.
2. Ready-Mix Concrete Delivery Tickets: Before unloading at the site, provide a delivery ticket from concrete supplier with each batch delivered to the site bearing the following information:
- a. Name of supplier.
- b. Name of batching plant and location.
- c. Serial number of ticket.
- d. Date.
- e. Truck number.

- f. Specific job designation, location, complete Project Name, and ProjectNumber.
 - g. Volume of concrete in cubic yards.
 - h. Class and type of concrete.
 - i. Time loaded.
 - j. Type and brand of cement.
 - k. Weight of cement.
 - l. Maximum size of aggregates.
 - m. Source of aggregates.
 - n. Type of aggregate.
 - o. Weight of coarse aggregate.
 - p. Weight of fine aggregate.
 - q. Maximum amount of water to be added and amount of water added at the site.
 - r. Kind and amount of admixtures.
 - s. Mix design designation,
 - t. Signature of a certified plant batcher, or a certified plant concrete technician, or a responsible officer or other authorized employee of the concrete supplier.
- B. Batch Mixing at Site: Comply with ACI 301, Chapter 7, Paragraph 7.2, supplemented and amended as specified herein.
 - 1. Excessive mixing, requiring the addition of water to preserve the required consistency shall not be permitted. Mix concrete to a consistency which can be readily placed without segregation. Where admixtures are specified, equip mixers with a device for measuring and dispensing the admixture.
 - a. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, amount of water introduced, revolution counter readings, aggregate dial settings, the class of concrete delivered, and mixer operator's signature.
 - b. Delivery tickets shall also indicate the strength of the concrete being delivered, the type of coarse aggregate (i.e. lightweight or stone) and, the exact time the cement and aggregate were discharged into the delivery truck, and a list of admixtures.
- C. Hand-Mixed Concrete: Hand-mixed concrete is not allowed.
- D. Retempering: Comply with ACI 301, Chapter 7, Paragraph 7.5. The following are in addition to requirements specified in ACI 301, Chapter 7, Paragraph 7.5. Retempering concrete by adding water or by other means will not be permitted except when concrete arrives at the project with slump below that suitable for placing. Water may be added only if neither the accepted mix design water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Such water addition shall be acceptable to the Architect and shall be performed under the supervision and sanction of the Testing Laboratory.

1. Concrete that becomes non-plastic, unworkable, or outside of the limits of the slump specified shall not be used. Concrete which has set shall be discarded and shall not be retempered.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. A pre-installation meeting shall be held.
 1. Prior to the commencement of any work under this Section, and when directed by the Architect, meet at the Project Site to review installation and coordination procedures. Among other topics, the coordination meeting shall address scheduling, method and sequence of concrete construction, standard of workmanship, material selection, testing and quality control requirements, detailed requirements of design mixes, placement procedures, off-site batching requirements, coordination of the Work with other trades, preparation of surfaces contiguous with this work, adjacent construction, and interferences, if any. This meeting shall be attended by any and all trades, manufacturer's representatives, and other interested parties whose work will be affected by the execution of the work under this Section.

3.2 FORMS

- A. Formwork: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Forms shall be well constructed, carefully aligned, substantial, firm, securely braced and fastened together in their final position and set to give the finished structure the specified camber, plus allowance for shrinkage and settlement. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction complying with ACI 347R. Tolerances shall conform to ACI 301, Paragraph 4.3, unless otherwise indicated or specified.
 1. Hydraulic Pressure: Design forms, studs and wales to limit deflections between supports to 1/360th of the span. All joints, gaps and apertures in forms, wherever located shall be gasketed, plugged or sealed with a suitable material so that they will withstand the full concrete hydraulic pressure and remain watertight.
 2. Tolerances and Finish Lines: Position formwork to maintain hardened concrete finish lines within the following permissible deviations:
 - a. Variation from Plumb
 - 1) In any 10 ft.: 1/4 in.
 - 2) In 40 ft. or more: 1/2 in.
 - 3) Cross-Sectional Dimensions: Minus 1/8 in., Plus 1/4 in.
 - 4) Surface Tolerances: Maximum offset between butt joints of individual or ganged forms: +/- 1/32 in.
 - b. Variation from Building Line: Variation of the linear building lines from established position to plan and related position of columns and walls:
 - 1) In any 10 ft.: 1/4 in.
 - 2) In 40 ft. or more: 1/2 in.

- c. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials. Prying against the face of the concrete will not be permitted. Only wooden wedges shall be used.
- d. Forms shall be strong enough to prevent fresh concrete from bulging the forms between supports and to withstand the action of mechanical vibrators. Provide for openings, offsets, sinkages, keyways, recesses, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in work.
- e. Position Tolerances: For cast-in items measured from datum line locations as shown on reviewed shop drawings:
 - 1) Blockouts and Reinforcements: Within 1/4 in. of position shown on shop drawings, where such positions have structural implications or affect concrete cover; otherwise within plus or minus 1/2 in.
 - 2) Anchors and Inserts: Within 3/8 in. of centerline location.
- 3. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
- 4. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- 5. Exposed joint edges and external corners shall be chamfered a minimum of 3/4-inch, unless otherwise specified or indicated. Where new concrete abuts existing concrete, match existing chamfers. Use wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- 6. In long spans, where intermediate supports are not possible, the anticipated deflection in the forms due to weight of fresh concrete shall be accurately figured and taken into account in the design of the forms, so that finished concrete members will have true surfaces conforming accurately to required lines, planes, and elevations.
- 7. Bolts and rods used for temporary internal form ties shall be so arranged that when the forms are removed, all metal will be not less than 1-1/2 inches from any finish concrete surface. Wire ties will not be permitted. The design of form ties shall be subject to the approval of the Architect.
- 8. Where shoring bears on ground, spread load from shores by suitable mud sills in order to prevent settlement. Where height of shores exceed ten feet, provide adequate diagonal bracing in both longitudinal and transverse directions. In addition, provide adequate diagonal braces at end of framework. Diagonal bracing shall extend from top to bottom of shores. Unbraced length of wood shores supporting forms shall not exceed fifty times least dimension.
- 9. Strike off concrete at top of forms and screed with wood to a float finish.
- B. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

- C. Rustication Strips: Mill rustication strips smooth to avoid protruding splinters which may become embedded in the concrete.
- D. Construction Joints: Construction joints shall be at locations shown or as approved on Shop Drawings. Remove loose material from the surface prior to the erection of forms. The formwork for the succeeding lift shall be held tight against the top of the previous lift and gasketed or caulked to prevent leakage.
- E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed as necessary to obtain the smooth surfaces required. Retighten forms and bracing before concrete placement so as to prevent mortar leaks and maintain proper alignment.
- F. PREPARATION OF FORM SURFACES
 - 1. Clean re-used forms of concrete matrix residue in accordance with ACI 301, Paragraph 4.4, repair and patch as required to return forms to acceptable surface condition.
 - 2. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.
 - 3. Moisten wood forms immediately before placing concrete where form coatings are not used.
 - 4. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete shall be placed. Apply in compliance with manufacturer's instructions.
 - 5. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.3 VAPOR-RETARDER INSTALLATION

- 1. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
- 2. Lap joints 6 inches and seal with manufacturer's recommended tape or per manufacturer's recommendations.

3.4 PLACING REINFORCEMENT

- A. CRSI Requirements: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Placing tolerances shall comply with ACI 301, Chapter 5, Paragraph 5.6. When splices not shown on the Drawings are approved by the Architect, such splicing shall conform to ACI 318.

2. Place reinforcing bars having assigned positions so that they agree with those given on the shop drawings relating to or calling for the bars.
 3. Secure reinforcing bars in place with high-density plastic supporting and spacing devices and metal tying devices. Reinforcing in concrete members that have one or more surfaces exposed, whether painted or unpainted finish, shall be tied with 14 gage soft annealed galvanized wire. Uncoated tie wire in exposed members shall not be accepted.
 4. Restore damaged bars to full capacity in accordance with CRSI requirements and in a manner acceptable to the Architect.
- B. Cleaning Reinforcement: Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Positioning, Supporting, and Securing Reinforcement: Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required and approved by the Architect. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Comply with ACI 301, Paragraph 5.
- D. Installation of Welded Wire Fabric: Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least two full mesh and lace splices with wire or a min of 8 inches. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Expansion Joints: Expansion joints shall be provided as indicated on the Contract Drawings. Unless otherwise shown, do not extend reinforcement or other embedded metal items through any expansion joints. Expansion joints shall be provided with premolded fillers and waterstops where shown.
- B. Contraction Joints: Provide horizontal contraction joints in slabs by soft cutting, and in walls by formed or saw cutting to the indicated depth after the surface has been finished. Sawed joints in horizontal surfaces shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.
- C. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength. Joints shall be provided by placing concrete in alternate pours not sooner than 24 hours of the placing of contiguous members. Waterstops shall be provided where indicated.
1. Provide keyways at least 1-1/2 inches deep, unless otherwise shown, in construction joints in walls and slabs and between walls and footings.
 2. Unless otherwise indicated, place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.

- D. Bonding Construction Joints: Bonding of construction joints shall conform to the requirements specified. In joining fresh concrete to set concrete, the work already in place shall have its surface roughened thoroughly. All loose and foreign material shall be removed. The surface shall be washed and scrubbed with wire brooms when necessary to remove substances that will interfere with bonding. Concrete of the preceding placement shall be thoroughly wetted prior to placement of the next unit of fresh concrete.

3.6 INSTALLATION OF EMBEDDED ITEMS

- A. Setting Anchorage Devices: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.
- C. Embedded Steel Items: Insure that all required steel members required to be cast into concrete are properly placed and secured. In particular, coordinate the work with Section 05500, "Metal Fabrications" and drawing details.

3.7 CONCRETE PLACEMENT

- A. General: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", supplemented and amended as specified herein.
 - 1. Do not place concrete when sun, heat, wind, or limitations of facilities shall prevent finishing and curing.
 - 2. Deposit concrete as closely as possible to its final position to avoid rehandling. Deposit concrete continuously or in layers of such thickness that no concrete shall be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 3. Force the concrete under and around the reinforcement without displacement. Avoid jarring the forms or placing any strain on the ends of projecting reinforcement after the concrete has taken its initial set.
 - 4. Do not place concrete which has attained initial set. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 75 minutes if the air temperature is between 85-90 degrees F. Further reduce mixing and placement time to 60

- minutes when the air temperature is above 90 degrees F. Retempering of concrete which has partially set is prohibited.
5. Cast-in-place concrete shall not be mixed, placed, or finished without sufficient natural light or an adequate and accepted artificial lighting system. Do not place concrete when weather conditions detrimentally affect the quality of finished work.
 6. When placing operations would involve dropping the concrete more than 5 feet, the concrete shall be dropped through a tube fitted with a hopper head, or through other approved devices, as necessary to prevent segregation of the mix and spattering of mortar on forms above the elevation of the lift being placed.
- B. Preparation Before Placing: Conform to ACI 301, Chapter 8, Paragraph 8.1, and as specified.
1. Apply temporary protective covering to lower 24 inches of finished work and guard against spattering during placement.
 2. Clean mixer thoroughly prior to batching all concrete. Load truck mixers at only the capacity which will ensure a uniform batch at the slump specified. In the event that mixing in any truck mixer is not uniform, the truck load will be rejected and shall not be used on the Project.
 3. Handle concrete from the mixer to the place of final deposit as rapidly as practical by methods which prevent separation or loss of the ingredients.
 4. Clean transporting and handling equipment at frequent intervals and flush thoroughly with water before and after each day's run.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309, supplemented and amended as specified herein.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators 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 set. Limit duration of vibration at each insertion to time necessary to consolidate concrete and to complete embedment of reinforcement and other embedded items without causing segregation of mix.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Maintain reinforcing in proper position during concrete placement.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- E. Hot-Weather Placing: Place concrete in compliance with ACI 305 and as herein specified when hot weather conditions exist that would impair quality and strength of concrete.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 95 degrees F. Mixing water may be chilled, or chopped ice may be used to control temperature provided, that when ice is used it shall be added with the water and counted as part of the water-cement ratio.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature shall not exceed the ambient air temperature immediately before embedment in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
 4. Use water-reducing retarding admixture when required by high temperatures, humidity, or other adverse placing conditions, when acceptable to the Architect.
- F. Conveying:
1. Comply with ACI 301, Chapter 8, Paragraph 8.2. and ACI 304R.
 2. Provide a spout or downpipe and elephant trunk or other appropriate method to prevent concrete from falling freely through a height greater than 5 ft. Free fall in walls and columns shall not exceed 15 ft.
 3. Pumping: ACI 304R and ACI 304.2R. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. Minimum size of pipe diameter shall be 5 inches. Rapid changes in pipe sizes shall be avoided. Maximum size of coarse aggregate shall be limited to 33 percent of the diameter of the pipe. Maximum size of well rounded aggregate shall be limited to 40 percent of the pipe diameter. Samples for testing shall be taken at both the point of delivery to the pump and at the discharge end.
 4. Placing concrete by pumping will be permitted only when authorized by the Architect. Equipment shall be arranged such that no vibrations that might damage freshly placed concrete will occur. Equipment shall be thoroughly cleaned prior to use. The operation of the pump shall be such that a continuous stream of concrete without air pockets is delivered. If concrete remaining in the pipe line is to be used, it shall be ejected in such a manner that there will be no contamination of concrete or separation of ingredients.
- G. Vibration: Conform to ACI 309. Concrete shall be thoroughly consolidated during and immediately following placement. Consolidation shall be accomplished by mechanical vibration subject to the following provisions:
1. Vibration shall be internal to the concrete but not applied directly to reinforcement or formwork.
 2. Vibrators shall be per ACI 309R

- a. Vibrators used to consolidate concrete containing epoxy-coated bar reinforcement shall have a resilient covering to prevent damage to such reinforcement.
- b. The intensity of vibration shall visibly affect a mass of concrete over a radius of at least 18 inches.
- c. Provide a sufficient number of vibrators to consolidate each batch immediately after it is placed in forms.
- d. Vibrators shall be manipulated to work concrete thoroughly around reinforcement and embedded fixtures and into corners and angles of forms.
- e. Vibration shall be applied at the point of deposit and in the area of the freshly placed concrete.
- f. Vibrators shall not be pulled through concrete and shall be inserted, withdrawn slowly and maintained nearly vertical at all times.
- g. Vibration shall be of sufficient duration and intensity to consolidate concrete thoroughly but shall not be continued so as to cause segregation.
- h. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.
- i. Application of vibrators shall be at points uniformly spaced and not further apart than 1 1/2 times the radius over which the vibration is visibly effective.
- j. Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners and locations inaccessible to vibrators.
- k. External vibrators shall be used on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.
- l. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer.
- m. Do not insert vibrators into lower layers of concrete that have begun to set.
- n. Limit duration of vibration at each insertion to time necessary to consolidate concrete and to complete embedment of reinforcement and other embedded items without causing segregation of mix.

3.8 SURFACE FINISHES

- A. Not Against Forms (Top of Walls): Surfaces not otherwise specified shall be finished with wood floats to even surfaces.
- B. Formed Surfaces:
 1. Class A per ACI 347 R14 - 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. Class A permits gradual or abrupt irregularities of +1/8 inch.
 - a. Apply to concrete surfaces - exposed to view
 2. Class B per ACI 347 R14 Coarse textured 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. Class B permits gradual or abrupt irregularities of +1/4 inch.

- a. Apply to concrete surfaces - covered with a coating or covering material applied directly to concrete. Coordinate texture with covering material.
 3. Class C per ACI 347 R14 - Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Class C permits gradual or abrupt irregularities of +1/2 inch.
 - a. Apply to concrete surfaces – not exposed to view.
 4. Class D per ACI 347 R14 - 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. Class D permits gradual or abrupt irregularities of +1 inch.
 - a. Apply to concrete surfaces – foundations not exposed to public view.
- C. In order to secure a satisfactory "true and even surface," the surface of the concrete shall, where required, be rubbed down in an approved manner to the extent necessary.
- D. The quality of casting and the finished members shall be subject to inspection and approval by the Architect. Individual members may be rejected because of any of the following:
 1. Variations in the exposed face that substantially deviates from designated standards.
 2. Dimensions not conforming to designated tolerances.
 3. Defects which would affect the structural integrity, physical characteristics, or architectural appearance of the member.
 4. Defects that indicate imperfect casting or forming.
 5. Defects indicating honeycombed concrete, cracks, casting fractures, exposed reinforcing steel, or insufficient concrete compressive strength.
 6. Concrete exposed to public view does not match the on-site reference sample in color or texture.
 7. Shrinkage cracking beyond acceptable ACI standards.
- E. The Architect will determine whether defective concrete shall be repaired or rejected. Repair of concrete, if allowed, shall be done in a manner satisfactory to the Architect. Repair to concrete surfaces which will be exposed- to-view after completion of construction shall be subject to approval by the Architect.
- F. Repair formed surfaces by removing minor honeycombs, pits greater than one square inch surface area or 0.25 inches' maximum depth, or otherwise defective areas, as determined by the Architect. Provide edges perpendicular to the surface and patch with patch material. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects) which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete shall not vary more than the allowable tolerances of ACI 347. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish unless otherwise specified.

- G. Slab, and Pavement Finishes and Miscellaneous Construction: ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Provide interior floor slabs with a steel troweled finish.
1. Concrete floors shall meet the following floor flatness and levelness tolerances:
 - a. Slabs Cast on Grade: Ff=20; Fl=17 (as defined by ASTM E1155) unless noted otherwise on the drawings.
 - b. Slabs Cast on Metal Deck: Ff=20 unless noted otherwise on the drawings.
 2. Dustproofing: Provide dustproofer on concrete floor surfaces: After trowelling, apply two (2) coats of dustproofer, in accordance with the approved manufacturer's printed instructions.
 3. Finishing: Place, consolidate, and immediately strike-off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.
 - a. Floated: Provide for machinery pads and exterior slabs where not otherwise specified. Float the surface by hand with a wood or magnesium float, or use a power-driven float. Floating of any one area shall be the minimum necessary to produce an even finish, level within 1/4 inch in 10 feet for exterior work and level within 1/8 inch in 10 feet for interior work where floor drains are not provided.
 - b. Steel Troweled: Provide for interior floor slabs. First, provide a floated finish. When slab attains a proper set, trowel to a smooth, hard, dense finish. Finished surfaces shall be free of troweled marks, uniform in texture, and a true plane, flat within 0.01 foot (approximately 1/8 inch) in 10 feet. Hand-finish portions of the slab not accessible to power finishing equipment (e.g., edges, corners) to match the remainder of the slab. Power trowel twice and finally hand trowel for exposed concrete floors.
 - c. Broomed: Provide for exterior walks, platforms, patios, and ramps, unless otherwise indicated. Provide a floated finish, then finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.
 - d. Areas to receive floor coatings the floor finish shall be per the manufacturer's recommendations.
 4. Concrete Saw Cutting: When sawing of joints is specified, provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. Provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. Provide adequate artificial lighting facilities for sawing. All of this equipment shall be on the job both before and at all times during concrete placement.
 - a. When joints in concrete are sawed, the joints shall be cut as shown on the plans. The circular cutter shall be capable of cutting a groove in a straight

line and shall produce a slot indicated, and to the depth shown. When shown on the plans or required by the specifications, the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved beveling to provide adequate space for joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Architect.

- b. Provide backup rod and sealant which is fuel resistant as specified under other Sections of the specifications.

3.9 CONSTRUCTION TOLERANCES

- A. Variation in alignment, grade, and dimensions of structure from established alignment, grade, and dimensions shown on the Drawings shall be within the tolerances as specified within ACI 117-

3.10 CONCRETE CURING AND PROTECTION

- A. Protection: Protection of concrete shall begin immediately following concrete placement in the formwork and shall continue without interruption during the curing period. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before floating.
- B. Initial Curing: Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Final Curing: Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures, supplemented and amended as specified herein. Avoid rapid drying at end of final curing period.
- D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified or by the application of a spray applied, membrane type curing compound. Moist curing is the only method allowed for concrete having a water-cement ratio of 0.40 or less.
 - 1. Moisture Curing: All material, equipment, and labor necessary to promptly apply the moist curing shall be on Project Site before any concrete is placed. Provide moisture curing in accordance with ACI 308 and by the following methods.
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.

- c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
 - d. The entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface.
 - e. The rate of water application shall be controlled to the maximum rate that can be applied without causing excessive runoff, spattering, splashing, or other water damage. Steps shall be taken to properly protect surrounding work and construction from damage by water or water runoff. The nozzle size, water pressure, sprinkling or wetting equipment, etc., shall be adjusted and regulated so that the optimum quantity of water is applied to the curing area. Care shall be taken to insure that the overlay absorptive cover is clean, thoroughly saturated over its entire area, drained of excess water, and remains flat at all times.
 - f. Curing shall be done so that the concrete is always moist. Improperly cured concrete will be considered defective. Failure to use, or lack of water to adequately provide for curing requirements shall be cause for immediate suspension of concrete placing operations. Placing operations shall not be resumed until proper procedures are used.
 - g. Failure to completely cover concrete surfaces with saturated absorptive covers immediately after the concrete has been placed shall be cause for rejection as determined by the Architect.
 - h. After moisture curing has been properly completed, sprinkling equipment, wetting lines, connections, and appurtenances shall be removed in a manner acceptable to the Architect and the work left in a first class and satisfactory condition. Any damage shall be repaired or the damaged work replaced to the satisfaction of the Architect at no additional cost to the Owner.
 - i. Cured concrete shall be uniform in color, texture, and finish, with no objectionable form marks or irregularities. Concrete containing plastic shrinkage cracks will be considered defective and shall be repaired or removed and replaced as directed by the Architect at no additional cost to the Owner.
 - j. Continuous sprinkling coverage shall be complete, shall prevent loss of moisture from the entire concrete surface, and shall prevent early drying shrinkage.
 - k. Continuous wetting shall be replaced by wetting at regular intervals if, in the opinion of the Architect, expected ambient air temperature could result in freezing of run-off water.
 - l. Concrete shall not be left exposed for more than 30-minutes during the curing period.
2. Moisture Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at

- least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Spray Applied, Membrane Type Curing Compound:
- a. Before using a membrane type curing compound, verify compatibility with proposed floor finishes.
 - b. Apply at the maximum rate recommended by the compound manufacturer.
 - c. Apply curing compound immediately after finishing operation have been completed.
 - d. Provide two coats of curing compound applied at right angles to each other.
- E. Curing Formed Surfaces: For vertical and other formed surfaces, after the concrete has hardened and the forms are removed apply curing compound.
- F. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, pile caps and other flat surfaces, by application of appropriate curing method.
- G. Condition of Cured Concrete: Cured concrete shall be uniform in color, texture, and finish, with no objectionable form marks or irregularities.

3.11 REMOVAL OF FORMS

- A. Do not remove forms until the concrete has thoroughly hardened and has attained sufficient strength to support its own weight and construction live loads to be placed thereon, without damage to the structure. In general, do not disturb forms for framing until the concrete has attained at least 40% of design strength for side forms and 80% of design strength for bottom forms.
1. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and similar structural elements may not be removed in less than 14 days or until the concrete has achieved at least 80 percent of its 28-day design compressive strength.
 2. Assume all responsibility for proper form removal, and replace any work damaged due to inadequate maintenance or improper or premature form removal.
 3. Any work, labor materials, etc., required to effect such replacement shall be provided at no additional cost to the Owner.
- B. If used, and unless directed by the Architect, stripping cylinders shall be taken as follows:
1. 6 during the first two hours of the pour and 6 during the last two hours of the pour. These shall be broken into 3 sets of four cylinders; 2 from the samples taken during the first two hours and 2 from the samples taken during the last two hours of the pour. One set of 4 cylinders shall be tested at 2 days, one set at 3 days and one set at 4 days after the pour, or at such intervals of time as are consistent with the expected time of form removal, or as directed by the Architect.

- C. Any defective work disclosed after the forms have been removed shall be removed and replaced immediately. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb which cannot be repaired satisfactorily in opinion of the Architect, the entire section shall be removed and replaced at no additional the expense to the Owner. When defects in work do not, in the opinion of the Architect justify removal and replacement, such work shall be patched or otherwise repaired immediately to the satisfaction of the Architect.

3.12 REUSE OF FORMS

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing material shall not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Architect.

3.13 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases, Pads and Foundations: Provide machine and equipment bases, pads and foundations, as shown on the Contract Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
 - 1. The concrete to be provided beneath the various pieces of mechanical and electrical equipment shall be at locations shown, however, the extent shall be governed by the configuration of the equipment finally selected and approved by the Architect.

3.14 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect. Comply with ACI 301, Chapter 9, supplemented and amended as specified herein.
 - 1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched

- with specified bonding agent. Place patching mortar before bonding compound has dried. Apply patching material per manufacturer's recommendations.
2. Remove and replace concrete that, in the Architect's opinion, does not satisfy the requirements of the Contract Documents.
 3. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar shall match surrounding color.
 4. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Architect. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.
1. Correct low and high areas as herein specified.
 2. Repair finished surfaces containing defects affecting durability of concrete.
 3. Correct high areas in surfaces by grinding after concrete has cured at least 14 days.
 4. Correct low areas in surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete.
 5. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete.
 6. Dampen concrete surfaces in contact with patching concrete and apply bonding compound.
 7. Mix patching concrete of same materials to provide concrete of same type or class as original concrete.
 8. Place, compact, and finish to blend with adjacent finished concrete.
 9. Cure in same manner as adjacent concrete.
- C. Additional Repair Methods: Repair methods not specified above may be used, subject to acceptance of the Architect.

3.15 PROTECTION FROM AND REMOVAL OF STAINS

- A. Protect concrete structure from rust staining by structural steel members and from other substances during the work.
- B. If staining should occur, remove stains and restore concrete to its original color.
- C. Remove all dust, dirt, mortar, and other foreign matter which would mar appearance of exposed concrete or prevent bond of applied materials.
 1. Use approved methods, to complete satisfaction of the Architect.

3.16 DEFECTIVE CONCRETE AND CORRECTIVE WORK

- A. Concrete shall be considered defective unless it is structurally sound, properly finished, and within specified tolerances.

- B. Replace, strengthen, or correct defective concrete as directed. This work shall be provided at no additional cost to the Owner. The Architect will have the sole authority to decide whether concrete shall be removed and replaced or repaired.
- C. Before final acceptance of the work, neatly repair damaged surfaces, corners of concrete and concrete finish.
- D. Where surface repairs are permitted, finish damaged areas to smooth, dense water-tight condition.
- E. Where corrective work is unsatisfactory, completely remove such work and replace with new work conforming to specified requirements.

3.17 FIELD QUALITY CONTROL

- A. Refer to specification Field Quality Control 03 45 00
- B. Prior to the commencement of any work under this Section, and when directed by the Engineer or OAR meet at the Project Site to review installation and coordination procedures. Among other topics, the coordination meeting shall address scheduling, method and sequence of concrete construction, standard of workmanship, material selection, testing and quality control requirements, detailed requirements of design mixes, placement procedures, off-site batching requirements, coordination of the Work with other trades, preparation of surfaces contiguous with this work, adjacent construction, and interferences, if any. This meeting shall be attended by any and all trades, manufacturer's representatives, and other interested parties whose work will be affected by the execution of the work under this Section, including the following:
 - 1. Architect
 - 2. Appropriate Design Consultant(s)
 - 3. Contractor
 - 4. Concrete Subcontractor
 - 5. Testing Laboratories
 - 6. Ready-mix Concrete Supplier
 - 7. Any other subcontractor and/or material supplier or manufacturer required
- C. Sampling and Testing:
 - 1. The following requirements are intended to supplement GOAA's specification 01 4529 Structural Testing and Inspection. Where conflict exist specification 01 4529 Structural Testing and Inspection shall govern.
 - 2. Sampling: ASTM C 172. The Contractor's testing agency will collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.
 - 3. Testing:
 - a. Slump Tests: ASTM C 143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.

- b. Temperature Tests: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.
- c. Compressive Strength Tests: For concrete to be placed in walls, slabs or other structural members. ASTM C 39. Make five test cylinders for each set of tests in accordance with ASTM C 31. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Provide concrete cylinders for compressive tests not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. If the average strength of the 28-day test cylinders is less than f'_c and a maximum of one single cylinder is less than f'_c minus 300 psi, take three ASTM C 42 core samples and test. If the average strength of the 28-day test cylinders is less than f'_c and two or more cylinders are less than f'_c minus 300 psi, take six core samples and test. The Architect will determine if concrete represented by core tests is considered structurally adequate. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new, acceptable concrete. Repair core holes with nonshrink grout.
- d. Air Content: ASTM C 173 or ASTM C 231. Test air-entrained concrete for air content at the same frequency as specified for slump tests.
- e. Verification of Material Suitability: Prior to manufacture, establish the suitability of any material used in the concrete work, prepare design mixes that will produce concrete of specified compressive strengths, make preliminary tests in accordance with ACI 301, Chapter 3, Paragraph 3.8, Method 1 or Method 2, and submit data certifying that proposed concrete ingredients and proportions will result in concrete mixes meeting specified requirements.
- f. Concrete Mix Tests: Separate design mixes are required for each anticipated and/or actual change in mix materials.
- g. Identification of Design Mixes: Each design mix shall be fully identified as to its proposed use.
- h. Review of Proposed Mix Designs: Proposed mix designs, preliminary testing procedures, and results will be subject to review and approval by the Architect.
- i. Additional "Preliminary Tests": Whenever either a change of brand or a change of source for any of the concrete ingredients occurs, additional "preliminary tests" will be required and the cost of these tests shall be at no additional cost.
- j. Standard Deviation: The Testing Laboratory will establish an initial standard deviation for the statistical evaluation of concrete for the Project. The standard deviation will be established for the Project on the basis of not less than 30 test results from any one class of concrete. Be fully acquainted with all provisions relative to standard deviation and fully comply with the applicable requirements.

- 1) The Testing Laboratory will maintain a moving average for compressive strength based on the 3 latest 28-day test results to check compliance with specification requirements. The figures for the standard deviation and moving average for strength will be kept continuously up to date by the Testing Laboratory on the Project Site, and reported without delay to the Architect.
 - 2) The Testing Laboratory will maintain a continuous up-to-date log in both graphical and tabulated form for each class of concrete.
 - 3) The Testing Laboratory will maintain a moving average for range of test results for quality control purposes as described in ACI 214, Chapter 4, Paragraphs 4.4 and 4.5, respectively.
 - 4) The standard deviation shall be assumed to be greater than 600 psi unless another value has been determined from current similar tests, or until it may be calculated from the results of 30 or more job tests. The computation is described in ACI 214.
- k. Strength Requirements: Concrete will be considered to meet strength requirements of the Specifications when in compliance with ACI 301, Chapter 17, Paragraph 17.2., supplemented and amended as specified herein.
- l. Inspection: The testing agency retained by the Owner will perform the following inspections as a minimum:
- m. Plant and Field Inspection: Concrete work will be subject to detailed inspection at the plant and in the field.
- 1) Do not allow placement of concrete until the following is inspected and all deficiencies have been corrected:
 - a) Placement and alignment of forms.
 - b) Spacing of reinforcement.
 - c) Placement of embedded items such as angles, sleeves, PVC weep holes, waterstops and other structural or nonstructural embedments.
 - d) Placement of granular base and vapor barrier.
 - 2) Verify that concrete placement procedures are followed.
 - 3) Verify that cold-weather or hot-weather placing procedures of concrete are strictly followed.
 - 4) Verify that concrete curing procedures are strictly followed.
 - 5) Verify that forms are not removed before time specified.
 - 6) Verify that the delivery ticket shall contain the following information:
 - a) The strength of the mix of concrete being delivered.
 - b) The type of coarse aggregate; lightweight or stone.
 - c) The exact time the cement and aggregate were discharged into the delivery truck.
 - d) List of admixtures.
 - e) Name of supplier.
 - f) Name of batching plant and location.
 - g) Serial number of ticket.
 - h) Truck number and batch number.
 - i) Job designation (Contract number and location).

- j) Amount of water added.
 - k) Type and brand of cement.
 - l) Weight of cement.
 - m) Maximum permissible amount of water to be added to the site, if any.
 - n) Mix design designation.
 - o) Signature of a responsible officer or employee of the concrete supplier.
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- 7) If upon reaching the job, ready-mix concrete cannot be placed within the time limits stated, or if the type of concrete delivered is incorrect, the inspector will reject the load for use, and it shall be removed from the Project Site at no additional expense.
 - 8) A record of each such inspection shall be submitted to the Architect, covering the quality and quantity of concrete materials, mixing and placing of concrete, concrete formwork, placing of reinforcing steel, and the general progress of the work.
 - 9) Take prompt action to correct assignable conditions which have resulted in or could result in submission of materials, products, or completed construction which do not conform to the requirements of the Contract Documents.
- n. Batch Plant Inspection: At the start of the Project and at least once each month until the completion of concrete work, observe and evaluate the following for compliance with the Contract Documents.
 - 1) Condition of batching equipment.
 - 2) Condition of materials.
 - 3) Type of materials used.
 - 4) Mixing time.
 - 5) Delivery time.
 - 6) Additional pertinent controls; depending on weather, job conditions, and other factors affecting the work.
 - 7) Inspect aggregate stockpiles and storage practices. Check for unacceptable material handling which may cause segregation or contamination within the stockpiles.
 - 8) Inspect trucks used to transport concrete to assure that they are clean and in condition to mix and to deliver a uniform mix.
 - o. Preparatory Inspection: Preparatory inspection shall be performed before beginning work and, in addition, before beginning each segment of work. Preparatory inspection shall include a review of the Contract Document requirements, the review and approval of drawings and other submittal data, a check to assure that required control testing has been provided, a physical examination to assure that all materials conform to specified requirements, and a check to assure all required preliminary work has been completed.
 - 1) Check materials upon delivery at job site to determine that they are the material referenced in the report of test results or certificates of compliance.

- 2) Check materials for proper storage to assure adequate protection against damage and deterioration.
 - 3) Check to assure that required inspections and observations are being performed.
 - 4) Review Contract Document requirements with each person involved in performing the work.
- p. Initial Inspection: Initial inspections shall be performed as soon as practicable after representative segments of the particular item of work have been accomplished in order to provide visual evidence that the concrete mix and the hydraulic cement concrete operations are producing the desired results.
- 1) Check for workmanship. Initial inspection for workmanship shall include installation of the forms; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, concrete vibration and, concrete finishing.
 - 2) Check for defective or damaged materials.
 - 3) Assure that damaged and/or defective materials are removed from the site and replaced.
 - 4) Batching and Mixing Operations:
 - a) Check mixing time.
 - b) Continually check for assurance of complete control over batching and mixing.
 - c) Check volumes of material used in mix, mixing time, and other controlling features.
 - d) Check moisture content of aggregates frequently. Adjust batch weights in accordance with variations in moisture content.
 - e) Check gradations of aggregates frequently.
 - f) Check the freshly mixed concrete to see that uniformity is maintained. Any marked change from normal consistency or appearance indicates something wrong with the batching or the mixing, and the concrete shall not be accepted for placement.
 - g) Record rejected batches with reasons for rejection.
 - h) Check slump and entrained air content as often as necessary to confirm visual checks.
 - 5) Preplacement Inspection: Check all of the following prior to each placement. Do not permit placing to start until all are satisfactory.
 - a) Verify that sufficient quantities of all materials are on hand to permit continuous placement and completion.
 - b) Verify location, dimensions, alignment and grade.
 - c) Verify that the mud slab has been properly installed.
 - d) Verify that excavations are free from frost, ice or mud; moist as required; free from standing or running water.
 - e) Check form materials.
 - f) Check to see that re-used form materials have been reconditioned as required.
 - g) Verify that construction is mortar-tight; smooth; free from offsets and blemishes.

- h) Verify that ties and bracing is adequate to maintain position, shape, and alignment of form.
- i) Verify that temporary spreaders are arranged so as to be easily removable as the concrete rises in the form.
- j) Verify that ties are installed where permitted so that they may be withdrawn or broken off to leave no metal closer than the specified minimum distance from the concrete surface.
- k) Verify that forms have been oiled, wetted, or sealed. Check to see that surplus oil has been removed from forms and that there is no oil on steel reinforcement, on construction joints, or on other surfaces where bonding is required. Verify that forms are clean prior to placing concrete.
- l) Check forms for movement which may occur during placing operations. Verify that measuring devices or reference lines have been set up.
- m) Verify that necessary clean-outs have been provided for in the bottom of the forms.
- 6) Joints:
 - a) Verify that all joints (expansion, contraction, construction) are located as shown on Contract Drawings or as otherwise approved.
 - b) Verify that construction joints have been prepared as required. Check requirements for air-water cutting, wet sand-blasting, roughening, wetting, etc.
 - c) Verify that filler has been installed and securely fastened in expansion joints.
 - d) Verify that expansion joints are free from irregularities or debris which would interfere with free movement.
 - e) Verify that all arrangements are in place for sawcutting of joints in the slabs (where specified) within the time indicated in this Specification. If this requires night time work verify that all arrangements of lighting the work area are in place.
 - f) Check all joints which are intended to allow for expansion or contraction. Reinforcement or other fixed metal shall not be continuous through the joint.
- 7) Reinforcement:
 - a) Verify that all reinforcement is in place in accordance with accepted shop drawings. Check bar diameters, bar lengths, lengths of splices, bar-to-bar spacing and clearances.
 - b) Verify that reinforcement has been cleaned of all loose, flaky, rust and scale, dried concrete, oil, grease or other foreign material which would reduce or prevent bond.
 - c) Verify that reinforcement is tied and supported securely so that displacement will not occur during concrete placement.
 - d) Verify that reinforcement spacers, ties, plastic covered chairs, and supports are as specified or approved.
- 8) Miscellaneous Preparation:

- a) Verify that satisfactory arrangements have been made to get concrete into all parts of the placement without segregation, loss of ingredients, formation of air pockets or cold joints, vertical drops in excess of permissible limit, "running" of concrete by means of vibrator, and within the maximum time allowed after mixing.
- b) Verify that conveying equipment (i.e., crane, buggies, truck mixers, pumpcrete pipe, etc.) is capable of reaching all parts of the placement.
- c) Verify that temporary form openings, tremies, chutes, conveyors or other special equipment have been provided as necessary and approved.
- d) Verify that arrangements have been made, and all necessary equipment is on hand and in working order to provide curing and protection (including cold weather protection if needed).
- e) Verify that safe access and footing have been provided by means of ladders, platforms, walkways, and stagings.
- 9) Assure that damaged or defective work is corrected.
- 10) Note and discuss any deficiencies observed and corrective action to be taken. If corrective action is to be taken, conduct an additional initial inspection to verify that proper adjustments, corrections, or revisions have been made.
- 11) Assure that accomplishment of corrective action is in accordance with requirements.
- q. Follow-Up Inspections: Follow-up inspections shall be performed daily and more frequently as necessary, and shall include continued testing and examinations to assure continued conformance with Contract Document requirements.
 - 1) Conveying and Placing Operations:
 - a) Check requirements pertaining to placing fresh concrete on concrete which has set.
 - b) Verify that the time between completion of mixing and placement in final position in the form is within the maximum allowed by the Specifications.
 - c) Check method of placement in handling of concrete to prevent segregation. Check height concrete is allowed to drop freely and method used to guide concrete into place.
 - d) Verify that concrete is placed rapidly enough to avoid formation of cold joints.
 - e) Verify that layers are maintained approximately horizontal and not exceeding specified thickness.
 - f) Verify that form ties and supports are checked frequently and are adjusted as necessary to prevent or correct movements of the form.
 - g) Verify that the rate of placement is within safe limits, such that forms will not be overstressed by too-rapid rise of fluid concrete.

- h) Verify that each layer of concrete is vibrated until fully consolidated.
 - i) Do not allow vibration to be overdone to the extent of promoting segregation. Do not allow vibrators to be used to transport concrete in the forms.
 - j) Check use of hand compaction tools insofar as practicable to assist in obtaining smooth, dense surfaces.
 - k) Do not allow excessive working of the concrete surface in completing a lift.
- r. Removal of Forms:
 - 1) Verify that care is being taken to assure that concrete is sufficiently hard and strong before removal of forms.
 - 2) Check to see that forms used for curing are left in place until expiration of required curing period. Forms shall be tightened and maintained "snug" against concrete surfaces at all times while curing.
 - 3) Verify that spalling, chipping, and gouging of concrete is avoided during the form removal operation.
 - 4) Verify that safety practices are being completely exercised during the form removal.
- s. Finishing:
 - 1) Check the type of finish required.
 - 2) Verify that defective areas have been repaired and that fins, forms marks and holes are completely removed immediately upon removal of forms.
 - 3) Check the cleaning of areas to be patched. Have honeycomb and rock pockets been cut back to solid material? Has loose material been removed.
 - 4) Check the requirements for the treatment of areas containing defective concrete.
 - 5) Check for complete curing of patched areas.
 - 6) Check surfaces for specified smoothness tolerances. Require rough areas and high spots to be ground smooth.
 - 7) Check that all work is properly and continuously cured for a minimum total of 14 days.
 - 8) Correct deficiencies in cast-in-place concrete work that inspections have indicated as non-conforming.
 - 9) Perform additional inspections as necessary to reconfirm any non-conformance of original work and to show conformance of corrected work.
 - 10) Do not allow any addition to, or building upon, non-conforming work unless correction can be made without disturbing the continuing work.
 - 11) Verify that damaged or defective work is corrected properly and approved by the Architect.
 - 12) Re-inspect replaced materials to determine conformance with Contract Document requirements.

- 13) Work accomplished shall be considered satisfactory only when inspections show that all variances have been corrected in an acceptable manner and that the completed work is in conformance with the Contract Documents.
- 14) If, following submission of inspection results, the Architect finds that such inspection reveals a failure of the work to conform to the requirements of the Contract Documents, the deficiencies shall be corrected in a manner approved by the Architect.
- 15) The final and governing determination of conformance or non-conformance with the Contract Documents will be made by the Architect based on inspection results and Controlled Inspection documentation after all work of this Section has been fully completed in accordance with the Contract Documents.

3.18 Special Inspections:

- A. The inspection agency retained by the owner will perform inspections in accordance with the provisions of the Florida Building Code.
- B. The Contractor shall coordinate his operations with the Owners inspection agency to insure that inspections can be completed in a timely fashion.

END OF SECTION 03 30 00

SECTION 03 45 00 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Architectural precast concrete cladding units.
- B. Related Requirements:
 - 1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
 - 2. Section 03 30 00 "Cast-in-Place Concrete" for installing connection anchors in concrete.
 - 3. Section 05 12 00 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
 - 4. Section 05 50 00 "Metal Fabrications" for kickers and other miscellaneous steel shapes.
 - 5. Section 07 19 00 "Water Repellents" for water-repellent finish treatments.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)

- b. Corporate Sustainability Reporting (CSR's)
- C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- D. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate details at building corners.
 - 5. Retain subparagraphs below applicable to Project.
 - 6. Indicate separate face and backup mixture locations and thicknesses.
 - 7. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 - 8. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 9. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 - 10. Include plans and elevations showing unit location and sequence of erection for special conditions.
 - 11. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 - 12. Indicate relationship of architectural precast concrete units to adjacent materials.
 - 13. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
 - 14. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
 - 15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- E. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
 - 1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
- F. Delegated-Design Submittal: For architectural precast concrete 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. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements:
 1. Fabricator:
 - a. Submit plant certification.
 - b. Submit evidence of experience and capabilities.
 - c. Submit copies of plant quality control program.
 2. Erector: Submit evidence of experience and capabilities.
 3. Welding: Submit welding certificates and field welding processes.
- B. Material Certificates: For the following items:
 1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Structural-steel shapes and hollow structural sections.
- C. Material Test Reports: For aggregates.
- D. Preconstruction test reports.
- E. Source quality-control test reports.
- F. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.
- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units at time of bidding or designated as an APA-certified plant for production of architectural precast concrete products.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- F. Mockups: After sample panel and range sample approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution. Refer to Section 01 43 39 "Visual Mock-up Requirements" for additional requirements.
 - 1. Build mockup as indicated on Drawings complete with anchors, connections, flashings, and joint fillers.
 - 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 undamaged at time of Substantial Completion.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design architectural precast concrete units.
- B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Calculated Fire-Test-Response Characteristics: Provide architectural precast concrete units with fire-resistance rating indicated as calculated according to ACI 216.1 and acceptable to authorities having jurisdiction.
- D. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Retain "Loads" Subparagraph below if design loads are shown on Drawings.
 - 2. Loads: As indicated.
 - 3. Retain five loads subparagraphs below if including design loads here; revise requirements to suit Project, and insert other performance and design criteria if applicable.
 - 4. Dead Loads: Refer to Structural.
 - 5. Live Loads: Refer to Structural.
 - 6. Wind Loads: Refer to Structural.
 - 7. Seismic Loads: Refer to Structural.
 - 8. Project-Specific Loads: Refer to Structural.
 - 9. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 1/2 inch.
 - 10. Revise "Thermal Movements" Subparagraph below to suit local conditions. Temperature data are available from National Climatic Data Center, www.ncdc.noaa.gov.
 - 11. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 deg F.

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Use with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Provide Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Corporate Sustainability Report: Provide third-party verified Corporate Sustainability Report (CPD) including impacts of extraction operations and activities associated with the manufacturer's product and product's supply chain conforming the following:
 1. Global Reporting Initiative (GRI) Sustainability report
 2. Organization for Economic Co-operation and Development (OOECD) Guidelines for Multinational Enterprises.
 3. U.N. Global Compact: Communication of Progress
 4. ISO 26000: 2010 Guidance on Social Responsibility
 5. USGBC Approved Program: Other approved programs meeting the CSR criteria.
- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- E. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, with ASTM A 767/A 767M, Class II zinc coating and chromate treatment.
- F. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated.
- G. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

- H. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.
- I. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.
- K. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- C. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C 618, Class N.
 - 3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 5. Blended Hydraulic Cement: ASTM C 595, [Type IS, portland blast-furnace slag] [Type IP, portland-pozzolan] [Type I (PM), pozzolan-modified portland] [Type I (SM), slag-modified portland] cement.
- D. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: To match design reference sample.
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.
- E. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330/C 330M, with absorption less than 11 percent.

- F. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- I. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: 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. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 - 9. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M.

2.5 STEEL CONNECTION MATERIALS

- A. Provide Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Corporate Sustainability Report: Provide third-party verified Corporate Sustainability Report (CPD) including impacts of extraction operations and activities associated with the manufacturer's product and product's supply chain conforming the following:
 - 1. Global Reporting Initiative (GRI) Sustainability report
 - 2. Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises.
 - 3. U.N. Global Compact: Communication of Progress
 - 4. ISO 26000: 2010 Guidance on Social Responsibility

- 5. USGBC Approved Program: Other approved programs meeting the CSR criteria.
- D. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- E. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- F. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- G. Malleable Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.
- H. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30.
- I. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- J. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.
- K. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65.
- L. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.
- M. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or ASTM F 1554, Grade 36; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.
- N. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.
- O. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
- P. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.
- Q. Welding Electrodes: Comply with AWS standards.

2.6 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.
 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18 .1 0.2; or with MIL-C-882E.
 4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.7 ACCESSORIES

- A. Reglets: Specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
- B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.
- C. 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.
- D. 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.
- E. Weep/Vent Products: Use the following unless otherwise indicated:
1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by length equal to thickness of precast concrete panel.

2.8 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use a single design mixture for units with more than one major face or edge exposed.
 - 2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- E. Normal-Weight Concrete Mixtures: Proportion [face mixtures] [face and backup mixtures] [full-depth mixture] [face and backup mixtures or full-depth mixtures, at fabricator's option] by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- G. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft., plus or minus 3 lb/cu. ft., according to ASTM C 567.

- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- I. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated

- reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcing steel and prestressing strands to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

- M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/8 inch.
 - b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
 - c. 20 to 40 feet, plus or minus 1/4 inch.
 - d. Each additional 10 feet, plus or minus 1/16 inch.
 - 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/4 inch.
 - b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
 - c. 20 to 40 feet, plus or minus 3/8 inch.
 - d. Each additional 10 feet, plus or minus 1/8 inch.
 - 3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
 - 4. Rib Thickness: Plus or minus 1/8 inch.
 - 5. Rib to Edge of Flange: Plus or minus 1/8 inch.
 - 6. Distance between Ribs: Plus or minus 1/8 inch.
 - 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
 - 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
 - 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
 - 10. Bowing: Plus or minus L/360, maximum 1 inch.
 - 11. Local Smoothness: 1/4 inch/10 feet.
 - 12. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
 - 13. Tipping and Flushness of Plates: Plus or minus 1/4 inch.

14. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 1. Weld Plates: Plus or minus 1 inch.
 2. Inserts: Plus or minus 1/2 inch.
 3. Handling Devices: Plus or minus 3 inches.
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch.
 8. Location of Opening within Panel: Plus or minus 1/4 inch.
 9. Location of Flashing Reglets: Plus or minus 1/4 inch.
 10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
 13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
 14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
 15. Position of Sleeve: Plus or minus 1/2 inch.

2.13 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:
 1. Design Reference Sample: Provided by Architect.
- B. Finish exposed back surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.
- D. Finish all surfaces to receive sealant or membrane smooth and free from rock pockets, honeycombing, and other imperfections that may interfere with sealant or membrane.

2.14 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.

- B. Construction Manager will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
 - 1. Allow Construction Manager's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- C. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318.
 - 1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 - 2. Test cores in an air-dry condition.
 - 3. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

2.15 PRECAST CONCRETE STAIR TREADS

- A. Comply with "Concrete Materials" article to provide concrete with a minimum 28-day compressive strength of 5000 psi and a total air content not less than 4 percent or more than 6 percent,
 - 1. Flexural Strength: 2500 to 3000 psi in accordance with ASTM C 293.
 - 2. Water Absorption: 3 to 4 percent absorption in accordance with ASTM C 67.
- B. Reinforcing Bars: #3 - 3/8 inch (10mm) deformed rebar meeting the requirements of ASTM A 615, Grade 40.
- C. Embedded Stair Tread Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts with nuts for attaching and securing stair treads to stair framing.
 - 2. Stair tread manufacturer's standard "shoulder nut" anchor bolt design to resist damage due to excessive torque stress on anchor bolt nut, or normal stair movement.
- D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 5. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.
- F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are

completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
 - d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 - 6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 - 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
 - 9. Maximum Joint Taper: 3/8 inch.
 - 10. Joint Taper in 10 Feet: 1/4 inch.
 - 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
 - 13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Architectural precast concrete installer shall provide field quality control by PCI certified staff and shall provide the following reports and checklists.
 - 1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.

2. Provide field inspection reports within 5 working days of inspection.
- B. Testing Agency: Construction Manager will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.

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Terminal C
Airside Concourse

PRECAST ARCHITECTURAL CONCRETE

SECTION 03 45 00

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 45 00

SECTION 03 47 13 - TILT UP CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies load-bearing, tilt-up concrete, including the following:
 - 1. Monolithic panels.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for slab-on-grade closure strip and general concrete construction.

1.3 DEFINITIONS

- A. Face-down Surface: Concealed surface of as-cast, tilt-up panel formed against the casting slab.
- B. Face-up Surface: Exposed upper surface of as-cast, tilt-up panel.
- C. Reveal: Projection of the coarse aggregate from the matrix after exposure.

1.4 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 8113.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)

- B. Product Data: For each type of product indicated.
- 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.
- D. Shop Drawings: Detail fabrication and installation of tilt-up concrete units. Indicate panel locations, plans, elevations, dimensions, shapes, cross sections, and details of steel embedments.
 - 1. Include steel reinforcement, detailing fabrication, bending, and placing. Include material, grade, bar schedules, stirrup spacing, bent-bar diagrams, arrangement, and supports of concrete reinforcement.
 - 2. Include additional steel reinforcement to resist hoisting and erection stresses.
 - 3. Include locations and details of hoisting points and lifting devices for handling and erection.
 - 4. Casting Slab: Submit shop drawing showing size, type, and location of all casting slabs.
 - 5. Forms: Submit shop drawing showing edge forms for panels.
 - 6. Calculations: Submit complete signed and sealed engineering calculations. Include engineering analysis data of additional steel reinforcement and hoisting and erection details, signed and sealed by the qualified registered professional engineer in the state of Florida.
 - 7. Indicate welded connections by AWS standard symbols. Detail cast-in inserts, connections, and joints, including accessories.
- E. Sample: Prepare for approval of Architect/Engineer a minimum of one sample panel for each type of finish specified. Sample panel shall be 3 feet by 3 feet by 4 inches minimum thickness cast from a minimum 3 cubic yard truck load. Approved panels shall remain on the job site until the Architect gives instructions for removal and disposal. Rejected panels shall be disposed of off site.
- F. Welding certificates.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- H. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Bondbreakers.
 - 5. Curing compounds.
 - 6. Inserts and embedments.

- I. Field quality-control test and inspection reports.
- J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs a supervisor on Project who is an ACI-certified Tilt-up Supervisor.
- 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 qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be an 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. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," Sections 1 through 5, unless modified by requirements in the Contract Documents.
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Mockups: Refer to specification 01 4339 Visual Mock-Up Requirements. Cast and erect tilt-up concrete panel mockups to demonstrate typical reveals, surface finishes, texture, color, and standard of workmanship.
 - 1. Build mockup panels in the location and of the size indicated or, if not indicated, as directed by Architect.

2. In presence of Architect, damage part of an exposed surface for each finish, color, and texture required, and demonstrate materials and techniques proposed for repairs to match adjacent undamaged surfaces.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with tilt-up concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Tilt-up concrete subcontractor.
 2. Review special inspection procedures; testing and inspecting agency procedures for field quality control; tilt-up concrete finishes and finishing; curing procedures; casting-slab construction, flatness and levelness, finish, and joint requirements; steel reinforcement installation tilt-up concrete repair procedures; and tilt-up concrete protection.

PART 2 - PRODUCTS

2.1 FORMS AND ACCESSORIES

- A. Forms: Metal, dressed lumber, or other approved materials that are nonreactive with concrete and that will provide continuous, true, and smooth concrete surfaces.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch
- C. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
- D. Reveal Strips: Metal, PVC, rubber, straight dressed wood, or plywood; with sides kerfed.
- E. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleedwater and prevent migration of set-retarding chemicals from wood or plywood.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Plain-Steel Wire: ASTM A 82galvanized.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- G. Bar Supports: Manufactured according to CRSI's "Manual of Standard Practice" of plastic or CRSI Class 1 plastic-protected steel wire or Class 2 stainless-steel wire.

2.3 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I or I Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Coarse Aggregate: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source.
- D. Fine Aggregate: ASTM C 33 manufactured or natural sand, from same source for Project, free of materials with deleterious reactivity to alkali in cement.
- E. Exposed Coarse Aggregate: Hard and durable; washed; free of material that reacts with cementitious material or causes staining; from a single source, as follows:
 - 1. Aggregate Sizes: 1/2 to 3/4 inch (13 to 19 mm) nominal.
 - 2. Gradation: Uniformly graded.
- F. Water: Clean, fresh, drinkable, free of oils, acids or organic matter harmful to concrete.

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.

- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.5 BONDBREAKERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in this Article.
- B. Products: Subject to compliance with requirements, provide one of the following products listed in this Article.
- C. Solvent-Borne, Chemically Reactive Bondbreaker: Penetrating polymerized solution containing no oils, waxes, paraffins, or silicones, and compatible with casting-slab curing compound.
 - 1. Burke by Edoco; Clean Lift 90 V.O.C.
 - 2. Conspec Marketing and Manufacturing Co., Inc., a Dayton Superior Company; Conspec CST VOC.
 - 3. Dayton/Richmond Concrete Accessories; Maxi Tilt.
 - 4. Dayton Superior Corporation; Sure Lift (J-6).
- D. Solvent-Borne, Membrane-Forming Bondbreaker: Dissipating polymerized solution containing no oils, waxes, paraffins, or silicones, and compatible with casting-slab curing compound.
 - 1. Burke by Edoco; Super Bondbreaker V.O.C.
 - 2. Conspec Marketing and Manufacturing Co., Inc., a Dayton Superior Company; Tilt-Eez VOC.
- E. Waterborne, Chemically Reactive Bondbreaker: Penetrating polymerized emulsion containing no oils, waxes, paraffins, or silicones, and compatible with casting-slab curing compound.
 - 1. Burke by Edoco; Super Tilt Bondbreaker W.B.
 - 2. Conspec Marketing and Manufacturing Co., Inc., a Dayton Superior Company; Conspec CST/WB.

3. Dayton/Richmond Concrete Accessories; Maxi Tilt E.
 4. Dayton Superior Corporation; Sure-Lift WB (J-5).
 5. Nox-Crete Products Group, Kinsman Corporation; Silcoseal 2000F.
- F. Waterborne, Membrane-Forming Bondbreaker: Dissipating polymerized emulsion containing no oils, waxes, paraffins, or silicones, and compatible with casting-slab curing compound.
1. Burke by Edoco; Super Bondbreaker W.B.
 2. Conspec Marketing and Manufacturing Co., Inc., a Dayton Superior Company; Tilt-Eez WB.
 3. Dayton/Richmond Concrete Accessories; Rich Tilt E.

2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 CONNECTION MATERIALS

- A. Embedded Metal Items and Loose Hardware: Materials for securing tilt-up concrete panels together and to supporting and adjacent construction are specified in Division 05 Section "Metal Fabrications."
- B. Loose Hardware: Materials for securing tilt-up concrete panels together and to supporting and adjacent construction are specified in Division 05 Section "Metal Fabrications."
- C. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- D. ASTM A 307 defines the term "studs" to include stud stock or threaded rods.
- E. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
- F. Unheaded Carbon-Steel Rods and Nuts: ASTM A 36/A 36M, threaded rods with ASTM A 563, nuts.

- G. Welded Headed Studs: AWS D1.1, Type B headed studs, and cold-finished, carbon-steel bars.
- H. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- I. Chord Bar Sleeves: Tubular sheathing, plastic or moisture-resistance-treated cardboard.
- J. Welding Electrodes: Comply with AWS standards.
- K. Hot-Dip Galvanized Finish: Apply zinc coating to steel connections by hot-dip process, complying with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.
 - 1. Zinc Repair Paint: SSPC-Paint 20.

2.8 LIFTING INSERTS AND ACCESSORIES

- A. Furnish inserts, dowels, bolts, nuts, washers, and other items to be cast in panels for tilting and lifting.
 - 1. Manufacture inserts with feet of plastic, galvanized steel wire, plastic-tipped steel wire, or stainless-steel-tipped steel wire.
- B. Furnish brace anchors and other accessories to be cast in panels and in casting slab for attaching bracing.
 - 1. Manufacture wall brace anchors and accessories with feet of galvanized steel wire, plastic-tipped steel wire, or stainless-steel-tipped steel wire.
 - 2. Manufacture floor brace anchors that will not penetrate vapor retarder under slab-on-grade.

2.9 BEARING PADS

- A. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet; Type A Shore durometer hardness of 50 to 70, ASTM D 2240; and minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
- B. Random, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer with a Type A Shore durometer hardness of 70 to 90, ASTM D 2240.
- C. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded in elastomer with a Type A Shore durometer hardness of 80 to 100, ASTM D 2240.
- D. High-Density Plastic Strips: Multimonomer, nonleaching plastic.

2.10 GROUT

- A. 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.
- B. 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, of consistency suitable for application.

2.11 MISCELLANEOUS MATERIALS

- A. Chemical Surface Retarder: Water-soluble, liquid set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to depth of reveal or etch required of specified finish.
- B. Form Retarder: Chemical liquid set retarder, for application on hardened horizontal concrete and capable of temporarily delaying final hardening of newly placed concrete to depth of reveal specified.
 - 1. Mold Release: Solution specially formulated by manufacturer for use under form retarder.
- C. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Patching Mortar: Dry-pack mix consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

2.13 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on 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 concrete design mixtures based on laboratory trial mixtures.
- B. Proportion concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days unless noted otherwise.

2. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete according to ACI 301 requirements.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.14 CONCRETE 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 above 90 deg F (32 deg C), reduce mixing and delivery time to 75 minutes.
- B. Project-Site-Produced Concrete: Measure, batch, and mix concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. Provide a batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record panel locations where concrete is deposited.

PART 3 - EXECUTION

3.1 FORMS

- A. Construct and brace formwork so tilt-up concrete panels are of size, shape, alignment, elevation, and position indicated.
 1. Construct forms on slab-on-grade or on temporary casting slab, at Contractor's option.
 2. Provide for openings, offsets, recesses, reveals, rustications, reglets, and blockouts.
 3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Use kerfed inserts, such as those forming reglets, rustications, and recesses, for easy removal.
- C. Set edge forms for panels to achieve required panel thickness.

- D. Chamfer exposed corners and edges, unless otherwise indicated, using chamfer strips fabricated to produce uniform, smooth lines and tight edge joints.
- E. Coat contact surfaces of wood forms and chamfers with sealer before placing reinforcement.

3.2 BONDBREAKERS

- A. Uniformly and continuously apply two coats of bondbreaker to casting-slab surfaces by power spray or roller according to manufacturer's written instructions, before placing steel reinforcement. Recoat areas subjected to moisture before drying. Maintain continuity of coating until concrete placement.
- B. After placing steel reinforcement, touch up or recoat worn or damaged areas with bondbreaker. Do not splash or coat steel reinforcement and inserts.

3.3 FORM RETARDER

- A. Uniformly and continuously apply form retarder to slab surfaces by power spray, roller, or brush according to manufacturer's written instructions, before placing steel reinforcement. Recoat areas subjected to moisture before drying. Maintain continuity of coating until concrete placement.
 - 1. Uniformly apply mold release according to manufacturer's written instructions and allow to dry before applying form retarder.
- B. After placing steel reinforcement, touch up or recoat worn or damaged areas with form retarder. Do not splash or coat steel reinforcement and inserts.

3.4 REINFORCEMENT AND INSERTS

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating and placing reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 1. Field weld reinforcement according to AWS D1.4, where indicated.
 - 2. Do not tack-weld crossing reinforcing bars.
 - 3. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. 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.

- D. Accurately place and securely support embedded items, anchorages, inserts, cramps, retainers, bar chords and sleeves, and other items to be built into panels. Coordinate with other trades for installing cast-in items.

3.5 PANEL CASTING, GENERAL

- A. Comply with ACI 301 for handling, placing, and consolidating concrete.
- B. Maintain position of steel reinforcement, inserts, and anchors during concrete placement, consolidation, and finishing.
- C. Screed panel surfaces to correct level with a straightedge and strike off.
 - 1. Begin initial floating before excess moisture or bleedwater appears on the surface. Use bull floats or darbies to form a uniform and open-textured surface plane free of humps or hollows. Do not disturb panel surfaces before beginning finishing operations.
- D. Form chamfers at top edges of panel perimeters, openings, and similar locations not formed by chamfer strips, unless otherwise indicated.
- E. Surface Defects: Limit visible surface defects to those permitted by TCA's "Tilt-up Concrete Association's Guideline Specifications" for Grade A, Architectural panel surfaces.

3.6 CASTING TOLERANCES

- A. Cast tilt-up concrete panels without exceeding the following tolerances:
 - 1. Height and Width of Panels:
 - a. For Panels up to 20 Feet (6.1 m) Tall: 1/4 inch (6 mm) wide.
 - b. For Panels 20 to 30 Feet (6.1 to 9.1 m) Tall: 3/8 inch (10 mm) wide.
 - c. Each Additional 10 Feet (3.05 m) in Excess of 30 Feet (9.1 m) Tall: 1/8 inch (3 mm) wide.
 - 2. Thickness: 3/16 inch (5 mm).
 - 3. Skew of Panel or Opening: Difference in length of diagonals of 1/8 inch per 72 inches (3 mm per 1830 mm) with a maximum difference of 1/2 inch (13 mm).
 - 4. Openings Cast into Panel:
 - a. Size of Opening: 1/4 inch (6 mm).
 - b. Location of Centerline of Opening: 1/4 inch (6 mm).
 - 5. Location and Placement of Embedded Items:
 - a. Inserts, Bolts, and Pipe Sleeves: 3/8 inch (10 mm).
 - b. Lifting and Bracing Inserts: As required by manufacturer.

- c. Lateral Placement of Weld Plate Embedments: 1 inch (25 mm).
 - d. Tipping and Flushness of Weld Plate Embedments: 1/4 inch (6 mm).
6. Deviation of Steel Reinforcement Cover: Maintain minimum cover required by ACI 301.

3.7 FACE-UP FINISHES

- A. Float Finish: Consolidate surface of plastic concrete with power-driven floats or by hand floating. Restraighten and cut down high spots and fill low spots. Repeat float passes and restraighten until surface is left with a uniform, smooth, granular texture.
- B. Trowel Finish: After applying float finish, apply first trowel finish and consolidate plastic concrete by hand trowel or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and is uniform in texture and appearance.
- C. Trowel and Fine-Broom Finish: After applying float finish, apply a partial trowel finish to plastic concrete, stopping after second troweling. Immediately after second troweling, and when concrete is still plastic, slightly scarify the surface with a fine broom.
 - 1. Broom surface in a top-to-bottom direction.
- D. Brushed Exposed-Aggregate Finish: Produce exposed-aggregate finish to exterior surface of concrete by washing and brushing before panel erection, as follows:
 - 1. Immediately after floating, broadcast a single layer of aggregate uniformly onto panel surface. Tamp seeded aggregate into plastic concrete, and float to embed aggregate with mortar cover of 1/16 inch (1.6 mm).
 - 2. Spray chemical surface retarder on panel according to manufacturer's written instructions.
 - 3. Cover panel surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - 4. Without dislodging aggregate, remove excess mortar by lightly brushing surface with stiff nylon-bristle broom.
 - 5. Fine spray surface with water, and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- E. Abrasive-Blast, Exposed-Aggregate Finish: Produce exposed-aggregate finish to exterior surface of concrete by abrasive-blast finish before panel erection, as follows:
 - 1. Immediately after floating, spray chemical surface retarder on panel surface according to manufacturer's written instructions.
 - 2. Cover with plastic sheeting, sealing laps with tape, and remove after concrete has hardened.
 - 3. Apply abrasive-blast finish using abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces as follows:

- a. Light Exposure: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; maximum reveal of 1/16 inch (1.6 mm).
 - b. Medium Exposure: Generally expose coarse aggregate with slight reveal; maximum reveal of 1/4 inch (6 mm).
 - c. Heavy Exposure: Expose and reveal coarse aggregate to a maximum projection of 1/3 of its diameter; reveal of 1/4 to 1/2 inch (6 to 13 mm).
4. Acid Cleaning: After abrasive blasting, clean surfaces with a 5 to 10 percent concentration of hydrochloric acid wash. Thoroughly neutralize and flush acid from finished surfaces with water under pressure. Protect casting slab and adjacent panels from acid wash.

3.8 FACE-DOWN FINISHES

- A. Smooth, As-Cast Finish: Cast panel to produce a surface free of pockets, sand streaks, and honeycombs. Produce a surface appearance of uniform color and texture.
- B. Form-Liner Finish: Cast panel over form liners placed, secured, and sealed over casting slab to produce a textured surface free of pockets, streaks, and honeycombs. Produce a surface appearance of uniform color and texture.
- C. Abrasive-Blast, Exposed-Aggregate Finish: Produce exposed-aggregate finish to exterior surface of concrete by abrasive-blasting after panel erection.
 1. Apply abrasive-blast finish using abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces as follows:
 - a. Light Exposure: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; maximum reveal of 1/16 inch (1.6 mm).
 - b. Medium Exposure: Generally expose coarse aggregate with slight reveal; maximum reveal of 1/4 inch (6 mm).
 - c. Heavy Exposure: Expose and reveal coarse aggregate to a maximum projection of 1/3 of its diameter; reveal of 1/4 to 1/2 inch (6 to 13 mm).
- D. Brushed Exposed-Aggregate Finish: Produce exposed-aggregate finish to exterior surface of concrete by washing and brushing after panel erection, as follows:
 1. After panel erection and without dislodging aggregate, remove excess mortar by lightly brushing surface with stiff nylon-bristle broom.
 2. Fine spray surface with water, and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- E. Bushhammer Exposed-Aggregate Finish: Allow concrete to cure at least 14 days before starting bushhammer surface finish operations.

1. Surface Continuity: Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances of cut as shown on Drawings or to match mockup.
 2. Surface Cut: Maintain required depth of cut and general aggregate exposure. Use power tool with bushhammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.
- F. Sand-Bed, Exposed-Aggregate Finish: Place selected exposed aggregate on a sand bed over casting slab before placing reinforcement, embedments, and concrete. After erecting panel, remove sand to expose aggregate.

3.9 CONCRETE PROTECTING AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures according to ACI 301.
1. Apply evaporation retarder in hot, dry, or windy weather to protect concrete from rapid moisture loss before and during finishing operations. Apply according to manufacturer's written instructions after screeding and bull floating concrete, but before float finishing.
- B. Begin curing immediately after finishing concrete. Cure by one or a combination of the following methods according to ACI 308.1:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 ERECTION

- A. Use erection equipment with care to prevent damage to floor slabs and panels.

- B. Lift, support, and erect panels only at designated lifting or supporting points indicated on Shop Drawings.
- C. Do not erect panels until 75 percent of 28-day compressive strength of concrete has been verified.
- D. Install tilt-up concrete panels level, plumb, square, and true. Place panels on leveled grout-setting pads or shims in correct position. Maintain joint width of 1/2 inch between panels.
 - 1. Install tilt-up concrete panels with face-down surfaces exposed to exterior of building.
- E. Temporarily brace and support panels securely in position against 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 panels are secured.
- F. Anchor panels in place and, if indicated, to one another.
 - 1. Weld steel connectors to steel supports and embedments indicated, complying with AWS D1.1.
- G. Solidly grout-fill gaps between foundation system and bottom of panels.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before erection of tilt-up panels.
- C. Testing Services: Tests shall be performed according to ACI 301.

3.12 ERECTION TOLERANCES

- A. Install tilt-up concrete panels without exceeding the following erection tolerances:
 - 1. Joint Width Variation (Exterior Face): Without decreasing or increasing more than 50 percent from specified joint width, maintain joint width as follows:
 - a. For Panels up to 20 Feet (6.1 m) Tall: 1/4 inch (6 mm).

- b. Each Additional 10 Feet (3.05 m) in Excess of 20 Feet (6.1 m) Tall: 1/8 inch (3 mm).
- 2. Joint Taper: Maximum 3/8 inch (10 mm) over length, but not greater than the following:
 - a. For Panels up to 20 Feet (6.1 m) Tall: 1/4 inch (6 mm).
 - b. Each Additional 10 Feet (3.05 m) in Excess of 20 Feet (6.1 m) Tall: 1/8 inch (3 mm)
- 3. Panel Alignment:
 - a. Alignment of Horizontal and Vertical Joints: 1/4 inch (6 mm).
 - b. Offset in Exterior Face of Adjacent Panels: 1/4 inch (6 mm).

3.13 FILLING AND REPAIRS

- A. Patch holes and voids left by erecting and bracing inserts on tilt-up panels and slabs-on-grade. Cut or chip edges of voids perpendicular to concrete surface. Fill blockouts where indicated.
 - 1. Clean, dampen with water, and brush-coat holes, voids, and blockouts with bonding agent. Fill and compact with patching mortar of a stiff consistency before bonding agent has dried.
 - 2. Finish surfaces of fills and repairs to Architect's approval, with materials of same colors and textures as finishes on surrounding surfaces.
- B. Repair damaged galvanized steel surfaces of connectors by cleaning and applying a coat of zinc repair paint.
- C. Repair damage to tilt-up panels and slabs-on-grade resulting from tilt-up work, as directed by Architect.
- D. Remove and replace tilt-up panels that do not comply with requirements in this Section.
- E. Demolish and remove temporary concrete casting slabs.

END OF SECTION 03 47 13

SECTION 04 22 00 - CONCRETE 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry-joint reinforcement.
 - 5. Embedded flashing.
 - 6. Miscellaneous masonry accessories.
 - 7. Masonry-cell fill.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - 2. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry assemblies.
 - 3. Section 07 62 00 "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 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

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

1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's) this will depend on the manufacturer sections
- B. 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.
 4. Control joint locations corresponding with joints in cladding materials where applicable.
- C. Samples for Verification: For each type and color of the following:
1. Exposed CMUs.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties.
 2. Grout mixes. Include description of type and proportions of ingredients.
 3. Reinforcing bars.
 4. Joint reinforcement.
 5. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar. 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.
- D. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

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

- B. Mockups: Build mockups as indicated in Section 01 43 39 "Visual Mock-up Requirements".
 - 1. Build mockup of typical wall area as directed by Architect.
 - 2. Protect accepted mockups from the elements with weather-resistant membrane.
 - 3. 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.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. 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 aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 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.
- B. Do not apply uniform loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

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 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 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.
 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.
- D. Sustainability Requirements
 1. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 10 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
 2. Regional Materials: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for CMUs manufactured within 100 miles of

Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.4 CONCRETE MASONRY UNITS

- A. 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.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
 - 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) ACM Chemistries.
 - 2) BASF Corporation; Construction Systems.
 - 3) Grace Construction Products.
- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
- D. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 - 2. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints with modular coursing.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.5 MASONRY LINTELS

- A. General: Provide one of the following:
- B. 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.

2.6 INSULATED CONCRETE MASONRY UNITS

- A. Insulated Concrete Masonry Units: Pre-assembled structural concrete masonry units composed of an inner component concrete masonry shell that is continuously thermally broken from the outer concrete shell. The thermal break is expanded polystyrene (EPS) closed cell insulation. The insulation EPS is held firmly between the two concrete block shells by dove tail slots and internal stainless-steel metal anchors molded into the EPS inserts, creating a cohesive and tightly fitting single unit.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Northfield, an Oldcastle Company; InsulTech Insulated Concrete Masonry Units or comparable approved product meeting all requirements including sustainability requirements.
 - a. Refer to Sections 01 25 00 "Substitution Procedures" and 01 60 00 "Product Requirements" for comparable product requirements.
- B. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi. Weight Classification: Medium weight with density not to exceed 125 lbs. per cubic foot concrete.
- C. Molded-Polystyrene Insulation:
 - 1. Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I.
 - 2. Provide specially shaped insulation designed for installing in face shells of insulated masonry units and providing continuous thermal barrier across head joints, including corner units. Provide an adhesive applied to EPS insert which serves as a continuous air barrier. Provide compliant closed cell gasket material to provide air tightness and continuous insulation across the bed joints.
- D. Special Shapes:
 - 1. Provide special shapes as follows: Provide shapes including right and left corner and L corner units, jambs, half-size shapes, solid bottom bond beams, and other special conditions manufactured as pre-assembled units with EPS, complying with above requirements, and match exposed finish of insulated concrete masonry units.
 - 2. Provide square-edged units for outside corners. Provide EchelonMasonry.com separate 8" unit matching exposed finish to be installed at base of wall, above doors and windows, and other areas where flashing is required. Provide exterior face shell preassembled with 3" EPS with inside face shaved flush to be installed at base of wall, above doors and windows, and other areas where flashing is required.

2.7 THERMALLY IMPROVED CONCRETE MASONRY UNITS

- A. Thermally improved concrete masonry units: Specially formed concrete masonry units with pre-formed, molded expanded polystyrene inserts.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Omni Block Concrete Masonry Units or comparable approved product meeting all requirements including sustainability requirements.
- B. Provide special block sizes and shapes required or as shown on Drawings.

2.8 CMU INSULATION

- A. Where indicated, units shall contain rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.
 - 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. Concrete Block Insulating Systems.
 - b. Shelter Enterprises Inc.

2.9 MORTAR AND GROUT MATERIALS

- A. 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.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4-inch-thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Aggregate for Grout: ASTM C 404.
- F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACM Chemistries.
 - b. BASF Corporation - Admixture Systems.

c. Grace Construction Products.

G. Water: Potable.

2.10 REINFORCEMENT

- A. Provide Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- D. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Exterior Walls: Stainless steel.
 - 3. Wire Size for Side Rods: 0.187-inch diameter.
 - 4. Wire Size for Cross Rods: 0.187-inch diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.11 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry 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:
 - 1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
- C. 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.
- D. 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.

2.12 EMBEDDED FLASHING MATERIALS

A. Single-Wythe CMU Flashing

1. System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Mortar Net Solutions, BlockFlash or comparable approved product meeting all requirements including sustainability requirements.
 - 1) Refer to Sections 01 25 00 "Substitution Procedures" and 01 60 00 "Product Requirements" for comparable product requirements.
 - b. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 40 percent.
 - 1) Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.

B. Flexible Thru-Wall Flashing

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 1.0 mm (40 mil).
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) GCP Applied Technologies Inc. (formerly Grace Construction Products).
 - 3) W. R. Meadows, Inc.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

2.13 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated 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. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Advanced Building Products Inc.
 - 2) Keene Building Products.
 - 3) Mortar Net Solutions.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Configuration: Strips to fit within individual masonry cells.

2.14 MASONRY-CELL FILL

- A. Lightweight-Aggregate Fill: ASTM C 331/C 331M.

2.15 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. 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.
- B. 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.
 1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
 5. For mortar parge coats, use Type S or Type N.
- C. 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, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 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 would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 FIELD QUALITY CONTROL

- A. Concrete unit masonry installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.4 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.

C. Joints:

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

3.5 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. 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.

- D. Retroactive Work: Where work requires modification of existing CMU installations and stepping back of courses is not feasible, either too the new CMU infill units or provide vertical and horizontal masonry control joints as required to infill or replace masonry. Tie new joint reinforcement to existing reinforcement to the extent possible.
- 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 nonload-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. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.6 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

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

3.7 MASONRY-CELL FILL

- A. Pour lightweight-aggregate fill into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.

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 1/2-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 as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
 - 2. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.11 LINTELS

- A. 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.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall 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 lintels, 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.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 3 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
 - 4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
- 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 reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

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 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 Prior to Construction: One set of tests.

3.15 PARGING

- A. Parge exterior faces of masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.16 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 nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.17 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.

END OF SECTION 04 22 00

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.
- B. Related Requirements:
 - 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

1.3 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."
- B. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.

1.4 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.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 8113.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance – where possible.
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- 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 qualified by testing, including the following:

1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand critical welds.
- 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and shop-painting applicators.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats or fire proofing 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.
 6. Nonshrink grout.
 7. Rods
 8. Clevis
- F. Survey of existing conditions.
- G. Source quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE for building over 200,000 sf.
- 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."

1.9 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.
 - 2. Use Load and Resistance Factor Design; data are given at factored-load level or Allowable Stress Design; data are given at service-load level., refer to the drawings notes for each building
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of moment frame, braced frame, and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. 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-Shapes: 60 percent.
 - 3. Plate and Bar: 85 percent.
 - 4. Cold-Formed Hollow Structural Sections: 30 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992, Grade 50.
- C. Channels, Angles, M-Shapes: ASTM A 36/A 36M or A 572.
- D. Plate and Bar: ASTM A 572/A 572M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: As shown on Contract drawings
 - 2. Finish: Black except where indicated to be galvanized.
- G. Seamless Carbon and Alloy Steel Mechanical Tubing ASTM A 519 Grade 1096
- 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 High Strength Tension Rods System:

- A. Steel rods shall be carbon steel and shall conform to DIN EN 10025.
 - 1. For rods ½" in diameter or less provide S355 (51 ksi yield) steel
 - 2. For rods greater than ½" in diameter provide S460 (66 ksi yield) steel.
 - 3. Fabricate rods with right hand threads and left hand threads on alternate ends.
- B. Fittings shall be cast steel and shall be capable of developing 1.5 times the full breaking strength of the steel rod.
 - 1. For rods ½" in diameter or less material shall be forged carbon steel S355J2 DIN EN 10025
 - 2. For rods greater than ½" in diameter material shall be cast steel G20 Mn5+QT DIN EN 10293.

- C. Provide a complete system from one of the following or approved substitution:
1. Halfen Detan rod system, Halfen, USA, Inc., 8521 FM 1976, P.O. Box 547, Converse, TX 78109
 2. Macalloy 460 rod system, Macalloy, Caxton Way, Dinnington, Sheffield, S25 3QE, UK.
 3. Pfeifer Tension Rod System Typ 860, Pfeifer Seil- und Hebetchnik GmbH, Dr.-Karl-Lenz-Strasse 66, DE-87700 Memmingen.

2.4 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM 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. Retain "Direct-Tension Indicators" Subparagraph below if applicable. If using corrosion-resisting (weathering) steel, revise Type 325 to Type 325-3; ASTM F 959M does not include a designation for corrosion-resistant steel.
 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM 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 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: Mechanically deposited zinc coating] [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 1852, 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 (interior) and Mechanically deposited zinc coating (exterior).
- 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. Headed Anchor Rods: ASTM F 1554, Grade 55 unless shown otherwise on contract drawings, straight.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 Type 1, hardened carbon steel.
 - 4. Finish: Plain (interior) and Mechanically deposited zinc coating, ASTM B 695, Class 50 (exterior).
- G. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM A 36/A 36M carbon steel.
 - 3. Finish: Plain and Mechanically deposited zinc coating, ASTM B 695, Class 50.
- H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
- K. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint. Refer to drawings.
 - 1. Provide slide bearing system from one of the following or approved equal:
 - a. Con-Serv Inc. - Con Slide
 - b. Steel Supply Company
 - 2. Mating Surfaces: PTFE and mirror-finished stainless steel.
 - 3. Coefficient of Friction: Not more than 0.05
 - 4. Design Load: Not less than 4,000 psi.
 - 5. Total Movement Capability: See architectural drawings
- L. Urethane Springs: Compression Springs machined from Urethane rod stock or precision cast. Outer diameter and length as shown on Contract drawings. Inner diameter to be an interference fit for the rod diameter shown on Contract drawings.
 - 1. Fabricate from 60A Durometer urethane, natural color.
 - 2. Provide compression springs from one of the following or approved equal:
 - a. Gallagher Corp., 3908 Morrison Dr, Gurnee, IL 60031
 - b. Precision Urethane, 612 3rd St, Hempstead, TX 77445
 - c. Century Spring Corp., 5959 Triumph Street, Commerce, CA 90040

2.5 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.
- C. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 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.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 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, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning," and SSPC-SP 2, "Hand 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. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- I. 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.

2.8 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 unless shown otherwise on the drawings.
- 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.

2.9 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.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- 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: As per the primer manufacturer's recommendation.

- 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.

2.10 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 and welded door frames attached to structural-steel frame and located in exterior walls.
 - 3. Galvanize steel to be embedded in concrete or exposed to exterior.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Contractor will 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.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 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. Work shown on Contract drawings indicates final conditions only. The Contractor shall be responsible for insuring the stability of the construction during construction.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate [as indicated on the drawings](#).
 - 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 unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- 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 tab, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: **Owner will 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, inspect welds and perform non-destructive testing.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M. 100% visual inspection of all fillet welds including fit up and partial penetration welds with 25% subject to Liquid Penetrant or Mag Particle and 100% UT testing of full pen.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures.
 - 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.
- D. 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.

3.7 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.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

- D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 05 1200

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. K-series steel joists.
 - 2. KCS-type K-series steel joists.
 - 3. Joist accessories.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
 - 2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
 - 3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.3 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 nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 8113.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)

- 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.

1.5 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.

1.6 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."

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 SEQUENCING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Canam Steel Corporation
 - 2. Nucor, Vulcraft
 - 3. Or approved substitution

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Roof Joists: Vertical deflection of 1/240 of the span.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- D. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- E. Do not camber joists.
- F. 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.

- B. Primer: Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

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/A 36M 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 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.
- D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

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 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. The following requirements are intended to supplement GOAA's specification 01 4529 Structural Testing and Inspection. Where conflict exist specification 01 4529 Structural Testing and Inspection shall govern.
- B. Testing Agency: **Contractor will engage** a qualified testing agency to perform tests and inspections.
- C. 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. Ultrasonic Testing: ASTM E 164.
 - d. Radiographic Testing: ASTM E 94.
- D. Visually inspect bolted connections.
- E. Prepare test and inspection reports.

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.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

END OF SECTION 05 2100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Composite floor deck.
 - 3. Noncomposite form deck.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Sustainable Design Documentation Submittals: Refer to section 01 8113.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- 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.

1.4 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.

1.5 QUALITY ASSURANCE

- A. The following requirements are intended to supplement GOAA's specification 01 4529 Structural Testing and Inspection. Where conflict exist specification 01 4529 Structural Testing and Inspection shall govern.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- D. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" refer to drawings for building ratings.

1.6 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. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

2.2 ROOF DECK

- A. Manufacturers:
1. Canam Steel Corporation
 2. Nucor, Vulcraft
 3. Epic Metals
 4. Roof Deck Inc.
 5. Or approved substitution
- B. 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-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 80, G90 zinc coating.
 2. Deck Profile: Type WR wide rib or As indicated on the drawings.
 3. Profile Depth: 1-1/2 inches or as indicated on the drawings (2", 3" and 3 1/2")
 4. Design Uncoated-Steel Thickness: 0.0358 inch or as indicated on the drawings.
 5. Span Condition: Double span.
 6. Side Laps: Overlapped or interlocking seam at Contractor's option. The contractor shall follow FM Global for side lap installation
 7. Vented

2.3 COMPOSITE FLOOR DECK

- A. Manufacturers:
1. Canam Steel Corporation
 2. Nucor, Vulcraft
 3. Or approved substitution
- B. 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-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G90 zinc coating.
 2. Profile Depth: 2 inches or as indicated on the drawings.
 3. Design Uncoated-Steel Thickness: 0.0474 inch or as indicated on the drawings.
 4. Span Condition: As indicated on the drawings.

2.4 NONCOMPOSITE FORM DECK (Refer to drawings)

- A. Manufacturers:
 - 1. Xanam Steel Corporation
 - 2. Nucor, Vulcraft
 - 3. Or approved substitution
- B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G90 zinc coating.
 - 2. Profile Depth: 2 inches.
 - 3. Design Uncoated-Steel Thickness: 0.0358 inch or as indicated on the drawings.
 - 4. Span Condition: Double span or as indicated on the drawings.
 - 5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.5 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. 10 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.

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.
 - 1. Roof fasteners have to be FM Global approved

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Spacing: As indicated on drawings
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, or as indicated on the drawings and as follows:
 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 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 mechanical 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:
 1. Weld Diameter: 5/8 inch or as indicated on drawings, nominal.
 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 3. 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 not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 2. Mechanically clinch or button punch.
 3. Fasten with a minimum of 1-1/2-inch- long welds.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:
 - 1. End Joints: Lapped.
- 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. The following requirements are intended to supplement GOAA's specification 01 4529 Structural Testing and Inspection. Where conflict exist specification 01 4529 Structural Testing and Inspection shall govern.
- B. Testing Agency: **Contractor will engage** a qualified testing agency to perform tests and inspections.
- C. Field welds will be subject to inspection.
- D. 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.

END OF SECTION 05 3100

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. Exterior soffit framing.
3. Interior non-load-bearing wall framing as required to meet performance criteria.

B. Related Requirements:

1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Section 05 50 00 "Metal Fabrications" for masonry shelf angles and connections.
3. Section 07 42 13.23 "Metal Composite Material Wall Panels" for sheet metal zee component of wall assemblies.
4. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
5. Section 09 22 16 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
6. Section 09 24 00 "Cement Plastering" for cold-formed metal zees for cement plaster attachment.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.

- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Regional/Local Multiplier Compliance
 - b. Leadership Extraction Practices for Recycled Content
2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)

C. Shop Drawings:

1. Include layout, spacing, 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Mechanical fasteners.
 - 4. Vertical deflection clips.
 - 5. Horizontal drift deflection clips
 - 6. Miscellaneous structural clips and accessories.
- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.
- E. Delegated-Design Submittal: For cold-formed steel framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data signed and sealed by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional Licensed Structural Engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing – General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing – Header Design."

1.6 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 to design exterior curtain wall and window wall metal stud framing details, shop drawings, and calculations for Deferred Submittal to obtain supplemental permits and approval from Authorities Having Jurisdiction. Design shall include framing for all non-full height elements, bulkheads, soffits, and exterior walls incorporating metal stud framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As follows:
 - a. Dead Loads: Weights of materials and construction.
 - b. Live Loads: As indicated on drawings.
 - c. Seismic Loads: As indicated on drawings.
 - 2. Design Wind Loads: As indicated on drawings.
 - 3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of $1/360$ of the wall height.
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of $1/360$ of the wall height.
 - c. Ceiling Joist 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 indicated on Drawings.
 - 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:
 - 1. Wall Studs: AISI S211.
 - 2. Headers: AISI S212.
 - 3. Lateral Design: AISI S213.
- 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 E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Coating: G90 or equivalent.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification

2.3 MANUFACTURERS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide Marino\Ware cold-formed metal framing products or a comparable product by one of the following:
 - 1. Clarkwestern Dietrich Building Systems LLC
 - 2. MBA Building Supplies
 - 3. Steel Structural Products

2.4 EXTERIOR AND INTERIOR 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: 0.0428 inch.
 - 2. Minimum Flange Width: 1-3/8 inches.
 - 3. Minimum Stud Depth: 3-5/8 inches.
 - 4. Section Properties: As required by design requirements.
- 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 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:
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 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.
 - 2. Inner Track: Of web depth indicated.
- 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.
- G. Z-Furring: Manufacturer's standard Z-shaped steel furring, of web depths indicated and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Minimum Flange Width: 1-1/4 inches.
 - 3. Web Depth: As indicated.
 - 4. Section Properties: As required by design requirements.

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: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.
 - 3. Retain "Section Properties" Subparagraph below if not assigning design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.
 - 4. Section Properties: As required by design requirements.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, including but not limited to the following:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.

- 9. Hole reinforcing plates.
- 10. Backer plates.

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 headless, hooked 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.
- 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. 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.
- E. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- 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. 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.
- D. Sealer (Strip) 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.

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. 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 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.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. 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.
- F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- G. Install insulation, specified in Section 07 21 00 "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 AND INTERIOR 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: As required by design requirements, 16 inches maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single 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 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.
 - 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: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors and grilles.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams, hoist beams, and divider beams.
6. Steel shapes for supporting elevator door sills.
7. Shelf angles.
8. Metal ladders.
9. Metal crossovers.
10. Elevator pit sump covers.
11. Miscellaneous steel trim including steel angle corner guards and loading-dock edge angles.
12. Metal bollards.
13. Pipe guards.
14. Loose bearing and leveling plates for applications where they are not specified in other Sections.
15. Premanufactured guardrails.

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

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 22 00 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 12 00 "Structural Steel Framing."
4. Section 32 93 00 "Exterior Plants" and 32 94 00 "Interior Plants" for tree grates.

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 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.

1.4 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for ceiling-hung toilet compartments.
 - 2. Steel framing and supports for overhead doors and grilles.
 - 3. Steel tube reinforcement for low partitions.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Elevator machine beams, hoist beams, and divider beams.
 - 7. Steel shapes for supporting elevator door sills.
 - 8. Shelf angles.
 - 9. Metal ladders.
 - 10. Metal pipe crossovers.
 - 11. Elevator pit sump covers.
 - 12. Miscellaneous steel trim including steel angle corner guards and loading-dock edge angles.
 - 13. Metal bollards.
 - 14. Wire rope.
 - 15. Pipe guards.
 - 16. Metal downspout boots.
 - 17. Loose steel lintels.
- C. Delegated-Design Submittal: For ladders and alternating tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 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.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. 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."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 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 professional Licensed Structural Engineer who is legally qualified to practice in jurisdiction where Project is located to design ladders.
- B. 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.

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. Sustainability Requirements
 - 1. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.

- a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
 2. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification
 3. Corporate Sustainability Report: Provide third-party verified Corporate Sustainability Report (CPD) including impacts of extraction operations and activities associated with the manufacturer's product and product's supply chain conforming the following:
 - a. Global Reporting Initiative (GRI) Sustainability report
 - b. Organization for Economic Co-operation and Development (OOECD) Guidelines for Multinational Enterprises.
 - c. U.N. Global Compact: Communication of Progress
 - d. ISO 26000: 2010 Guidance on Social Responsibility
 - e. USGBC Approved Program: Other approved programs meeting the CSR criteria.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- F. 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.
- G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- H. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- K. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- O. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

- P. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (lead red brass) or No. C84400 (lead semired brass).
- Q. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- R. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent lead nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 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.
- 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. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. 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.
- E. 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.
- F. 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.
- G. 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.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting," Section 09 91 23 Interior Painting," and Section 09 96 00 "High-Performance Coatings."

- 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. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- H. 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.
- I. 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 3000 psi.
- J. Shim Pads: Multi-polymer plastic, non-stain shim pad. 1/8-inch thick. Size as needed to provide separation from dissimilar metals.

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. Galvanize miscellaneous framing and supports where indicated.
- 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. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3, except for elevator pit ladders.
 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 1. Space siderails 18 inches apart unless otherwise indicated.
 2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
 3. Rungs: 3/4-inch-diameter steel bars.
 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 6. Galvanize exterior ladders, including brackets.

2.9 ELEVATOR PIT SUMP COVERS

- A. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch in least dimension.
- B. Provide steel angle supports as indicated.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel 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.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Fill bollards with concrete as indicated in Section 03 30 00 "Cast-In-Place Concrete.
 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. Prime bollards with zinc-rich primer.

2.12 PREMANUFACTURED GUARDRAILS

- A. Provide premanufactured steel guardrail with welded connections and steel baseplate for connection to floor.
1. Approximate height: 15 inches.
 2. Finish: Shop finish with manufacturers standard finish.
 - a. Color: Safety Yellow.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. FS Industries
 2. Ideal Warehouse Innovations Inc.

2.13 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch-thick by 12-inch-wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Galvanize pipe guards indicated for external locations.
- C. Prime pipe guards indicated for internal locations with zinc-rich primer.

2.14 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.

2.15 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.

2.16 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.17 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.

2.18 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.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

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.

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 operable partitions overhead doors and overhead grilles 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.

3.4 INSTALLING WIRE ROPE

- A. Install wire rope at locations indicated. Secure wire ropes to structure and tighten to remove slack.

3.5 INSTALLING PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers or where indicated. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.6 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of 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.

3.7 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.
- 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.
 - 2. Railing gates at the level of exit discharge.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for pipe and tube railings.

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 anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
- D. Coordinate locations of stair bases with structural.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 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. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design stairs.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930

3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- G. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- H. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.

2.3 ABRASIVE NOSINGS

- A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Nystrom, Inc.; Model STSB-N3E or a comparable product by one of the following:
 - a. Amstep Products.
 - b. Balco, Inc.
 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
 3. Nosings: Square-back units, 3 inches (75 mm) wide, without lip.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; 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.
 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.
- D. Post-Installed Anchors: chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing

according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- F. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it. Refer to Sections 09 9113 "Exterior Painting" and Section 09 91 23 "Interior Painting" for additional requirements.
- D. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates or channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld 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. 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 cold-rolled steel sheet.
 - 2. Steel Sheet: Galvanized-steel sheet, where indicated.

3. Directly weld metal pans to stringers; locate welds on top of subreads where they are concealed by concrete fill. Do not weld risers to stringers.
- D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- E. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 51 13

SECTION 05 51 16 - METAL FLOOR PLATE STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes industrial-type, straight-run stairs with steel floor plate treads and railings attached to metal floor plate stairs.
- B. Related Requirements:
 - 1. Section 05 51 13 "Metal Pan Stairs" for concrete filled metal pan stairs and platform.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for pipe and tube railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal floor plate stairs and the following:
 - 1. Metal floor plate treads.
 - 2. Paint products.
 - 3. Grout.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design stairs.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. 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.
- E. Abrasive-Surface Floor Plate: Steel diamond plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Balco, Inc.

- b. Grace Construction Products; W.R. Grace & Co. -- Conn.
- c. IKG Industries, a division of Harsco Corporation.
- d. SlipNOT Metal Safety Flooring; W.S. Molnar Company.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; 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.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.
- D. Post-Installed Anchors: 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 Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. 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.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, 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.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Form exposed work with accurate angles and surfaces and straight edges.
- C. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.
- D. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," industrial class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel tubes as indicated
 - a. Provide closures for exposed ends of steel tube stringers.
 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 3. Weld stringers to headers; weld framing members to stringers and headers.
- C. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from rolled-steel floor diamond plate of thickness needed to comply with performance requirements, but not less than 3/16 inch or as indicated.
1. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
 2. Weld steel supporting brackets to stringers and weld treads to brackets.
 3. Fabricate platforms with integral nosings matching treads and weld to platform framing.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."
1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
 2. Connect posts to stair framing by direct welding unless otherwise indicated.
 3. Perforated-Metal Infill: Perforated-metal panels edged with U-shaped channels made from metal sheet, of same metal as perforated metal, and not less than 0.123 inch thick. Orient perforated metal with pattern as indicated on Drawings with vertical panel joints aligned with railing posts.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

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

3.3 ADJUSTING AND CLEANING

- A. 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 51 16

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe railings.
 - 2. Stainless-steel pipe railings.
- B. Related Requirements:
 - 1. Section 05 51 13 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
 - 2. Section 05 51 16 "Metal Floor Plate Stairs" for steel tube railings associated with metal pan stairs.

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 anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 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 professional Licensed Structural Engineer who is legally qualified to practice in jurisdiction where Project is located to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. 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.
 - C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F.
- 2.2 METALS, GENERAL
- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
 - B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2-1/4-inch clearance from inside face of handrail to finished wall surface.
- 2.3 STEEL AND IRON
- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
 - B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - a. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - b. Industry Wide Product Specific Type III EPD Third Party Certification
 - C. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 - D. 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.
 - E. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- 2.4 STAINLESS STEEL
- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
 - B. Tubing: ASTM A 554, Grade MT 304.

- C. Pipe: ASTM A 312/A 312M, Grade TP 304.
- D. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- E. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.5 FASTENERS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
- C. Industry Wide Product Specific Type III EPD Third Party Certification
- D. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - 3. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
- E. 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.
- F. Fasteners for Interconnecting Railing Components:
 - 1. 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.
- G. Post-Installed Anchors: chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.

1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
- C. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 1. For stainless-steel 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.
- E. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- F. Galvanizing Repair Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting".
- G. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting".
- H. Intermediate Coats and Topcoats: Provide products that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- I. 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.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. 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.
- J. Form Changes in Direction as Follows:
 - 1. By inserting prefabricated elbow fittings.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. 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.
- M. 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.
- N. 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.
- O. 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.
- P. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load,

measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 STEEL AND IRON FINISHES

- A. 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; however, galvanize anchors to be embedded in 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, "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. Shop prime uncoated railings with primers specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" unless indicated.
 - 2. Do not apply primer to galvanized surfaces.

2.9 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines, or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.
- C. Dull Satin Finish: No. 6.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 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. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals shall be separated with #30 building felt.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches 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. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.
- B. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. 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 stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

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

END OF SECTION 05 52 13

SECTION 05 53 13 - BAR GRATINGS

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 metal bar gratings and metal frames and supports for gratings.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for structural-steel framing system components.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.3 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Clips and anchorage devices for gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For gratings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control" to design gratings.
- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 - 2. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft.
 - 3. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft.
 - 4. Limit deflection to $L/360$ or $1/4$ inch, whichever is less.

2.2 METAL BAR GRATINGS

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welded Steel Grating:
 - 1. Bearing Bar Spacing: $1-3/16$ -inch o.c.
 - 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 - 3. Bearing Bar Thickness: As required to comply with structural performance requirements but not less than $3/16$ inch.
 - 4. Crossbar Spacing: 4 inches o.c.
 - 5. Traffic Surface: Smooth.
 - 6. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- C. Wire Rod for Bar Grating Crossbars: ASTM A 510.
- D. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.

- E. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
- F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M, Type 316L.
- G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

2.4 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 stainless steel.
- 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, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 2.
- 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. Post-Installed Anchors: Torque-controlled expansion or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material 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 from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and 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.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Toeplate Height: 4 inches unless otherwise indicated.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 - 2. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- I. Do not notch bearing bars at supports to maintain elevation.

2.7 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- B. Galvanize steel frames and supports.

2.8 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

2.9 SCAFFOLD DEBRIS NETTING

- A. Scaffold Debris Netting: Flame-retardant, heavy duty HDPE monofilament material to prevent tools and materials from falling to lower levels.
 - 1. Attachment Method: Manufacturer's standard reinforced button holes or metal grommets.
 - 2. Mesh Size: 3/8-inch maximum.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. 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. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and 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.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. 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 53 13

SECTION 05 53 16 - PLANK GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes formed-metal plank gratings and metal frames and supports for gratings.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for structural-steel framing system components.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

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 anchorages for gratings, grating frames, and supports. 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. Formed-metal plank gratings.
 - 2. Extruded-aluminum plank gratings.
 - 3. Paint products.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: Include plans, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For gratings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

- B. Welding certificates.
- C. 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 the following:
 - 1. 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 gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design gratings.
- D. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 125 lbf/sq. ft. or concentrated load of 2000 lbf, whichever produces the greater stress.
 - 2. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 - 3. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft..
 - 4. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft..
 - 5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
 - 6. Limit deflection to L/360 or 1/4 inch, whichever is less.

2.2 FORMED-METAL PLANK GRATINGS

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.
 - 1. Channel Width: As required to comply with structural performance requirements.
 - 2. Channel Depth: As required to comply with structural performance requirements.
 - 3. Material: 0.104-inch-thick steel sheet, hot-dip galvanized after fabrication.

2.3 FERROUS METALS

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.
- E. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 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.

- B. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting".

2.6 FABRICATION

- A. Cut, drill, and punch material 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.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Welding: Comply with AWS recommendations and 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.
- D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates for attaching in the field.
 - 2. Toeplate Height: 4 inches unless otherwise indicated.
- E. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
 - 1. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- F. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8-inch-thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

2.7 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24

inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4-inch-thick by 8 inches long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.
2. Interior, where indicated.

2.8 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. 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. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Attach toeplates to gratings by welding at locations indicated.

F. Field Welding: Comply with AWS recommendations and 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.

G. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL PLANK GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach removable units to supporting members by bolting at every point of contact.
- C. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
- D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 53 16

SECTION 05 58 13 - COLUMN COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal column covers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings (applied on-site only)
 - b. Low Emitting Materials for Adhesives and Sealants
 - 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: Show fabrication and installation details for column covers.
- D. Coordination Drawings: Show all items to be enclosed within, attached to, and inserted into the column covers.
- E. Samples for Initial Selection: For products involving selection of color, texture, or design.
- F. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build in-place mockups of typical column covers as selected by the Architect.
 - 2. Mock-up shall include all concealed utilities, equipment, etc. provided by others as well as access panels and grilles.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver column covers wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

PART 2 - PRODUCTS

2.1 COLUMN COVERS (MCC1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Gordon, Inc.; eConnect Metal Column Covers or comparable product by one of the following manufacturers meeting all requirements including sustainability requirements.
 - 1. BellPro Architectural, LLC.
 - 2. C.R. Laurence Co., Inc.
 - 3. Fry Reglet Architectural Metals
- B. Materials:
 - 1. Galvanized Steel Sheet: 20 gauge.
 - a. Finish: Custom Powder Coat As indicated in the Finish Legend.
 - b. Color: As indicated in the Finish Legend.
 - 2. Top Cap: ASTM B 209 Aluminum, 5052-H34, 0.063" Thick (min)
 - a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- C. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- D. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification

2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting column covers and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.
 - 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- B. Access Panels: Fabricated from the same basic metal, finish and color as the column cover.
 - 1. Door Type: Flush with concealed flanges and concealed hinges.
 - 2. Door Size and Location: As required to access interior equipment.
 - 3. Latch and Lock: Cam latch, key operated with interior release.
- C. Speaker Covers: Fabricated from acoustically transparent material.
 - 1. Location: Coordinate location with speaker locations.

2.3 FABRICATION, GENERAL

- A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush, oil-can free surfaces without cracking or grain separation at bends.

2.4 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of column covers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place column covers plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install column covers.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Apply #30 building felt between concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean 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. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
- C. Cleaning: Refer to section 01 74 23 "Final Cleaning" for approved cleaning products.

3.4 PROTECTION

- A. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 58 13

SECTION 05 71 00 - DECORATIVE METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes steel-framed decorative metal stairs.
- B. Related Requirements:
 - 1. Section 03 45 00 "Precast Architectural Concrete" for precast concrete treads.
 - 2. Section 05 73 13 "Glazed Decorative Metal Railings" for glazed decorative metal railings.
 - 3. Section 09 66 23 "Resinous Matrix Terrazzo Flooring" for terrazzo treads and landings for decorative metal stairs.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Abrasive nosings.
 - 2. Paint products.
 - 3. Grout.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Shop drawings shall be sealed by a licensed professional engineer licensed in the state of Florida.
- D. Structural Calculations:

1. Structural calculation to be sealed by a licensed professional engineer licensed in the State of Florida.
- E. Samples for Initial Selection: For products involving selection of color, texture, or design.
- F. Samples for Verification: For the following products:
 1. Abrasive nosings, 12-inches long.
- G. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Qualification Data: For qualified professional engineer.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For ornamental steel-framed stairs, materials and finishes to include in maintenance manuals as specified in Section 01 78 00 "Closeout Submittals".
- B. Warranties: 12-month warranty as specified in Section 01 78 00 "Closeout Submittals".

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 1. Ornamental Stairs: Architectural class.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control, to design stairs.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: 100 lbf/sq. ft..

2. Concentrated 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- G. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- H. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

2.3 ABRASIVE NOSINGS

- A. Extruded Units: Stainless steel units, 2-inches wide, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions as indicated in Drawings.
 1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
- B. Provide anchors for embedding units in terrazzo, either integral or applied to units, as standard with manufacturer.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; 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.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. 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. Shop Primers: Provide primers that comply with Sections 09 91 13 "Exterior Painting" and 09 91 23 "Interior Painting".
- B. 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.

2.6 PRECAST RESINOUS MATRIX TERRAZZO TREADS AND RISERS

- A. Resinous Matrix Terrazzo: Refer to Section 09 66 23 "Resinous Matrix Terrazzo Flooring".

2.7 RESINOUS MATRIX TERRAZZO LANDINGS

- A. Resinous Matrix Terrazzo: Refer to Section 09 66 23 "Resinous Matrix Terrazzo Flooring".

2.8 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, 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. 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 connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.9 STEEL-FRAMED STAIRS

- A. Stair Framing:
 - 1. Fabricate stringers of steel sections as indicated.
 - 2. Construct platforms of steel tube headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
- B. Subtreads, Risers, and Subplatforms:
 - 1. Form subtreads, risers, and subplatforms to configurations indicated from cold-rolled steel sheet 0.075 inch thick or of thickness indicated.
 - 2. Weld subtreads to stringers. Locate welds on top of subtreads where they will be concealed by finished treads.
 - 3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
- C. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.10 STAIR RAILINGS

- A. Comply with applicable requirements in Section 05 73 13 "Glazed Decorative Metal Railings."
 - 1. Connect railing to stair framing by direct welding unless otherwise indicated.

2.11 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast 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, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

END OF SECTION 05 71 00

SECTION 05 73 00 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stainless-steel decorative railings with stainless-steel wire-rope guard infill.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring railings.
 - 2. Section 09 22 16 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- 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.
- 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 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 meet structural performance requirements.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Shop Drawings: Include plans, elevations, sections, and attachment details.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

- E. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Welded connections.
- F. 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. Preconstruction test reports.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
- 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. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made by Owner. Retesting of products that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
 - 2. Test railings according to ASTM E 894 and ASTM E 935.
 - 3. Notify Architect seven days in advance of the dates and times when laboratory mockups will be tested.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stainless-Steel Decorative Railings:
- B. Basis of Design Manufacturers: Subject to compliance with requirements, provide Phoenix Tube Company, Inc products or a comparable product by one of the following :
 - 1. Architectural Metal Works.
 - 2. Livers Bronze Co.
 - 3. Peterson Metals
 - 4. VIVA Railings, LLC.
- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. 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 railings 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.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. End (termination) posts: 2" square tube x ¼" wall, type 304 stainless steel, #4 finish.
- C. Line posts: 1"x2" rectangle tube x 11ga. wall, type 304 stainless steel, #4 finish.
- D. Top rail: 1"x3" rectangle tube x 11ga. wall, type 304 stainless steel, #4 finish.
- E. Infill: Ø3/16 cable, 1:19 strand, left hand lay, type 316 stainless steel, #4 finish.
- F. Fittings: Receiver and swage stud system, type 316 stainless steel, #4 finish.
- G. Handrail: Ø1-1/2" round tube x 11ga. wall, type 304 stainless steel, #4 finish.
- H. Handrail bracket: Ø5/8" round rod, type 304 stainless steel, #4 finish.

2.4 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
- E. Bars and Shapes: ASTM A 276, Type 304.
- F. Wire Rope and Fittings:
 - 1. Wire Rope: 1-by-19 wire rope made from wire complying with ASTM A 492, Type 316.
 - 2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless-Steel Components: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring 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. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
 - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Applied Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- 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. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. 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. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- D. 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.

- E. Form work true to line and level with accurate angles and surfaces.
- F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Connections: Fabricate railings with welded connections unless otherwise indicated.
- I. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.
- J. Mechanical 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 hollow 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 to 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.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.

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. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

- 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 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach handrails to walls with wall brackets. Provide brackets with 2-1/4-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. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For 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.
 - 4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
 - 5. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and

conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING

- A. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional requirements.

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.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 73 00

SECTION 05 73 10 - SMOKE BAFFLE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pre-engineered, component-based, smoke baffle system.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring railings.

1.3 REFERENCES

- A. ANSI Z97.1 - Safety Glazing Material Used in Buildings.
- B. ASTM E 985 – Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes and installation instructions. Installation instructions include all structural computations and test reports provided by the manufacturer evidencing compliance with the specifications.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation. Show details of attachment of smoke baffle system to supports.
- D. Submit manufacturer's samples of standard materials, finishes, colors, and textures.
- E. Manufacturer's Quality Assurance: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application. Submit certification that the manufacturer has not less than 5 years' experience producing the product specified in this section. Installation of this product will be done by the manufacturer or an approved installer.

- F. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.
- G. Warranty: Submit manufacturer's standard warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

PART 2 - PRODUCTS

2.1 SMOKE BAFFLE SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Smoke Baffle Systems by Blumcraft a division of C.R. Laurence Co. Inc. or comparable product by one of the following:
 - 1. Livers Bronze
 - 2. VIVA Railings
- B. Pre-Engineered, Component-Based, Smoke Baffle System
 - 1. Base 1-17/32" (38.9 mm) x 2-51/64" (71 mm) extruded aluminum - for 1/2" (12 mm) Tempered Glass.
 - 2. Glazing Material: ANSI Z97.1.
 - a. Field glaze glass panels.
 - b. Tempered Glass: Kind FT (fully tempered).
 - c. Thickness: 1/2-inch.
 - 3. Finish
 - a. Powder Coat: Color as selected by the Architect from Manufacturer's full range.
- C. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive smoke baffle system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install smoke baffle system in accordance with manufacturer's instructions using trained installers.
- B. Install units rigid, straight, level, and plumb.
- C. Attach smoke baffle system securely in place using fasteners supplied or approved by manufacturer. All embedded anchor plates and supporting steel shall be provided by another trade and coordinated with the smoke baffle supplier.
- D. Attach smoke baffle system to supports as indicated on the drawings and as approved by manufacturer.
- E. Use manufacturer's supplied hardware.
- F. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- G. Remove and replace defective or damaged components that cannot be successfully repaired as determined by Architect.

3.3 CLEANING

- A. Clean smoke baffle system promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh or abrasive cleaning materials or methods that would damage glass or finish.
- C. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

3.4 PROTECTION

- A. Protect installed smoke baffle system from damage during other construction.

END OF SECTION 05 73 10

SECTION 05 73 13 - GLAZED DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-supported railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

- 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.
- 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 items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 3. Product Certificates: Provide the following:
 - a. Health Product Declarations (HPD's)

b. Corporate Sustainability Reporting (CSR's)

- C. Shop Drawings: Include plans, elevations, sections, and attachment details.
- D. Samples for Verification: For each type of exposed finish required.
- E. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- D. Preconstruction test reports.
- E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.8 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide Wagner Companies glazed decorative metal railing products or a comparable product by one of the following:
 - 1. Architectural Metal Works.
 - 2. Blum, Julius & Co., Inc.
 - 3. Laurence, C. R. Co., Inc.
 - 4. Livers Bronze Co.

5. VIVA Railings, LLC.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 01 60 00 "Product Requirements."
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a professional Licensed Structural Engineer who is legally qualified to practice in jurisdiction where Project is located to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 2. Copper Alloys: 60 percent of minimum yield strength.
 3. Stainless Steel: 60 percent of minimum yield strength.
 4. Steel: 72 percent of minimum yield strength.
 5. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. 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.
- 3. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings 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.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666 or ASTM A 240/A 240M, Type 304.
- E. Bars and Shapes: ASTM A 276, Type 304.

2.5 STEEL AND IRON

- A. Tubing: ASTM A 500/A 500M (cold formed) or ASTM A 513.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

2.6 GLASS AND GLAZING MATERIALS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
 - 1. Basis of Design: PPG Starphire or comparable product meeting all requirements including sustainability requirements by one of the following manufacturers
 - a. Guardian Glass, LLC
 - b. Pilkington North America.
 - 2. Glass Color: Ultraclear.
 - 3. Thickness: As required by structural loads, but not less than 12.0 mm.

- B. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and polyvinyl butyral interlayer not less than 0.060 inch thick.
 - 1. Basis of Design: PPG Starphire or comparable product meeting all requirements including sustainability requirements by one of the following manufacturers
 - a. Guardian Glass, LLC
 - b. Pilkington North America.
 - 2. Kind: LT (laminated tempered).
 - 3. Glass Color: Ultraclear.
 - 4. High Strength Interlayer:
 - a. Basis of Design: DuPont™ SentryGlas® Plus, as manufactured by DuPont™ Building Innovations™; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; www.DuPont.com/safetyglass
 - b. Thickness: 0.060 inch
 - c. Color: Clear
 - d. Interlayer Physical Properties:
 - 1) Young's Modulus: 43 kpsi, when tested in accordance with ASTM D5026
 - 2) Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
 - 3) Elongation: 400%, when tested in accordance with ASTM D638
 - 4) Flex Modulus: 50 kpsi, when tested in accordance with D790.
 - 5) Heat Deflection Temperature at 0.46 MPa: 110 deg F, when tested in accordance with D648.
 - 5. Glass Plies: Thickness required by structural loads, but not less than 6.0 mm thick, each.
- C. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
 - 1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.
- D. Glazing Gaskets for Glass Infill Panels: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

2.7 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless-Steel Components: Type 304 stainless-steel fasteners.
 - 2. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring 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. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
 - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 MISCELLANEOUS MATERIALS

- A. Shop Applied Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- B. 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.
- C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.9 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. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

- G. Mechanical 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.
- H. Form changes in direction as follows:
 - 1. As detailed.
- I. 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.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.
- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where 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 to prevent bracket or fitting rotation and crushing of substrate.
- L. 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.

2.10 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
 - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
 - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Balusters: Provide laminated, tempered glass panels.

2.11 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.12 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Directional Satin Finish: No. 4.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 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. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- 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.

3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- 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.

3.3 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - 1. Attach base channel to building structure, then insert and connect factory-fabricated glass panels.
 - 2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - 3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.
- C. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional requirements.

3.6 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.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

ORLANDO INTERNATIONAL AIRPORT
BP-S195
Terminal C
Airside Concourse

GLAZED DECORATIVE METAL RAILINGS

SECTION 05 73 13

END OF SECTION 05 73 13

SECTION 05 75 00 - DECORATIVE FORMED METAL

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Formed metal trim.
 - 2. Metal base.
 - 3. Overhead clearance bars

1.3 COORDINATION

- A. Coordinate installation of anchorages for decorative formed metal items. 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 items to Project site in time for installation.
- B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Sustainable Design Submittals:
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

- D. Samples for Initial Selection: For products involving selection of color, texture, or design.
- E. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: For Installer.
- C. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- 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. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 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. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.

1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.2 MISCELLANEOUS MATERIALS

- A. Sealants, Interior: Nonsag, paintable sealant complying with Section 07 92 00 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
1. Use filler metals that will match the color of metal being joined and will not cause discoloration.
- C. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.
 2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
- E. Anchor Materials:
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.
- F. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
- G. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal, will prevent telegraphing and oil-canning, and is compatible with substrate and noncombustible after curing.
1. Field applied adhesives shall comply with low emitting adhesives requirements:
 - a. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.

2.3 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in 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.

- B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch-wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 - 1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.4 DECORATIVE FORMED METAL FABRICATIONS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Decorative Formed Metal Type DM1 and Type DM2 as indicated in Section 09 00 01 "Finish Key" or comparable approved product meeting all requirements including sustainability requirements.
 - 1. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- B. Form from metal of type and thickness indicated. Fabricate to fit tightly to adjoining construction.
- C. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
- D. Drill and tap holes needed for securing closures and trim to other surfaces.
- E. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
- F. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.5 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- D. Finish items indicated on Drawings after assembly.
- E. 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.

2.6 OVERHEAD CLEARANCE BEAMS

- A. Basis-of-Design: Signal-Tech "I-Bar" or subject to compliance with criteria, comparable product.
- B. Construction: Single-piece extruded aluminum bar with end caps and adjustable eyebolts for top mounting.
 - 1. Size: 7 inches high by 4 inches deep by lengths shown on Drawings.
 - 2. Finish: Manufacturer's standard powder coat finish.
 - 3. Color: Traffic Yellow.
 - 4. Graphics: Vinyl letters and warning striping, color black.

2.7 CEILING DEVICE SLOT

- A. Form ceiling device slots from metal of type and thickness indicated below. Coordinate size of slots, location of cutouts for electrical, mechanical, and fire protection and method of attachment to adjoining construction.
 - 1. Aluminum Sheet: 0.063 inch (1.60 mm).
 - a. Finish: Baked enamel or powder coat.
 - 2. Fabricate light coves with hairline butt joints.
 - 3. Provide factory endcaps.
 - 4. Ceiling device slots may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

2.8 WIRE MESH INFILL PANELS

- A. Woven-Wire Mesh: Intermediate-crimp, square pattern, 1-inch woven-wire mesh, made from 0.120-inch nominal diameter (minimum) stainless steel wire complying with ASTM A 580/A 580M, Type 316.

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 decorative formed metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.
- F. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths. Refer to Section 01 74 23 "Final Cleaning" for additional requirements.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 75 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking, cants, and nailers.
 - 2. Plywood backing panels.
- B. Related Sections
 - 1. Section 07 13 26 "Self-Adhering Sheet Waterproofing" for separator between wood blocking and roof deck, cold-formed metal framing, aluminum flashing, and other metal components.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2-inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2-inches nominal size or greater but less than 5-inches nominal size in least dimension.
- C. OSB: Oriented strand board.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Testing Data:
 - a. Documentation on Low Emitting Composite Wood Materials.
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all rough carpentry unless otherwise indicated.
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

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 D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. Roof construction.
 3. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 - 1. Mixed southern pine or southern pine; SPIB.
 - 2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide Roseburg Arreis products or a comparable product by one of the following
 - 1. Boise Cascade
 - 2. Certified Wood Products, Inc.
 - 3. Dixie Plywood and Lumber Co.
 - 4. Timber Products Co.
- B. 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.
- C. Low Emitting Materials: Comply with the requirements of the California Air Resources Board (CARB), Airborne Toxic Measure ATCM requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional requirements

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. 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.
- C. 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.
- D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- E. 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.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 230 4.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).

- I. Install high temperature self-adhering membrane between pressure-treated wood blocking and metal components and in locations 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.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 FIELD QUALITY CONTROL

- A. Architectural precast concrete installer shall provide field quality control by PCI certified staff and shall provide the following reports and checklists.
 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.

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

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Parapet sheathing.
 - 3. Roof Sheathing.
 - 4. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
 - 2. Section 07 27 29 "Air-Barrier Coatings" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
 - 3. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants

1.4 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.

1.5 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 Sheathing, general

- A. Recycled Content of Gypsum Based Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Health Product Declaration: Provide Health Product Declaration (HPD) with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Corporate Sustainability Report: Provide third-party verified Corporate Sustainability Report (CPD) including impacts of extraction operations and activities associated with the manufacturer's product and product's supply chain conforming the following:
 - 1. Global Reporting Initiative (GRI) Sustainability report
 - 2. Organization for Economic Co-operation and Development (OOECD) Guidelines for Multinational Enterprises.
 - 3. U.N. Global Compact: Communication of Progress
 - 4. ISO 26000: 2010 Guidance on Social Responsibility
 - 5. USGBC Approved Program: Other approved programs meeting the CSR criteria.

2.3 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Building Products; Dens-Glass Gold.
 - b. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - c. United States Gypsum Company; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.

3. Size: 48 by 96 inches for vertical installation.
- B. Cementitious Backer Units: ASTM C1325, Type A.
 1. Thickness: 5/8 inch.

2.4 ROOF AND PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Building Products; DensDeck Prime Roof Board.
 - b. National Gypsum Company; DEXcell Cement Roof Board.
 - c. United States Gypsum Company; Securock Glass-Mat Roof Board.
 2. Type and Thickness: Type X, 5/8 inch thick.
 3. Size: 48 by 96 inches for vertical installation.

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 parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. 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. Refer to Section 07 27 29 "Air-Barrier Coatings" for joint treatment materials.

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 Florida Building Code Fifth Edition – Building.

- D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

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.
 - 4. Exposure after installation shall be determined by GA-253 or by Manufacturer's written instructions.
- 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 elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.3 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

END OF SECTION 06 16 00

SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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 that are not concealed within other construction.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
 - 2. Section 12 36 61.19 "Quartz Agglomerate Countertops".

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 08 71 00 "Door Hardware" to fabricator of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Documentation on Low Emitting Materials.

3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- C. Shop Drawings: For plastic-laminate-faced architectural cabinets.
 1. Include plans, elevations, sections, and attachment details.
 2. Show large-scale details.
 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
 5. Apply AWI Quality Certification Program label to Shop Drawings.
- D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.
- E. Samples for Initial Selection: For each type of exposed finish.
- F. Samples for Verification: For the following:
 1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 2. Provide one sample applied to core material with specified edge material applied to one edge.
 3. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
 4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For the following:
 1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. High-pressure decorative laminate.
 4. Glass.
 5. Adhesives.
- C. Quality Standard Compliance Certificates: AWI Quality Certification Program.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.
- B. Installer Qualifications: Fabricator of products.
- C. 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 of typical architectural cabinets as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants 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/concealed by construction, 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.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Custom.
- C. Type of Construction: As Indicated.
- D. Door and Drawer-Front Style: As Indicated.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 1. Colors, Patterns, and Finishes: Refer to the Finish Key and drawings.
- F. 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: As indicated.
- G. Materials for Semiexposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - b. 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: Thermoset decorative panels with PVC or polyester edge banding.
 3. Drawer Bottoms: Thermoset decorative panels.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As selected by Architect from laminate manufacturer's full range.

2.2 WOOD MATERIALS

- A. Manufacturers
 - 1. Boise Cascade Company
 - 2. Collins
 - 3. Timber Products Company
- B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
- C. Composite Wood: Provide composite wood products that meet the California Air Resources Board (CARB), Airborne Toxic Measure ATCM requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hinges:
 - 1. Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - a. Item #BH71M2680; Blum distributed by Cabinetparts.com, Inc.
 - 1) Provide minimum 2 hinges per opening; provide additional hinges required based on hinge capacity and weight of door.
- C. Pulls:
 - 1. Products and Manufacturers: As indicated on the Drawings.
- D. Adjustable Shelf Support Clip:
 - 1. Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - a. Item No. 282.47.402 Shelf Support, Double Pin, transparent plastic; Hafele America, Archdale, NC
- E. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
 - 1. Basis-of-Design manufacturer: Subject to compliance with requirements, provide the following products by Accuride International Inc. or comparable product meeting all requirements including sustainability requirements.
 - a. File Drawer Rails: Full extension, side mounted, heavy-duty; 150 pound load rating.
 - 1) Model 4032; Accuride International, Inc.
 - b. All Other Drawers up to 30" Wide: Full extension, side mounted, heavy-duty; 100-pound load rating.
 - 1) Model 4033; Accuride International, Inc.

- c. All Drawers 30" Wide to 42" wide: Full extension, side mounted, heavy-duty; 255-pound load rating.
 - 1) Model 7950; Accuride International, Inc.
2. Other approved manufacturers:
 - a. Blum, Inc.
 - b. Centerline
 - c. Knappe & Vogt Manufacturing Company
 - d. Rev-A-Shelf, LLC

2.4 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. Low Emitting Adhesives and Sealants
 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- D. CBP Exit Podium Pole
 1. Indicator pole attached directly to podium with electrical access directly into podium.
 - a. Basis is design product: Architectural Brass; S-282353819900 Security Podium Pole 5"SQ X 90"H
 2. Body material: 304 stainless steel
 - a. Directional Satin Finish: No. 4
 3. LED indicator light with controller panel installed in podium
 4. Duress Light: blinking strobe signal warning lamp with controller in podium
 - a. Color: Red.
 5. Lane indicator: Die-cast vinyl numbers
 - a. Color: White

2.5 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. 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 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 humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings 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.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws 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 architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.
- D. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

END OF SECTION 06 41 16

SECTION 06 42 16 - FLUSH WOOD PANELING

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Flush wood paneling.
 - 2. Wood furring, blocking, shims, and hanging strips for installing flush wood paneling that is not concealed within other construction.
 - 3. Shop finishing of flush wood paneling.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - b. Leadership Extraction Practices for Forrest Certified Wood
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - b. Low Emitting Materials for Composite Wood
 - 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- B. Shop Drawings: For flush wood paneling.

1. Include plans, elevations, sections, and attachment details.
 2. Show details full size.
 3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 4. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
 5. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 6. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
1. Veneer-Faced Panel Products for Transparent Finish: 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Quality Standard Compliance Certificates: AWI Quality Certification Program.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Shop Certification: AWI's Quality Certification Program accredited participant.
- B. Installer Qualifications: Fabricator of products.
- C. Mockups: Build mockups as indicated in Section 01 43 39 "Visual Mock-up Requirements".
1. Build mockups of typical paneling as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation

areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where paneling is 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 paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is 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 PANELING FABRICATORS

- A. Source Limitations: Engage an FSC certified woodworking firm to assume undivided responsibility for production of paneling.

2.2 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.
 - 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
 - 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. FSC-Certified Products: For each product, provide FSC Chain of Custody certificate number (e.g. XXX-COC-#####) from the supplier or manufacturer. FSC-certified products must be sourced from a FSC-certified supplier or manufacturer.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements

2.3 FLUSH WOOD PANELING (WD2)

- A. Grade: Premium.

- B. Wood Species and Cut: Refer to Section 09 00 01 "Finish Key".
- C. Veneer Matching Method: Refer to Section 09 00 01 "Finish Key".
- D. Panel-Matching Method: Refer to Section 09 00 01 "Finish Key".
- E. Vertical Panel-Matching Method: Refer to Section 09 00 01 "Finish Key".
- F. Panel Core Construction: Medium Density Fiberboard (MDF).
 - 1. Low Emitting Composite Wood
 - a. Provide composite wood products that meet the California Air Resources Board (CARB), Airborne Toxic Measure ATCM requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
 - 2. Thickness: 3/4 inch unless noted otherwise.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to the following:
 - a. Georgia Pacific Wood Products, LLC.
 - b. Roseburg.
 - c. Columbia Forest Products.
- G. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.
- H. Panel Reveals: Stainless-steel sheet.
- I. Fire-Retardant-Treated Paneling: Panels shall consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
- J. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 8 to 13 percent.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
 - 1. Low Emitting Composite Materials – provide compliance with the California Air Resources Board (CARB), Airborne Toxic Measure ATCM requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

- a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
2. MDF: ANSI A208.2, Grade 130.
- D. Low Emitting Adhesives and Sealants – provide compliance with California Department of Public Health (CDPH) Standard Method v1.1 2010.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.6 INSTALLATION 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.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.
 1. Adhesives shall have a VOC complying with the requirements of Section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C".

2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Arrange paneling in shop or other suitable space in proposed sequence for examination by Architect. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - 1. Lay out one elevation at a time if approved by Architect.
 - 2. Notify Architect seven days in advance of the date and time when layout will be available for viewing.
 - 3. Provide lighting of similar type and level as that of final installation for viewing layout unless otherwise approved by Architect.
 - 4. Rearrange paneling as directed by Architect until layout is approved.
 - 5. Do not trim end units and other nonmodular-size units to less than modular size until after Architect's approval of layout. Indicate trimming by masking edges of units with nonmarking material.
 - 6. Obtain Architect's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.
- C. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify OAR and Architect seven days in advance of the dates and times paneling fabrication will be complete.
- D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.8 SHOP FINISHING

- A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.
- C. Transparent Finish:
 - 1. Grade: Same as item to be finished.
 - 2. Finish: System - 1, nitrocellulose lacquer.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Staining: None required.
 - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 6. Sheen: As indicated in Section 09 00 01 "Finish Key", gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
- C. Anchor paneling to supporting substrate as indicated in drawings.
- D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- C. Refer to Section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 06 42 16

SECTION 06 64 00 - PLASTIC PANELING

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass fiber reinforced paneling

1.3 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.5 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

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Wall and Door Protection types as indicated in Section 09 00 01 "Finish Key" or comparable approved product meeting all requirements including sustainability requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
 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: Molded pebble texture.
 5. Color: As selected by Architect from manufacturer's full range.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Corporate Sustainability Report: Provide third-party verified Corporate Sustainability Report (CPD) including impacts of extraction operations and activities associated with the manufacturer's product and product's supply chain conforming the following:
1. Global Reporting Initiative (GRI) Sustainability report
 2. Organization for Economic Co-operation and Development (OOECD) Guidelines for Multinational Enterprises.
 3. U.N. Global Compact: Communication of Progress
 4. ISO 26000: 2010 Guidance on Social Responsibility
 5. USGBC Approved Program: Other approved programs meeting the CSR criteria.

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: As selected by Architect from manufacturer's full range.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive
1. Low Emitting Adhesives

- a. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Henkel Corporation, OSI GreenSeries F-38 Drywall & Panel Construction Adhesive.
 - b. Red Devil, Inc., General Purpose Construction Adhesive
 - c. Titebond, Fast Set Polyurethane Construction Adhesive
 - d. Approved Substitution.
- E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant complying with requirements in Section 07 92 00 "Joint Sealants."

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. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. 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 panel joint locations for accurate installation.
 - 2. Locate panel joints 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 panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with product as indicated in Section 01 74 23 "Final Cleaning".

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. The work of this section includes, but is not limited to, the following:
 - 1. Pre-Applied sheet membrane waterproofing for horizontal applications prior to placement of poured concrete on top of the membrane, which forms and integral bond to poured concrete
 - 2. Sheet membrane waterproofing system for post-applied applications onto vertical concrete walls
 - 3. Prefabricated drainage and protection composite
- B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 03 30 00 "Cast-In-Place Concrete".
 - 2. Section 03 13 15 "Waterstops"
 - 3. Division 31 Sections for related earthwork.

1.3 REFERENCE STANDARDS

- A. The following standards and publications are applicable to the extent referenced in the text.
- B. American Society for Testing and Materials (ASTM)
 - 1. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
 - 2. D 412 Standard Test Methods for Rubber Properties in Tension
 - 3. D 570 Standard Test Method for Water Absorption of Plastics
 - 4. D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
 - 5. D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
 - 6. D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
 - 7. D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - 8. D 3767 Standard Practice for Rubber - Measurements of Dimensions
 - 9. D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
 - 10. E 96 Standard Test Methods for Water Vapor Transmission of Materials
 - 11. E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.
- B. Samples: Submit representative samples of the following for approval:
 - 1. Pre-Applied sheet membrane waterproofing
 - 2. Sheet membrane waterproofing system
 - 3. Prefabricated drainage and protection composite
- C. Shop Drawings showing waterproofing locations and typical details. Provide manufacturer approval.
- D. Installer certification from waterproofing manufacture.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of pre-applied membrane waterproofing and self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
- B. Installer: A firm which has at least 3 years' experience in work of the type required by this section and is approved by the waterproofing manufacturer to perform the work.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.
- E. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
 - 2. Protect mastic and adhesive from moisture and potential sources of ignition.
 - 3. Store drainage and protection composite flat and off the ground. Provide cover on top and all sides.
 - 4. Protect surface conditioner from freezing.

- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.8 WARRANTY

- A. Provide written watertight warranty from the manufacturer that includes both labor and material for the below grade walls and the under slab waterproofing. The warranty to be issued by the membrane manufacturer upon completion of the work.
1. Warranty Period: 10 years from date of Substantial Completion.
 2. Refer to Section 03 13 15 "Waterstops" for additional warranty information.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pre-applied Integrally Bonded Sheet Waterproofing Membrane: Preprufe® 300R Membrane or Preprufe 300LT Membrane for application temperatures between 25°F (-4°C) and 60°F (+16°C) by GCP Applied Technologies, Inc., a 1.2mm (0.046 in) nominal thickness composite sheet membrane comprising 0.8 mm (0.030 in.) of high density polyethylene film, layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

Property	Test Method	Typical Value
Color		White
Thickness	ASTM D 3767 Method A	0.046 in. (1.2 mm) nominal
Lateral Water Migration Resistance	ASTM D 5385 Modified ¹	Pass at 231 ft (71m) of hydrostatic head pressure
Low Temperature Flexibility	ASTM D 1970	Unaffected at -20°F (-29°C)
Resistance to Hydrostatic Head	ASTM D 5385 Modified ²	231 ft (71m)
Elongation	ASTM D 412 Modified ³	500%
Tensile Strength, film	ASTM D 412	4,000 psi (27.6 MPa)
Crack Cycling at -9.4°F (-23°C), 100 Cycles	ASTM C 836	Unaffected, Pass
Puncture Resistance	ASTM E 154	221 lbs (990 N)
Peel Adhesion to Concrete	ASTM D 903 Modified ⁴	5.0 lbs/in. (880 N/m)
Lap Peel Adhesion at 72°F (22°C)	ASTM D 1876 Modified ⁵	8.0 lbs/in. (1408 N/m)
Lap Peel Adhesion at 40°F (4°C)	ASTM D 1876 Modified ⁵	8.0 lbs/in. (1408 N/m)
Permeance to water vapor transmission	ASTM E 96 Method B	0.01 perms (0.6 ng/Pa x s x m ²)

1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the blind side waterproofing membrane. A hydrostatic head pressure of 71 m (231 ft) of water is the limit of the apparatus.
 2. Hydrostatic head tests are performed by casting concrete against the membrane with a lap. Before the concrete sets a 3 mm (0.125 in.) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to a head of 71 m (231 ft) of water which is the limit of the apparatus.
 3. Elongation of membrane is run at a rate of 50 mm (2 in.) per minute.
 4. Concrete is cast against the protective coating surface of the membrane and allowed to cure (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 50 mm (2 in.) per minute at room temperature.
 5. The test is conducted 15 minutes after the lap is formed as per manufacturer's instructions and run at a rate of 50 mm (2 in.) per minute at 72°F (22°C).
 6. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- B. Sheet Membrane Waterproofing System: Bituthene® System 3000 Membrane by GCP Applied Technologies, Inc.; a self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -25°C (-32°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified ¹	2240 kPa (325 lbs/in. ²) minimum
Tensile Strength, Film	ASTM D 882 Modified ¹	34.5 MPa (5,000 lbs/in. ²) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified ¹	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified ²	800 N/m (4 lbs/in.)
Peel Strength	ASTM D 903 Modified ³	1576 N/m (9 lbs/in.)
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	60 m (200 ft) of water
Permeance	ASTM E 96, Section 12 – Water	2.9 ng/m ² sPa (0.05 perms) maximum

	Method	
Water Absorption	ASTM D 570	0.1% maximum

1. The test is run at a rate of 50 mm (2 in.) per minute.
 2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at -4°C (25°F).
 3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.
 4. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- C. Preformed Inside and Outside Corners: Preprufe Preformed Corners by GCP Applied Technologies, Inc. as prefabricated inside and outside corners.
- D. Tape for covering cut edges, roll ends, penetrations and detailing: Preprufe Tape LT (for temperatures between 25°F (-4°C) and 86°F (30°C)) and Preprufe Tape HC (for use in Hot Climates, minimum 50°F (10°C))
- E. Tape to be located under all construction joints in the concrete on top of the pre-applied sheet waterproofing membrane: Preprufe CJ Tape LT (for temperatures between 25°F (-4°C) and 86°F (30°C)) and Preprufe CJ Tape HC (for use in Hot Climates, minimum 50°F (10°C))
- F. Prefabricated Drainage and Protection Composite for Vertical Applications: Hydroduct® 220 Drainage Composite by GCP Applied Technologies, Inc.. Drainage Composite shall be designed to promote positive drainage while serving as a protection course.
- G. Prefabricated Drainage and Protection Composite for Horizontal Applications: Hydroduct® 660 Drainage Composite by GCP Applied Technologies, Inc.. Drainage Composite shall be designed to promote positive drainage while serving as a protection course.
- H. Strip Waterstop: Adcor™ ES hydrophilic non-bentonite waterstop by GCP Applied Technologies, Inc. for non-moving concrete construction joints and penetrations.
- I. Gun-Grade Waterstop: Swellseal WA hydrophilic gun-grade waterstop by DeNeef/GCP Applied Technologies, Inc. for non-moving concrete construction joints and penetrations.
- J. Miscellaneous Materials: Primer, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.
- B. Horizontal Substrates to receive Pre-Applied Waterproofing Sheet Membrane
 - 1. It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability.
 - 2. The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.
- C. Vertical Cast-In-Place Concrete Wall Substrates:
 - 1. Do not proceed with installation until concrete has properly cured and dried.
 - 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
 - 4. Remove scaling to sound, unaffected concrete and repair exposed area.
 - 5. Grind irregular construction joints to suitable flush surface.
- D. Vertical Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.
- E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION

- A. Strictly comply with installation instructions in manufacturer's published literature.
- B. If required, install prefabricated drainage and protection composite for horizontal applications per manufacturer's requirements.
- C. Horizontal application of pre-applied sheet waterproofing membrane.
 - 1. Place the membrane HDPE film side to the substrate with the yellow zip strip facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers.
 - 2. Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.
 - 3. Peel back the clear plastic release liner in the overlap area to expose the adhesive in the selvedge area and adhere underside of successive sheet onto the adhesive, lining up leading edge with marked selvedge line. Achieve an adhesive bond at the overlap.

4. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.
 5. Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary.
 6. Allow to dry and apply Preprufe Tape LT (or HC in hot climates) centered over the lap edges and roll firmly. Apply additional Preprufe Tape LT (or HC in hot climates) a minimum of 2 in. beyond all edges of membrane that are not sealed by the selvedge.
 7. Immediately remove printed plastic release liner from the Preprufe Tape.
 8. Center Preprufe CJ Tape LT (or HC in hot climates) under locations of all control joints in the concrete slab and adhere the Preprufe CJ Tape to the top of pre-applied waterproofing membrane.
 9. Immediately remove printed plastic release liner from the Preprufe CJ Tape.
 10. Protect membrane in accordance with manufacturer's recommendations until placement of concrete. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer's recommendations.
- D. Strip Waterstop Installation
1. Refer to Section 03 15 13 "Waterstops".
- E. Vertical application of sheet membrane waterproofing system.
1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
 2. Delay application of membrane until primer is sufficiently dry. Dry time will vary with weather conditions.
 3. Seal daily terminations with troweled bead of mastic.
 4. Apply protection board and related materials in accordance with manufacturer's recommendations.
 5. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
 6. Install prefabricated drainage and protection composite for vertical applications per manufacturer's requirements.

3.4 FIELD QUALITY CONTROL

- A. Architectural precast concrete installer shall provide field quality control by PCI certified staff and shall provide the following reports and checklists.
1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.
- B. Testing Agency: Construction Manager will engage a qualified testing agency to perform tests and inspections and prepare test reports.

- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 07 13 26

SECTION 07 14 18 - FLUID-APPLIED WATERPROOFING DECK SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 SUMMARY

- A. The work of this section includes, but is not limited to, the following:
 - 1. Fluid applied waterproofing system
 - 2. Prefabricated drainage composite
 - 3. Protection board
 - 4. Insulation
- B. System Description: The fluid applied membrane shall consist of the following:
 - 1. Vertical Application: Vertical applications at parapet walls, upstands, etc. shall be coated with a minimum thickness of 80 mils applied in two 40 mil layers
 - 2. Horizontal Application: Horizontal applications shall be coated with a minimum thickness of 80 mils applied in one 80 mil layer.
- C. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 03 30 00 – Cast-In-Place Concrete
 - 2. Section 04 20 00 – Unit Masonry
 - 3. Section 07 60 00 – Flashing and Sheet Metal
 - 4. Section 07 92 00 – Joint Sealants
 - 5. Section 07 95 13.16 – Exterior Expansion Joint Cover Assemblies

1.3 REFERENCE STANDARDS

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM)
 - 1. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
 - 2. C 898 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Separate Wearing Course
 - 3. D 412 Standard Test Methods for Rubber Properties in Tension
 - 4. D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 5. D 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
 - 6. E 96 Standard Test Method for Vapor Transmission of Materials
 - 7. D 3767 Standard Practice for Rubber - Measurements of Dimensions
 - 8. D 2240 Standard Test Method for Rubber Property – Durometer Hardness

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.
- B. Shop drawings showing locations and extent of waterproofing including details for terminations and flashings, projections, penetrations, drains and treatment of substrate joints and cracks.
- C. Written documentation demonstrating installer's qualifications under the "Quality Assurance" article including reference projects of a similar scope.
- D. Samples: Submit representative samples of the following for approval:
 - 1. Fluid applied membrane
 - 2. Protection board (if applicable)
 - 3. Prefabricated drainage composite (if applicable)
 - 4. Insulation board (if applicable)
- E. Warranty: Submit a sample warranty identifying the terms and conditions stated below.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Waterproofing systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of waterproofing. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Installer: The installer shall demonstrate qualifications to perform the work of this Section by submitting the following:
 - 1. Certification or written license from the Waterproofing Manufacturer that the Installer is a certified applicator.
 - 2. List of at least three (3) projects contracted within the past five (5) years of similar scope and complexity to this project.
 - 3. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.
 - 4. Installer's credentials must be approved by both the Architect and the Waterproofing Materials Manufacturer.
- C. Materials: Fluid applied waterproofing material shall be two part 100% solids chemically crosslinked monolithic elastomer system free of bitumen. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of surface preparation, minimum curing period, installation procedures, special details and flashings, inspection, testing, protection and repair procedures.

- E. Inspection and Testing: All areas shall be tested by means of electronic testing or ponding to a minimum depth of 2 in. (50 mm) for a period of 24 hours and inspected an individual/firm approved by the waterproofing systems manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in the original, unopened containers with seals unbroken, labeled with the manufacturer's name, product brand name and type, date of manufacture and directions for storage and use.
- B. Store and handle materials in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1. Do not double-stack pallets of waterproofing on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
 - 2. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
 - 3. Protect waterproofing materials from freezing.
- C. B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive membrane waterproofing.
- C. Do not allow waste products (i.e. petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, acids, etc.) to come into contact with the waterproofing membrane. Any exposure to foreign materials or chemical discharges must be presented to the Membrane Manufacturer to determine the impact on the waterproofing assembly performance.
- D. Concrete Deck Surface condition:
 - 1. Ensure no excessive deflection or movement of the deck or other structural problems.
 - 2. The deck shall provide for support of the maximum anticipated dead and environmental loads and for expansion and contraction suitable for the roof system structure.
 - 3. All projections, penetrations and openings in the deck should be completed before the waterproofing application begins.
 - 4. Joints in pre-cast/pre-stressed concrete decks are to be grouted so that the top surface is level and smooth before membrane application.
- E. General contractor shall assure adequate protection and ventilation during the application of the Waterproofing assembly.

1.8 WARRANTY

- A. Fluid-Applied Waterproofing Deck System: Upon completion of the fluid-applied waterproofing deck system, the contractor must submit a written warranty for the waterproofing materials signed by the Waterproofing Manufacturer.
- B. Warranties available from the manufacturer:
1. Material Warranties:
 - a. Manufacturer's standard 10-year material warranty.

PART 2 - PRODUCTS

2.1 FLUID APPLIED WATERPROOFING MEMBRANES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following Fluid Applied Waterproofing Membranes: GCP Applied Technologies, Silcor® 900HA
- B. Waterproofing Membrane Physical Properties:

Physical Properties Silcor 900HA	Typical Value	Test Method
Resistance to hydrostatic head over post formed crack head	>230 ft	ASTM D5385
Tensile strength	1450 psi	ASTM D412
Elongation	450%	ASTM D412
Tear strength	> 228 lb/in	ASTM D624 C
Adhesion to concrete	> 300 psi or concrete failure ¹	ASTM D4541
Shore Hardness	75 A	ASTM D2240
Low temperature crack bridging	Pass	ASTM C836
Abrasion resistance (Taber Wear Index)	186 mg ²	
Setting time ³	30 min. tack free; 2-3 hrs foot trafficable	Internal

Footnote:

1. Tested on prepared, primed, and sand cast concrete.
2. H18/1000 cycles/1000g
3. At 73F

2.2 ACCESSORIES

- A. Protection Board:
1. Prefabricated Drainage Composite
 - a. Hydroduct® 660 Drainage Composite by GCP Applied Technologies for horizontal surfaces. Hydroduct 220 Drainage Composite by GCP Applied Technologies for all vertical surfaces. Drainage composite shall be designed to promote positive drainage while serving as a protection course.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid applied waterproofing.
- B. Cast-In-Place Concrete Substrates:
 - 1. Poured in-place concrete must be monolithic, smooth, and free of unapproved curing compounds, form release agents and other surface contaminants.
 - 2. The surface must be cured for a minimum of 28-days and have an International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) of 2-5 with a moisture content of 5% or less.
 - 3. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 4. Repair bugholes over 0.5 in. (13 mm) in length and 0.25 in. (6 mm) deep and finish flush with surrounding surface.
 - 5. Remove scaling to sound, unaffected concrete and repair exposed area.
 - 6. Grind irregular construction joints to suitable flush surface.
- C. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.
- D. Substrate Cleaning:
 - 1. Thoroughly sweep the substrate that is to receive the waterproofing membrane.
 - 2. Substrate must also be blown using oil free air to remove any remaining loose debris.
 - 3. A final check to determine if the substrate is sufficiently clean is to apply a test patch of the system and check its adhesion.

3.3 INSTALLATION

- A. Apply primer at rate recommended by manufacturer.
- B. Detailing: All details (including inside corners, outside corners, pipe penetrations, drains, cracks, construction joints, etc.) should be treated before application of the field of the membrane according to manufacturer's drawings and written application instructions.
- C. Vertical Application:
 - 1. Apply 2 coats at a minimum thickness of 40 mils (1.0 mm) over all vertical areas to be waterproofed. Perform wet film thickness tests as work progresses to confirm thickness.
- D. Horizontal Application:
 - 1. Apply at a minimum thickness of 80 mils (2.0 mm) over all horizontal areas to be waterproofed. Perform wet film thickness tests as work progresses to confirm thickness.

3.4 WATER TEST/LEAK DETECTION

- A. All areas of the deck must be water tested by means of electronic testing or ponding to a minimum depth of 2 in. (50 mm) for a period of 24-hours to confirm the integrity of the membrane.
- B. Allow the membrane to cure for a minimum period of 24 hours before starting water tests.
- C. Before flood testing, be sure the structure will withstand the dead load of the water.
- D. For well-sloped decks, segment the flood test to avoid deep water near drains.
- E. Mark any leaks and repair according to manufacturer's repair procedures when the membrane is dry.
- F. Re-test all areas after repairs have been completed.

3.5 FIELD QUALITY CONTROL

- A. Waterproofing installer shall provide field quality control by manufacturer certified staff and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.6 CLEANING AND PROTECTION

- A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work.
- B. Install any protection, drainage and insulation courses according to the manufacturer's instructions.

3.7 JOB COMPLETION

- A. Contractor and a Representative of the Membrane Manufacturer shall inspect the waterproofing assembly and notify the Architect of any defects. Waterproofing manufacturer shall approve installation prior to installation of overburden.
- B. Clean up all debris and equipment.

END OF SECTION 07 14 18

SECTION 07 16 13 - POLYMER MODIFIED CEMENT 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes polymer-modified cement waterproofing.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for the finishing of concrete walls and slabs to receive waterproofing.

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, and installation instructions.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Documentation on Low Emitting Materials.
- C. Samples for Initial Selection: For each type of exposed product.
 - 1. Include Samples of available color selection.
- D. Samples for Verification: For each type of waterproofing indicated, in manufacturer's standard sizes.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For each type of waterproofing, patching, and plugging material.
- C. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying polymer-modified cement waterproofing similar in material, design, and extent to that indicated for this Project,

whose work has resulted in applications with a record of successful in-service performance.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit polymer-modified cement waterproofing to be performed according to manufacturer's written instructions.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 FIELD-MIXED, POLYMER-MODIFIED CEMENT WATERPROOFING

- A. Sustainable Design Requirements
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- B. Manufacturer
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide SikaTop Seal 107 or comparable product by one of the following:
 - a. BASF Corporation.
 - b. Euclid Chemical Company (The); an RPM company.
- C. Materials
 - 1. Polymer-modified portland cement coating:
 - a. Component "A": A liquid polymer emulsion of an acrylic co-polymer base and additives.
 - b. Component "B": A blend of selected portland cements, specially graded aggregates, and admixtures to control setting time and workability.
 - c. The ratio of Component A: Component B shall be:
 - 1) Slurry 1:4 by weight
 - 2) Mortar 1:4.5 by weight
 - d. The material shall be non-combustible, either before or after cure.

2.2 PERFORMANCE CRITERIA

- 1. Properties of the mixed polymer-modified portland cement coating:
 - a. Pot Life: Approx. 60 minutes at 68F Approx. 30 minutes at 86F
 - b. Color: gray
- 2. Properties of the cured polymer-modified portland cement coating:

- a. Tensile Strength (ASTM C-307) 28 days
 - 1) Type Gray 990 psi (6.8 Mpa)
- b. Bond Strength (ACI 503R-30 Modified): Pull-off test
- c. Moisture Vapor permeability (ASTM E96)
 - 1) 28 days 18 perms
- d. Compressive Strength (ASTM D-695) at 28 days
 - 1) Type Gray 3400 psi (23.4 Mpa)
- e. Flexibility (ASTM D522 Modified)
 - 1) Approxmatly 25%
- f. Carbon Dioxide Diffusion
 - 1) Coefficient (uCO₂) Approx. 35,000 equivalent to 6 inches of concrete
- g. Watertightness under Hydrostatic Pressure (DIN 1048 Mod.)

Water Pressure		Penetrated Water		Water Absorption	
Feet	(bar)	Grains	(grams)	Grains	(grams)
				Ft ² * Hr	m ² *Hr
16	(0.5)	0	(0)	0	(0)
33	(1)	15	(1)	3	(2)
99	(3)	31	(3)	10	(7)

Rendering mortars absorbing less than 91 grains/ft.² * h (64 grams/m² *h) are considered watertight.
- h. The material shall not produce a vapor barrier.
- i. The material meets the chemical requirements in accordance with ANSI/NSF Standard 61- potable water approval.
- j. The material shall be thermally compatible with portland cement mortar and concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 SURFACE PREPARATION

- A. Substrate must be clean, sound, and free of surface contaminants. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means.
- B. Substrate will be in accordance with ICRI Guideline No. 03732 for coatings and fall within CSP4.

1. Prepare concrete surface to have open-textured, sandpaper-like finish.
- C. All surfaces must be saturated surface dry (SSD), with no standing water at time of application.

3.3 MIXING AND APPLICATION

- A. A. Mixing: Under normal circumstances, full quantities of both components are mixed together, a slurry consistency will result. For a trowelable consistency use only 90% of component A. Mix in a clean container by slowly adding the powder component to the liquid component and mixing with a slow speed (400-600rpm) drill and mixing paddle.
- B. Coating Application: Apply trowel, notched trowel, stiff bristle brush, or spray equipment. Work material into the prepared substrates, filling all pores and voids.
 1. For trowel consistency: Apply the first coat with a notched trowel and leave to harden (4 to 8 hours). Apply the second coat with a flat trowel.
- C. C. When applying the coating, never stop the application until the entire surface has been coated. Always stop application at an edge, corner, or joint. Never let a previously coated film dry; always coat into a wet film. Always apply the coating at a 45° angle to an edge, corner, or joint.
- D. Adhere to all limitations and cautions for the polymer-modified cement coating in the manufacturer's printed literature.
- E. Cure material per manufacturer recommendations for temperature range and relative humidity to achieve performance criteria.
 1. 71 degrees Fahrenheit-75 degrees Fahrenheit and 45%-55% relative humidity.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a manufacturer's site representative qualified to inspect substrate conditions, surface preparation, application, flashings, protection, and drainage components; and to furnish weekly reports to Architect. Manufacturer's representative shall approve application.
- B. Waterproofing will be considered defective if it does not pass tests and inspections.

3.5 CLEANING

- A. The uncured polymer-modified portland cement coating can be cleaned from tools with water. The cured polymer-modified portland cement coating can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION 07 16 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes traffic coatings for the following applications:
 - 1. Pedestrian traffic.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place 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.
 - 1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
- C. Shop Drawings: For traffic coatings.
 - 1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
 - 1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of traffic coating.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings 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. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build mockup for each traffic coating and substrate to receive traffic coatings.
 - 2. Size: 200 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 - 1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
- B. Do not install traffic coating until items that penetrate membrane have been installed.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
 - 1. Obtain traffic coatings from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

- A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for pedestrian traffic and equipment-room floor; according to ASTM C 957/C 957M.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide BASF Corporation; Construction Systems; MasterSeal Traffic 2000 (Pre-2014: Conipur Plus) or a comparable product by one of the following:
 - a. Advanced Polymer Technology Corporation.
 - b. Pecora Corporation.
- B. MATERIALS
 - 1. Basecoat: MasterSeal M200
 - 2. Topcoat: MasterSeal TC275
 - 3. Topcoat: MasterSeal 295
 - 4. Aggregate: MasterSeal 941
 - 5. Clean-up: MasterSeal 990
 - 6. Sealant Primer: MasterSeal P173
 - 7. Sealant: MasterSeal NP2, SL2, or CR195
 - 8. Deep joint Sealant: MasterSeal NP2 or SL2
 - 9. Plywood Joint Sealant: MasterSeal NP1, NP2, or CR195
 - 10. Reinforcing Fabric: MasterSeal 995

2.4 ACCESSORY MATERIALS

- A. Joint Sealants: As specified in Section 07 92 00 "Joint Sealants."
- B. Sheet Flashing: Nonstaining sheet material recommended in writing by traffic-coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 - 1. Test for moisture according to ASTM D 4263.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after substrate construction and penetrating work have been completed.
 - 2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
 - 3. Application of coating indicates acceptance of surfaces and conditions.

- A. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
 - 1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.
- C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to ASTM C 1127 and manufacturer's written instructions.
- B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.

- D. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- E. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- F. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform the following field tests and inspections:
 - 1. Materials Testing:
 - a. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
 - c. Testing agency shall verify thickness of coatings during traffic-coating application for each 600 sq. ft. of installed traffic coating or part thereof.
- B. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Waterproofing will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Refer to Section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 07 18 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following exposed vertical and horizontal surfaces other than those in the open air parking garage. For open air parking garage areas, refer to Section 07 19 01 "Water Repellents – Parking Garage". Non-exposed surfaces (those with finishes applied) are not required to be treated with penetrating water-repellents.
 - 1. Exterior Cast-in-place concrete.
 - 2. Exterior Precast concrete.
 - 3. Exterior Concrete unit masonry.
 - 4. Interior surfaces as indicated.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. ACTION SUBMITTALS
- C. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
- D. Product Data: For each type of product.
 - 1. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For each type of water repellent.
- C. Preconstruction Test Reports: For water-repellent-treated substrates.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction to demonstrate surface preparation and application of water repellents.

- a. Coordinate construction of mockups to permit inspection by owners' testing agency.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
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.

1.5 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 1. Concrete surfaces and mortar have cured for not less than 28 days.
 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 5. Rain or snow is not predicted within 24 hours.
 6. Not less than 24 hours have passed since surfaces were last wet.
 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Penetrating Water Repellent: Clear; with alcohol, mineral spirits, water, or other proprietary solvent carrier.
 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide PROSOCO, Inc; Consolideck SLX100 Water & Oil Repellent products or a comparable product by one of the following:
 - a. SINAK Corporation, HLQ-125.
 - b. W. R. Meadows, Inc; DECK-O-SHIELD.
- B. Low Emitting Paints & Coatings
 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.

2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

- B. Apply coating of water repellent on surfaces to be treated using 15 psi-pressure spray with a fan-type spray nozzle or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Precast Concrete: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven calendar days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.
- C. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECx A shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.5 CLEANING

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

ORLANDO INTERNATIONAL AIRPORT
BP-S195
Terminal C
Airside Concourse
END OF SECTION 07 19 00

WATER REPELLENTS

SECTION 07 19 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket.
 - 2. Mineral-wool board.
 - 3. Foam-plastic board insulation.
- B. Related Requirements:
 - 1. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
 - 2. Section 07 52 00 "SBS Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
 - 3. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Extended Producer Responsibility
 - b. Leadership Extraction Practices for Recycled Content
 - c. Documentation on Low Emitting Materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

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.

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
 - 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. Carlisle Coatings & Waterproofing Inc.
 - b. Dow Chemical Company (The).

- c. Firestone Building Products.
- d. Johns Manville.
- 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET

A. Sustainability Requirements

- 1. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional recycled content requirements.
- 2. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification

B. Glass-Fiber Blanket, Unfaced: 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. Basis of Design Manufacturers: Subject to compliance with requirements, provide Owens Corning; EcoTouch PINK Fiberglas Insulation or a comparable product by one of the following:
 - a. CertainTeed Corporation; Sustainable Insulation.
 - b. Johns Manville; a Berkshire Hathaway company; Formaldehyde Free Fiberglass Insulation.
 - c. Knauf Insulation; EcoBatt Unfaced with ECOSE Technology.

2.3 MINERAL-WOOL BOARD

A. Sustainability Requirements

- 1. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.
- 2. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification

B. Mineral-Wool Board, Type III, Unfaced: ASTM C 612, Type III; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 8 lb/cu. ft..

- 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide Thermafiber, Inc. an Owens Corning company; VersaBoard or a comparable product by one of the following:
 - a. Rock Wool Manufacturing Company; Delta 3 Mineral Wool Board
 - b. Roxul Inc; CAVITYROCK DD.

2.4 MINERAL-WOOL BLANKETS

- A. 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. Basis of Design Manufacturers: Subject to compliance with requirements, provide Thermafiber, Inc. an Owens Corning company; ULTRABATT or a comparable product by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company; MINWOOL
 - b. Knauf Insulation: KN Series

2.5 Sound Attenuation Batts

- A. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.
- B. Type: Unfaced glass fiber acoustical insulation complying with ASTM C 665, Type I.
- C. Size: 3½" x 16" x 96"
- D. Surface Burning Characteristics (When tested in accordance with ASTM E 84):
 - 1. Maximum flame spread: 10
 - 2. Maximum smoke developed: 10
- E. Combustion Characteristics:
 - 1. Passes ASTM E 136.
- F. Fire Resistance Ratings:
 - 1. Passes ASTM E 119 as part of a complete fire tested wall assembly.
- G. Sound Transmission Class: As indicated.
- H. Dimensional Stability: Linear Shrinkage less than 0.1%

2.6 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation.
 - d. Owens Corning.
 - 2. Type V, 100 psi. for use as rigid insulation forms for cast-in-place concrete.
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

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.
 - 1. Refer to Section 01 35 46 "Indoor Air Quality" for additional requirements.
- 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 INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Sound Attenuation Batts: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Support unfaced blankets with punched metal straps attached to the face of the framing, bent 90 degrees pointing into the stud cavity, and pushed into the insulation after installation.

- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.4 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.

3.5 FIELD QUALITY CONTROL

- A. Insulation installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.
- B. Installer shall inspect all areas and confirm, in writing, that installation contains no gaps or other breaches.

3.6 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. Closed-cell spray polyurethane foam.
- B. Related Requirements:
 - 1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Extended Producer Responsibility
 - b. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - 3. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
 - b. Low Emitting Materials for Adhesives and Sealants

1.3 INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide TPR² Corporation products or a comparable product by one of the following:

- a. CertainTeed Corporation.
 - b. Dow Chemical Company (The).
 - c. Icynene Inc.
 - d. Johns Manville; a Berkshire Hathaway company.
2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

- A. Intumescent Coating: Coating recommended by insulation manufacturer to provide a thermal barrier complying with the Florida Building Code – Building Section 26 03 .4.
 1. Provide at all locations where foamed-in-place insulation is installed without another approved thermal barrier.
- B. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

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

- A. Insulation installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - 1. BECx A shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.
- B. Installer shall inspect all areas and confirm, in writing, that installation contains no gaps or other breaches.

3.4 PROTECTION

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

END OF SECTION 07 21 19

SECTION 07 24 23 - DIRECT-APPLIED FINISH SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Direct-Applied Finish System for soffits and ceilings.

1.3 DEFINITIONS

- A. DEFS: Direct-applied exterior finish system(s).

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. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.
- C. Samples for Initial Selection: For each finish coat and for each color and texture specified.
- D. Samples for Verification: For each finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.6 QUALITY ASSURANCE

- A. Manufacturer: A qualified manufacturer with no less than 10 years' experience in the manufacture of direct-applied finish systems.
- B. Applicator: Approved by direct-applied finish system manufacturer to performing work of this section.
- C. 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 substrate and finish texture indicated for direct-applied finish system, including accessories.
 - 2. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit DEFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.
 1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F for a minimum of 24 hours before, during, and after application unless otherwise approved by the manufacturer in writing. Do not apply DEFS adhesives or coatings during rainfall.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original packaging, labeled with product identification, manufacturer, and batch number.
- B. Store products in a dry area with temperature maintained between 50 and 85 degrees F. Protect from direct sunlight. Protect from freezing. Protect from extreme heat (greater than 90 degrees F).
- C. Handle products in accordance with manufacturer's written instructions.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of DEFS assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of DEFS finishes and other DEFS materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Dryvit Systems, Inc.
 2. Parex USA, Inc.

3. Sto Corp.

- B. Source Limitations: Obtain DEFS from single source from single manufacturer and from sources approved by manufacturer as compatible with DEFS components.

2.2 DEFS MATERIALS

A. Textured Finishes

1. High performance decorative and protective acrylic-based textured wall finish with integral color, complies with SCAQMD Rule 1113 for architectural finishes

B. Primer

1. Acrylic-based sanded primer complies with SCAQMD Rule 1113 for primers.

C. Base Coat

1. Sto BTS Plus – one component polymer modified portland cement high build base coat

D. Surface Reinforcement

1. Mesh – nominal 4.5 oz/yd² glass fiber reinforcing mesh treated for compatibility with DEFS materials.
2. Detail Mesh – nominal 4.2 oz/yd² glass fiber reinforcing mesh treated for compatibility with DEFS materials.

E. Gypsum Sheathing

1. Glass-mat gypsum sheathing as specified in Section 06 16 00 "Sheathing".

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 framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where DEFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of DEFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect DEFS, substrates, and wall construction behind them from inclement weather during installation.
- C. Prepare and clean substrates to comply with DEFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 APPLICATION

- A. Install corrosion proof termination accessories per ASTM D1784 (PVC) with perforated flanges for keying of the base coat at junctures with penetrations and with abutting walls and columns. Install corrosion proof control joints per ASTM D1784 (PVC) with perforated flanges for keying of the base coat at intervals as required by the soffit board manufacturer.
- B. Reinforce perforated flanges of accessories with minimum 4 inch wide strips of Detail Mesh or Mesh embedded in base coat. Tape joints with minimum 4 inch wide Mesh or Detail mesh embedded in base coat. Allow base coat to dry.
- C. Install base coat and mesh to the soffit/ceiling board surface according to manufacturer's written instructions.
- D. Apply the primer by brush or roller to the entire base coat surface.
- E. Apply the textured finish by trowel. Apply finish in a continuous application, and work to a wet edge. Float the finish to achieve the desired texture.

3.4 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive DEFS coatings.

END OF SECTION 07 24 23

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes vapor-retarding air-barrier coatings.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

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 accessory materials 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.
 - 2. Air Barrier Coating manufacturer representative shall attend.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.
- C. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Certificates: Provide the following:
 - a. Corporate Sustainability Reporting (CSR's)
 - b. Health Product Declarations (HPD's)

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the 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.

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.
- B. Mockups for testing: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection by owners' testing agency of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 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.
- C. Visual Mock-ups: additional mock-up shall be completed for visual inspection in accordance with Section 01 43 39 "Visual Mock-Up Requirements".

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.

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended 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, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier. 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.

2.3 VAPOR-RETARDING, AIR-BARRIER COATING

- A. Vapor-Retarding, Air-Barrier Coating: Synthetic polymer membrane.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies, Perm-A-barrier NPL 10 or a comparable, impermeable product by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. Henry Company.
 - c. Approved Substitution.
 - 2. Performance Requirements
 - a. Dry mill thickness not less than 40 mils.
 - b. Water penetration resistance: joint treatment and primary air barrier and vapor barrier material, comply with ICC ES AC 212, par 4.8.3, no water penetration after 5 hours hydrostatic pressure
 - c. Nail sealability: ASTM D 1970, 7.9.1, primary air barrier and vapor barrier passes
 - d. Elongation: ASTM D 413, primary air barrier and vapor barrier material, > 500% at 7 days
 - e. Adhesion: joint treatment and primary air barrier and vapor barrier material, ASTM D 4541, $\geq$ 35 psi, or exceeds strength of glass mat facing on glass mat gypsum substrates
 - f. Surface burning: ASTM E 84, joint treatment and primary air barrier and vapor barrier material flame spread $\leq$ 25, smoke developed $\leq$ 450, Class A building material
 - g. Water vapor permeance: ASTM E 96 Method A, < 0.1 perms
 - h. Material air leakage: ASTM D 2178, primary air barrier and vapor barrier and joint treatment < 0.0002 cfm/ft² at 1.57 psf

- i. Assembly air leakage: ASTM E 2357, ≤ 0.004 cfm/ft² air leakage after conditioning protocol
- j. Field adhesion testing: ASTM D 4541, ≥ 35 psi (207 kPa) or exceeds strength of glass mat facing on glass mat gypsum substrates

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.
- D. Joint Reinforcing Strip: Air-barrier manufacturer's self-adhering glass-fiber-mesh tape.
- E. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- F. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- G. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187-inch-thick, and Series 300 stainless-steel fasteners.
- H. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- I. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.
- J. Joint Sealant: Single component, neutral curing, ultra-low modulus sealant compatible with air barrier coating and provided by air barrier coating manufacturer.
 - 1. Basis of design product: GCP Applied Technologies, PAB S100.
- K. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

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 concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test 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, and seal substrate according to manufacturer's written instructions. 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 membrane.
- 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.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air-barrier coating material and embed joint reinforcing in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of air-barrier coating material at joints. Tape joints with joint reinforcing after first layer is dry. Apply a second layer of air-barrier coating material over joint reinforcing.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air 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 modified bituminous transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
- 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.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 AIR-BARRIER COATING INSTALLATION

- A. General: Apply air-barrier coating to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply air-barrier coating within manufacturer's recommended application temperature ranges.
- B. Air-Barrier Coatings: Apply a continuous unbroken air-barrier coating to substrates according to the following thickness. Apply an increased thickness of air-barrier coating in full contact around protrusions such as masonry ties.
1. Vapor-Retarding, Air-Barrier Coating: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, applied in two or more equal coats.

2. Apply additional coats as needed to achieve void- and pinhole-free surface.
- C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Construction Manager will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. 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.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Air Barrier manufacturer shall make regularly scheduled site visits to inspect installation.
- D. Tests: As determined by Owner's testing agency from among the following tests:
 1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.
 2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

- E. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.
- F. 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.
- G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 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 required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane 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 by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 27 29

SECTION 07 41 10 – METAL CANOPY CLADDING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections (including all sustainability requirements), apply to this Section.
- B. Coordinate this work with all Contract Drawings and all other Sections of the Specifications for requirements therein affecting the work under this Section.

1.2 SUMMARY

- A. Section includes formed custom canopy cladding of type and profile indicated over air/vapor barrier, sub-base underlayment and insulation and related flashing, trims and accessories.
 - 1. Formed custom fabricated, mechanically attached, metal roof canopy panels of type and profile indicated over air/vapor barrier, sub-base underlayment and insulation and related flashing, trims and accessories for a weatherproof installation.
 - 2. Formed custom fabricated, mechanically attached, metal soffit canopy panels of type and profile indicated, flashing, counterflashing and all related appurtenances.
 - 3. Stainless steel gutters and downspouts as indicated on drawings.
 - 4. Provide metal accessories and trim for all recessed light fixtures, speakers, etc.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured roof panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- B. Air Infiltration: Provide manufactured roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft. of fixed roof area when tested according to ASTM E 283 at a static-air-pressure difference of 4.0lbf/sq. ft.
- C. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. and not more than 12.0 lb/sq. ft.
- D. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for Class 90 wind-uplift resistance and the Florida Building Code 5th edition (2014), and in accordance with the 2014 Florida Test Protocols.

- E. Structural Performance: Provide manufactured canopy panel composite assemblies which are capable of withstanding design loads indicated under in-service conditions as established by ASCE 7-05 analysis with vertical deflection no greater than the following when tested in accordance with ASTM E 330:
 - 1. Maximum Deflection: $L/175$ of the span.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review canopy panel requirements and installation, special details, mockups, air-leakage and bond testing, protection, and work scheduling.
 - 2. Canopy panel manufacturer representative shall attend.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and installation instructions, as applicable to materials and finishes for each component and for complete, single-source metal panel system.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Florida Product Approval: Provide documentation of product approval from the Florida Department of Business & Professional Regulation Florida Product Approval. A Notice of Acceptance (NOA) from Miami Dade County is preferred over a Florida State Product Approval.
- D. Shop Drawings: Show layouts of panels on roof, details of edge conditions, joints, panel profiles, supports, anchorage, trim, flashing, underlayment, closures, gutters, expansion joints, and special details. Distinguish between factory and field-assembled work.
- E. Samples for Verification: Provide sample panels 12 inches long by actual panel width, in the style, color, and texture indicated. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
- F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include manufacturer's certification of qualifications, lists of completed projects with project names and

addresses, names and addresses of project architects and owners, and any other information necessary to verify qualifications.

- G. Product Test Reports: Indicate compliance of canopy panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.
- H. Mockups: Build mockups as indicated in Section 01 43 39 "Visual Mock-up Requirements".
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- I. Provide material cleaning instructions and recommendation to be included in Operations and Maintenance Manuals.
- J. For installed products indicated to comply with certain design loading, include structural analysis data prepared in accordance with ASCE 7-05, signed and sealed by a licensed professional engineer.

1.6 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Manufacturer must also have a minimum of ten (10) years' experience in the manufacture of custom architectural sheet metal systems.
- B. Manufacturer's On-site Representation: Provide a manufacturer's representative to provide part-time inspection of canopy system installation. Submit construction/installation progress reports and a final inspection report to the Owner's Authorized Representative and the Architect.
- C. Installer Qualifications: Installer shall be certified by the manufacturer. The installer shall have completed metal roof panel projects similar in material, design, and extent to that indicated for this Project and have a documented record of successful in-service performance.
- D. Professional Engineer Qualifications: A professional engineer who is legally licensed to practice in the jurisdiction where the Project is located.
- E. Single-Source: Utilize coil/sheet produced by one manufacturer. Provide roof and soffit panels, flashing, and gutter profiles fabricated from material of a single sheet metal manufacturer. Award installation of waterproofing underlayment and metal canopy system to a single firm for undivided responsibility; including fabrication, erection and finishes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.
- B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.

- C. Stack material on platforms or pallets, covered with tarpaulins or other suitable weather-tight and ventilated covering. Store panels to ensure dryness. Do not store panels on contact with other materials that might cause staining, denting, or other surface damage.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 1. Established Dimensions: Take accurate field measurements before panels are made without delaying the work, establish dimensions and proceed with fabricating panels. Without field measurements product will be fabricated in accordance with dimensions noted on approved shop drawings. Coordinate canopy construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.9 WARRANTY

- A. General Warranty: Special warranties specified in the Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Document.
- B. Special Warranty: Submit a written, signed warranty covering failure of the factory-applied exterior paint finish on metal canopy panels within the specified warranty period and agreeing to repair finish or replace canopy panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
 - 1. Paint Finish Warranty Period: 20 years from date of Substantial Completion.
 - 2. Special Weather-tight Warranty: Submit a written single-source warranty, executed by the roofing system manufacturer agreeing to repair or replace the metal roof panel assembly that fails to remain weather-tight within the specified warranty period. The 20-year Weather-tight Warranty shall include all flashing, canopy panels, and all other metal system components.

PART 2 - PRODUCTS

2.1 METAL PANEL CANOPY SYSTEM

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design canopy cladding system.
- B. Provide products that comply with the Florida Product Approval Standards and the System SHALL obtain a valid and current Notice of Acceptance by the State or Miami Dade County A one-time Product Approval from Miami Dade County Office of Code Compliance is acceptable. An approved NOA shall be submitted prior fabrication or installation of any component,

- C. Flat, batten free, internal draining metal canopy system consisting of the following:
 - 1. Gutter System: Provide continuous 16 gage stainless steel gutter system with welded/soldered seams and expansion joints.
 - 2. Movement: Provide for independent movement of all roof components consistent with a thermal range of 120 degrees F and consistent with anticipated movement of building structure.
 - 3. Replacement of Panels and Drainage Components: Provide for non-destructive removal and replacement of individual roof panels and drainage components.
 - 4. Concealed fasteners.
 - 5. Infill board: Provide manufacturer's standard infill board to reduce metal panel warping with a compressive strength not less than 20 psi.
- D. Basis of Design Manufacturers: Subject to compliance with requirements, provide Berridge Manufacturing Co. products or a comparable product by one of the following :
 - 1. A. Zahner Co.
 - 2. CSI Architectural Metal, Inc.
 - 3. Overly Mfg. Company

2.2 METALS AND FINISHES

- A. Sheets: Aluminum 18 gauge (0.040 inches) 3003-H14 alloy.
 - 1. Panel Finish: 2-coat Kynar 500 PVDF, color as selected by Architect from manufacturer's full line.
 - 2. Panel Infill Board, factory applied to the underside of all panels, is required. Material shall be un-faced, pre-formed, rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 591, Type 2, thermal-resistance values for 1-inch thickness of 6.2 degrees F x h x sq. ft./Btu at 75 degrees F.
 - 3. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Fasteners: System fasteners shall be concealed and no less than a #12 stainless steel screw shall be used to anchor the internal drain channel; length as required for substrate construction.

2.3 ROOF UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Basis of Design Manufacturers: Subject to compliance with requirements, provide MFM Building Products Corp. products or a comparable product by one of the following :
 - a. GCP Applied Technologies
 - b. Mid-States Asphalt Quick Stick HT Pro
 - c. Polyglass Polystick MTS
 - d. Soprema Lastobond Shield HT
 - e. Tamko TW Underlayment or TW Metal & Tile Underlayment

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and accessories required for a complete canopy panel assembly and as recommended by panel manufacturer, unless otherwise indicated.
- B. Accessories: Unless otherwise specified, provide components required for a complete canopy panel assembly including trim, copings, fascia, mullions, sills, corner units, ridge closures, clips, seam covers, flashing, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of canopy panels.
- C. Fasteners: Type tested and approved to secure roof panel system in accordance with UL and uplift requirements.
- D. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type 1, Style 1b.
- E. Continuous Soffit Vents: Aluminum louvered construction.
 1. Basis of Design: GAF, LSV8 Series or approved equal.
 2. Style: Hat-shaped
 3. Length: 8-foot minimum length
 4. Opening: As indicated.

2.5 FABRICATION

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, 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 canopy system components to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
- C. Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashing, and other components of metal roofing to profiles, patterns, and drainage

arrangements shown and as required to resist water infiltration without excessive use of sealants (dry Joints) while also allowing any water infiltration behind the roof panels to weep out

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Coordinate metal panel roofing with rain drainage work; flashing; trim; and construction of decks, parapets, walls, and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

3.3 INSTALLATION

- A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.
 - 1. Field cutting exterior panels by torch is not permitted.
 - 2. Install panels with approved fasteners.
 - 3. Install plywood substrate, underlayment, and slip sheet material in accordance with material manufacturer's instructions and recommendations.
- B. Accessories: Install components required for a complete roof panel as assembly including trim, copings, fascia, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items.
- C. Installation Tolerances: Shim and align panel units within installed tolerance of 3/8 inch in 40-foot slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.

1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
2.
 - a. BECxA Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECxA checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
3. Provide field inspection reports within 5 working days of inspection.

3.5 FIELD TESTING

- A. Conduct 10 random fastener pull tests in accordance with this section in areas designed by the Owner's Authorized Representative, and submit test results for the comparison to design requirements.
- B. Block gutter drains and fill with water. Let stand for 24 hours. Repair gutter as required and retest until gutters are watertight.

3.6 CLEANING AND PROTECTING

- A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.
 1. Refer to Section 01 74 23 "Final Cleaning" for additional requirements.
- C. Protection: Do not permit unnecessary walking on finished roof. Require all personnel to wear rubber-soled shoes when walking on or installing this roof system.

END OF SECTION 07 41 10

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 Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of 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.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. 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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- 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 Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

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.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 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.

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: 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.
- 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.

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- E. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A- 90.
- F. 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.

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 a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under

one side of the panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together .

1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; Zee-Lock or comparable product by one of the following:
 - a. IMETCO.
 - b. McElroy Metal, Inc.
2. Metallic-Coated Steel Sheet: 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: 0.024 inch
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Painted materials shall have a removable plastic film to protect the paint during roll forming, shipping and handling.
 - d. Color: As selected by Architect from manufacturer's full range.
3. Clips: Zee-Clip to accommodate thermal movement.
 - a. Material: 0.024 inch nominal thickness, aluminum-zinc alloy-coated steel sheet.
4. Panel Coverage: 15 inches.
5. Panel Height: 2.375 inches.
6. Joint Type: Single folded.
7. Panel Coverage: 16 inches.
8. Panel Height: 2.0 inches.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mid-States Asphalt Quick Stick HT Pro
 - b. Polyglass Polystick MTS
 - c. Soprema Lastobond Shield HT
 - d. Tamko TW Underlayment or TW Metal & Tile Underlayment

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 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.
- 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 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. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Joint Sealant: 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.

2.5 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. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
3. 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.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 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 solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. 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 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
1. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.4 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. 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.
 7. 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. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA'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 intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch 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 indicated.
- J. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 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.

3.6 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. Testing Agency: Employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- D. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.
- 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.

3.7 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 41 50 - ALUMINUM RAIN-SCREEN WALL AND SOFFIT PANELS

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes: concealed-fastener, recessed flat seam metal wall/soffit system including the following components:
 - 1. Aluminum faced honeycomb core panels with integrated mounting clips
 - 2. Sub-structure for a complete installation on walls and soffit, including: vertical joint backing, gaskets, mounting sub-girt, anchorages, shims, expansion-contraction accommodating details
 - 3. Parapet coping, soffits, border and filler items indicated as integral components of the panel system or as designed
- B. Related Sections:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for support framing, including girt, studs, and bracing
 - 2. Section 07 42 10 "Continuous Insulation With Composite Framing Support System" for support framing
 - 3. Section 07 62 00 "Sheet Metal Flashing and Trim" for other sheet metal work that is not part of the metal wall or soffit panel assembly
 - 4. Section 07 92 00 "Joint Sealants"

1.3 DEFINITION

- A. Assembly: Recessed flat seam panels, attachment system components, miscellaneous metal framing.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum Honeycomb Core Panel assembly shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide Aluminum Honeycomb Panel System capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to specified norm:
 - 1. Deflection Limits: Façade Panels shall withstand wind loads with horizontal deflections no greater than $L/200$ of the span
 - 2. Under 1.5 times design pressure, permanent deflection of framing members shall not exceed $L/100$ of span length and components shall not experience failure or gross permanent distortion
 - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, 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: 200 deg F range on the material surfaces

1.5 SUBMITTALS

- A. Product Data: for each type of product indicated. Include construction details, material description, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings: digitally define project layout and all building elevations to receive facade panels indicating all panel layouts, panels' interfaces at differing planes, and slopes. Show details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories, and special details. All panels are to be factory fabricated ready for field assembly.
- C. Samples for Verification:
 - 1. For each type of exposed finish prepare two samples of color or finish selected, size 4" x 4"
 - 2. For the Panel System Assembly: two samples of each type of assembly, minimum size 12" x 12"
 - 3. For Trim and Closures: one 12" long representative sample, including fasteners and other exposed accessories
 - 4. A four way mock-up of the system, if required
- D. Two copies of the manufacturer's literature for panels and system
- E. Alternative materials must be approved by the architect prior to the bid date
- F. Product Test Reports: based on evaluation of comprehensive tests performed by a qualified testing agency, for panels and system
- G. Maintenance Data: for Aluminum Honeycomb Core panels to include maintenance manuals
- H. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum rain-screen wall and soffit 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: 5 years from date of Substantial Completion.
- I. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)

1.6 QUALITY ASSURANCE

- A. Aluminum Honeycomb Core Panel Manufacturer shall have a minimum of 15 years experience in the manufacturing of this type of products
- B. Aluminum Honeycomb Core Panel Manufacturer to be solely responsible for panels' manufacturing in an ISO 9001 factory, application of the finish, and system fabrication
- C. Testing Agency Qualifications: qualified according to ASTM E 329 for testing indicated
- D. Source Limitations: obtain each type of panel from single source from single manufacturer
- E. Mockups: present system mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation:
 - 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
- F. Pre-installation Conference: conduct conference at Project site.
- G. Field measurements should be taken prior to the completion of shop fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work. Field fabrication is to be reduced at minimum.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels, components, and manufactured items so as not to be damaged or deformed. Protect finish and edges according to panel manufacturer's recommendations.
- B. Store panels according to panel manufacturer's recommendations: stack panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering. Storing area has to ensure dryness with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- C. Unload, store, and erect Façade System in a manner to prevent bending, warping, twisting, and surface damage.

PART 2 - PRODUCTS

2.1 PANEL SYSTEM

- A. Honeycomb Panels
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide QCfaçades; QuadroClad™ Aluminum Honeycomb Core Panels or comparable approved product meeting all requirements.
 - a. Refer to Sections 01 25 00 "Substitution Procedures" and 01 60 00 "Product Requirements" for comparable product requirements.
 - 2. Panel Construction

- a. Two sheets of formed aluminum, inline coated, sandwiching a lightweight aluminum honeycomb core, and framed by an engineered aluminum extrusion
- b. Aluminum Micro Air transfer Honeycomb Cell $\frac{3}{4}$ " (19mm) Cell size
- c. An all-aluminum construction, 3000 series alloys, according to ASTM B209-07 and ASTM R0067
- d. Thickness Minimum: 0.960 in, unless otherwise specified
- e. Dimensions: height up to 60 in and length up to 240 in
- f. Tolerances: Length: ± 0.075 in (2mm), $\pm$ Width: 0.035 in (1mm), Thickness: ± 0.015 in, Flatness: 0.08 in/ any 72 in (2mm or 0.2%)
- g. Diagonal difference: ≤ 0.075 in (2mm)
- h. Weight: ≤ 2.2 lb/sq.ft
3. Surface finishes:
 - a. Front-side Panel: Luxacote™, PVDF (Kynar), or Polyester
 - b. Back-side Panel: Polyester (other on request)
 - c. Thickness: $\geq 25\mu\text{m}$, Gloss: 25 ± 7 units (60°)
 - d. Corrosion resistance: rating of 10 (max) for scribed and un-scribed panels, per ASTM D1654 (corrosive environment and ASTM D714 (degree of blistering)
 - e. UV resistance: 5 years Florida exposure with no checking, flaking, blistering, and chalking, color change ≤ 5 units, gloss retained $\geq 50\%$, per ASTM D4214
 - f. Any color meeting HDF standards
4. Adhesive: two-component polyurethane, high-temperature cured
5. Panel fire performance:
 - a. Class A, non-combustible composite per GB 8624-97
 - b. Class 0 (highest) surface fire performance, per BR1991
 - c. Flame spread Class 1 per BS 476 part 7
- B. Rainscreen System
 1. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with all requirements and performance standards. Replacements based on partial conformance are not accepted
 2. Fabrication and finishing of Rainscreen System, panels, sub-structure, and accessories, done at factory, in a ISO 9001 accredited company, according to manufacturer's standard procedures and processes, as necessary to fulfill performance requirements demonstrated by laboratory testing
 3. Installation shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight
 4. The system is designed as to allow for expansion contraction in all directions in a temperature range of -22°F to 158°F
 5. The design must allow for individual panel remove without removing adjacent panels
 6. System has no visible fasteners, and no other fastening to compromise a neat and flat appearance
 7. Joints are recessed, uniform and, of a dark color, and designed to contribute to the optimal drainage and back-ventilation of the Rainscreen
- C. Miscellaneous Materials

1. Self-tapping screws, bolts, nuts, self-locking rivets and bolts, studs, and other suitable fasteners designed to withstand design loads. Recommended fasteners: 300 series stainless steel, as per ELCO Construction Products; structural calculations to be performed by a qualified engineer
2. Factory-formed metal soffit panels designed to be installed by lapping and inter-connecting side edges of adjacent panels, usually to match profile and material of wall and soffit panels
3. Sheet Metal Accessories: fabricated flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated
4. Soffit Vent: Cor-A-Vent, Inc., PS-400 Strip Vent or equal.

2.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mid-States Asphalt Quick Stick HT Pro
 - b. Polyglass Polystick MTS
 - c. Soprema Lastobond Shield HT
 - d. Tamko TW Underlayment or TW Metal & Tile Underlayment

PART 3 - EXECUTION

3.1 GENERAL EXECUTION CONDITIONS

- A. Inspection
1. Surfaces to receive panels shall be even, smooth, sound, clean, dry, and free from defects due to detrimental work. Do not proceed with erection until unsatisfactory conditions have been corrected
 2. Surfaces to receive panels shall be structurally sound as determined by a registered Architect/engineer
- B. Installation
1. Fasten the substructure on wall or soffit, plumb and level. The system is designed to allow for adjustment in order to maintain all panels in the same plan
 2. Panels shall be erected in accordance with an approved set of shop drawings
 3. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings
 4. Conform to manufacturer's instructions for installation of concealed fasteners
 5. Do not install component parts that are observed to be defective, including warped, bowed, dented, bruised, and broken panels
 6. Do not cut, trim, weld, or braze panels or components during erection; return component part which require alteration or replacement to manufacturer

7. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by system's manufacturer

C. Quality Control

1. Provide a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports
2. Provide a manufacturer-authorized field service representative to inspect and test completed system installation, including accessories.
3. Any additional tests and inspections required, will be performed at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements
4. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - a. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - 1) BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - 2) BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - b. Provide field inspection reports within 5 working days of inspection.

D. Cleaning and Protection

1. Remove temporary protective coverings and strippable films, if any, as metal wall or soffit panels are installed within 30 days, unless otherwise indicated in manufacturer's written installation instructions
2. On completion of metal wall or soffit panel installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction
3. After panels installation, clear weep holes and drainage channels of obstructions and dirt
4. Replace metal wall or soffit panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures

END OF SECTION 07 41 50

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

A. SECTION INCLUDES

- 1. Continuous insulation (CI) composite framing support (CFS) system integrated with metal wall panels or Cement Plaster (Stucco) exterior wall cladding.
 - a. Substrate: Exterior sheathing over metal stud framing.

B. RELATED REQUIREMENTS

- 1. Section 05 40 00 "Cold-Formed Metal Framing" for metal stud substrate support framing
- 2. Section 06 16 00 "Sheathing" for exterior sheathing
- 3. Section 07 41 50 "Aluminum Rain-Screen Wall and Soffit Panels" for wall cladding system
- 4. Section 07 27 29 "Air-Barrier Coatings" for air, water, vapor barrier over exterior sheathing
- 5. Section 07 92 00 "Joint Sealants" for perimeter sealant
- 6. Section 09 24 00 "Cement Plastering" for wall cladding system

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate construction of wall cladding support system over substrate indicated for proper drainage, flashing, trim, back-up support, soffits, and other related Work.
 - 1. Review and finalize construction schedule.
 - 2. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
 - 3. Review means and methods related to installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment and attachment to structural support system.
 - 5. Review flashings, wall cladding details, wall penetrations, openings, and condition of other construction that affects this Work.
 - 6. Review temporary protection requirements for during and after installation of this Work.

1.4 SUBMITTALS

- A. Product Data: Submit for each type of product indicated; include construction details, material descriptions, dimensions of individual components and profiles, and accessories as necessary for complete fully functioning and assembled system.

- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Health Product Declarations (HPD's)
- C. Test and Inspection Reports: Submit test and inspection reports on each type of wall cladding/veneer system based on evaluation of comprehensive tests performed by nationally recognized testing agency.
- D. Coordinate with Warranty requirements in compliance with project requirements.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.
- B. Installer: Company specializing in performing work of this section and the following:
1. Install system in strict compliance with manufacturer's installation instructions.
 2. Have not less than three years of documented experience.
- C. Source Limitations: Obtain CI and CFS system from single source and single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original unopened containers and packaging with labels clearly identifying product name and manufacturer.
- B. Deliver components and other manufactured items or accessories without damage or deformation.
- C. Storage: Store materials in clean, dry, and level interior areas or outdoor areas for limited duration in accordance with manufacturer's written instructions.
- D. Protect components and auxiliary accessories during transportation, handling, and installation from moisture, excessive temperatures and other construction operations in accordance with manufacturer's written instructions.
- E. Handle components in strict compliance with manufacturer's written instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface, edge or corner damage.

1.7 SITE CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work in accordance with manufacturer's written installation instructions and warranty requirements.

1.8 WARRANTY

- A. CI and CFS System Warranty: Provide written warranty by manufacturer and installer agreeing to correct defects in manufacturing within five year or period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural: Measure the performance of the factory formed joints using a minimum of 30 psf (ASTM E72)
- B. System Thermal Design: Ensure installed CI and CFS system, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to interior face of insulation.
 - 1. System thermal design shall meet or exceed thermal design requirements in compliance with ASHRAE 90.1 energy code.
 - 2. Thermal Resistance: Wall assembly R Value as indicated.
- C. Temperature: Comply with structural loading requirements within temperature range of minus 55 degrees F to 180 degrees F.
- D. Fire-Test-Response Characteristics: Provide composite framing support system with fire-test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: In compliance with ASTM E84, for foam insulation, fiber reinforced polymer (FRP) and interior surfaces as follows:
 - a. Flame Spread Index (FSI): 25 or less.
 - b. Smoke Developed Index (SDI): 450 or less.
 - 2. Intermediate Scale Multistory Fire Test: Comply with NFPA 285 and/or IBC acceptance criteria for wall height above grade and fire separation distances, when wall type and other noted conditions require such testing or compliance with requirements as indicated.

2.2 COMPOSITE FRAMING SUPPORT (CFS) SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Advanced Architectural Products (A2P); SMARTci 2-in-1 System or comparable approved product meeting all requirements.
 - 1. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- B. CFS System: Provide CFS system consisting of polyester and vinyl ester bioresin matrix (FRP) with recycled materials, fire retardant additives and integral continuous metal inserts the length of profile. Reinforce CFS system with glass strand rovings

used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.

1. Depth of GreenGirt: as required for insulation.
2. On Center Spacing: 16 inch at Cement Plaster (Stucco) locations and 24 inch at Metal Panel locations.
3. Provide continuous non-corrosive steel insert for engagement of fasteners, 16 gage, minimum thickness, with G90 galvanized coating designation in compliance with ASTM A653/A653M.
 - a. Fully engage steel insert with adjacent CFS at ends.
 - b. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of CFS.
 - c. Provide integral 3-point compression seal in CFS sections to ensure insulation panel will not dislodge.
4. Provide integral anti-siphon grooves on exterior and interior flanges of CFS.
5. Provide force distribution zones integrally designed into profile of CFS.
6. Provide spline seals for adjacent insulation units into profile of CFS.
7. Surface Burning Characteristics:
 - a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
8. Flammability: Comply with ASTM E84.
9. Self-Extinguishing: Comply with ASTM D635.
10. Profile Visual Requirements: Comply with ASTM D4385.
11. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
12. Compressive Stress: Provide engineered lengthwise and crosswise compressive stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D695.
13. Flexural Stress: Provide engineered lengthwise and crosswise flexural stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D790.
14. Modulus of Elasticity: Engineered to meet performance loading criteria and specified safety factors.
15. Barcol Hardness: 45, in accordance with ASTM D2583.
16. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
17. Density: Within range of 0.062 to 0.070 lbs/cubic inch, in accordance with ASTM D792.
18. Lengthwise Coefficient of Thermal Expansion: 7.0×10^{-6} inch/inch/degrees F, in accordance with ASTM D696.
19. Notched Izod Impact, Lengthwise: 24 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.
20. Notched Izod Impact, Crosswise: 4 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.

2.3 INSULATION

- A. Insulation Panel Edges: Provide factory formed edges on insulation panels that interlock with CFS system components.

- B. Polyisocyanurate Panel Insulation: Rigid closed cell foam, complying with ASTM C1289; or Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 3, 25 psi compressive strength.
1. Flame Spread Index (FSI): 25 or less, tested in accordance with ASTM E84.
 2. Smoke Developed Index (SDI): 450 or less, tested in accordance with ASTM E84.
 3. Thermal Resistance: as indicated; ASTM C518 at 75 degrees F.
 4. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 5. Board Edges: Square.
 6. Compressive Strength: Grade 2, 20 psi; tested in compliance with ASTM D1621.
 7. Dimensional Stability: Less than 2 percent linear change after 7 days; ASTM D2126.
 8. Moisture Vapor Permeance: Less than 0.05 perm; ASTM E96/E96M.
 9. Water Absorption: Less than 0.05 percent by volume; tested to ASTM C209.
 10. Service Temperature: Range of minus 100 degrees F to 250 degrees F.

2.4 ASSEMBLY

- A. Assemble CI with CFS system using manufacturer's standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.
1. Comply with CFS system and dimensional and structural requirements as indicated on drawings.
 2. Erect CFS system in sequence in accordance with manufacturer's standard installation procedures.
 3. Provide spray foam sealant on backside of cantilevered fasteners that completely puncture the insulation layer.

2.5 ACCESSORIES

- A. Provide accessories necessary for complete CFS system including metal closure trim, transition angle, strapping, tie-in brackets, and similar items.
- B. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by CFS system manufacturer for project application.
1. Cladding to CFS System: Use standard self-tapping metal screws.
 2. CFS System to Metal Stud Wall Framing: Use standard self-tapping metal screws.
 3. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the CFS.
- C. Tape: Pressure sensitive adhesive coated polypropylene woven fabric. Must be mold, water, tear and UV resistant. Must be applicable in a wide temperature range (-20 degrees F).
- D. Wall Sheathing: Glass mat faced gypsum.
1. Refer to section 06 16 00 "Sheathing" for additional requirements.

- E. Weather Resistant Barrier (WRB): Refer to Section 07 27 29 "Air-Barrier Coatings" for requirements.
- F. Sealants: Provide sealants as recommended by CFS manufacturer for openings within CFS system and perimeter conditions.
 - 1. Refer to Section 07 92 00 "Joint Sealants" for sealant information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, CFS system conditions, and other conditions affecting performance of this Work.
- B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by CFS system manufacturer.
- C. Examine rough-in for components and systems penetrating CFS system to coordinate actual locations of penetrations relative to CFS systems joint locations prior to installation.
- D. Verify that mechanical and electrical services for exterior walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.
- E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
 - 1. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional requirements.
- B. Prepare surfaces using methods recommended by CFS manufacturer for achieving best result for substrate under project conditions.
- C. Prepare sub-framing, base angles, sills, furring, and other CFS system members and provide anchorage in accordance with ASTM C754 for substrate type and wall cladding type in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

- A. Install CFS system in accordance with manufacturer's installation instructions.
- B. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.
- C. Trim insulation neatly to fit spaces, and insulate miscellaneous gaps and voids.

- D. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.
- E. Seal gaps, voids or penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.
- F. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.
- G. Exposed insulation must be protected from open flame and kept dry at all times.
- H. Exterior wall insulation panels are not intended to be left exposed for periods of time in excess of 60 days without adequate protection.
 - 1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, window and door openings with a compatible waterproof tape.
- I. Install CFS system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.4 TOLERANCES

- A. Shim and align CFS system within installed tolerances of 1/4 inch in 20 feet, non-cumulative, level, plumb, and on location lines as indicated.

3.5 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - 1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.
- B. Installer shall inspect all areas and confirm, in writing, that installation contains no gaps or other breaches in the insulation.
- C. Manufacturer's representative shall inspect initial installation. Subsequent installation may proceed only after approval.

3.6 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Ensure that insulation panels are not exposed to moisture.
- C. Remove wet insulation panels or allow them to completely dry prior to installation of CFS system.

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BP-S195
Terminal C
Airside Concourse

CONTINUOUS INSULATION WITH COMPOSITE FRAMING SUPPORT

SECTION 07 42 10

D. Replace damaged insulation panels prior to Date of Substantial Completion.

END OF SECTION 07 42 10

SECTION 07 42 13.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Exposed-fastener, lap-seam metal wall panels.

- B. Related Sections:

- 1. Section 07 42 13.23 "Metal Composite Material Wall Panels" for metal-faced composite wall panels.
 - 2. Section 07 42 93 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.3 PREINSTALLATION MEETINGS

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

- 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of 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.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 type of panel and accessory.

1.5 ACTION SUBMITTALS

- A. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- B. 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.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
 1. Include Samples of trim and accessories involving color selection.
- 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.

1.6 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.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 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.

1.10 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.

1.11 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.

1.12 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 of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. 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-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- 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. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and a flat pan between major ribs.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide CENTRIA Architectural Systems products or a comparable product by one of the following :
 - a. Berridge Manufacturing Company.
 - b. Firestone Building Products.
 - c. McElroy Metal, Inc.
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Thickness: Not less than 0.032 inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Two-coat fluoropolymer.
 - d. Color: As selected by Architect from manufacturer's full range.
 - 3. Major-Rib Spacing: 7.2 inches o.c.
 - 4. Panel Coverage: 36 inches.
 - 5. Panel Height: 1-1/2 inch.

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.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. 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.
 - 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. GCP Applied Technologies Inc. (formerly Grace Construction Products); Grace Ice and Water Shield HT.
 - b. Henry Company; Blueskin PE200 HT.
 - c. Polyguard Products, Inc.; Deck Guard HT.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated

performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal 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 for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 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. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine 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.
 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 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 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. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. 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. 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 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.
 5. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal 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 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 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test 100 square foot area of assembly as directed by Architect 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. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 1. BECx A shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.

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

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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 07 42 13.13

SECTION 07 42 13.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Foamed-insulation-core horizontal and vertical metal wall panel assembly with integral reveals and profiled panels, with related metal trim and accessories.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for support framing for insulated core metal wall panels.
 - 2. Section 07 27 29 "Air-Barrier Coatings" for transition and flashing components of air/moisture barrier.
 - 3. Section 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets and roof drainage items.
 - 4. Section 07 92 00 "Joint Sealants" for field-applied joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of 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.
 - 8. Review procedures for repair of metal panels damaged after installation.

9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 type of panel and accessory.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Health Product Declarations (HPD's)
- 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 Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish, 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.

1.5 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.
- E. Florida Product Approval

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels 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. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.

1.8 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.

1.9 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.

1.10 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.

1.11 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 of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Health Product Declaration: Provide Health Product Declaration (HPD) with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 1. Product specific declarations in accordance with ISO 1404
 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. 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.
- E. 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..
- F. 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: 15 lbf/sq. ft..
- G. 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.
- H. 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. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 2. 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.
 3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
 4. Potential Heat: Acceptable level when tested according to NFPA 259.
 5. 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

- 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: 1.3 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: Subject to compliance with requirements, provide CENTRIA Architectural Systems; Formawall Dimension Series or a comparable product by one of the following:
 - a. Kingspan Insulated Panels.
 - b. Metl-Span.
 - 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: 0.034 inch.
 - b. Exterior Finish: Three-coat fluoropolymer.
 - 1) Color: Match Architect's samples.
 - c. Interior Finish: 0.2 mil primer with 0.6 mil acrylic color coat.
 - 3. Panel Coverage: **[36 inches] [40 inches] <Insert dimension>** nominal.
 - 4. Panel Thickness: **[1.0 inch] [1.5 inches] [2.0 inches] [2.5 inches] [3.0 inches] [4.0 inches] [5.0 inches] <Insert dimension>**.
 - 5. Thermal-Resistance Value (R-Value): **<Insert R-value>** 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. Backer Board: Hardboard complying with ANSI A135.4, Class 1 tempered, 1/8 inch thick unless otherwise indicated.
- D. 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.
- E. 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.
- F. 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.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. 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.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal 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.
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 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 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. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. 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.

2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- 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. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.
 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.4 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.
 7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
- 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. Laminated-Insulation-Core Metal Wall Panels:

1. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
2. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
3. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.

- a. Horizontal Joints: Maintain reveal joint of consistent width.
- b. Vertical Joints: Maintain reveal joint of consistent width.

4. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

D. 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.

E. 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 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage 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. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - 1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.6 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 07 42 13.19

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 Owner, Architect, Owner'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.
 - 8. Review procedures for repair of panels damaged 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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. 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, accessories, weeps, 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.
- D. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal 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. Florida Product Approval.
- D. Field quality-control reports.
- E. 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.
- B. Mockups: Build mockups as indicated in Section 01 43 39 "Visual Mock-up Requirements".
 1. Build mockup of typical metal composite material panel assembly, including corner, soffits, supports, attachments, and accessories.
 2. Water-Spray Test: Conduct water-spray test as indicated in Section 01 91 15 "Exterior Enclosure Commissioning".
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. 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.

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. 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.

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. 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: 1.57 lbf/sq. ft.
- C. 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.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- 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.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide 3A Composites USA, Inc., ALUCOBOND or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Firestone Metal Products, LLC.
- B. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404

2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Aluminum-Faced Composite Wall Panels ACM-1: Formed with 0.020-inch-thick, coil-coated aluminum sheet facings.
 1. Panel Thickness: 6 mm.
 2. Core: Standard.
 3. Exterior Finish: Three-coat fluoropolymer.
 - a. Color: As selected by Architect from manufacturer's full range.
- E. Aluminum-Faced Composite Wall Panels ACM-2: Formed with 0.020-inch-thick, coil-coated aluminum sheet facings.
 1. Panel Thickness: 4 mm.
 2. Core: Standard.
 3. Exterior Finish: Three-coat fluoropolymer.
 - a. Color: As selected by Architect from manufacturer's full range.
- F. Attachment Assembly Components: Formed from material compatible with panel facing.
- G. Attachment Assembly: Manufacturer's standard.

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. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

- 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.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form 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.

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.
 - 2. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- C. 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.
- D. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 - 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."
 - 2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
 - 3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- E. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
 - 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."
 - 2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.
- F. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
 - 1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - 2. Do not apply sealants to joints unless otherwise indicated.
- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal 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.
- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to 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: Contractor will engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test 100 square foot area of assembly in mock-up 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.
 1. Test specimen failing shall be repaired or replaced.
 2. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.

1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
2. Provide field inspection reports within 5 working days of inspection.

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.
- D. Refer to Section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 07 42 13.23

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal soffit panels.
- B. Related Sections:
 - 1. Section 07 41 13.13 "Formed Metal Roof Panels" for lap-seam metal roof panels.
 - 2. Section 07 42 13.23 "Metal Composite Material Wall Panels" for metal wall panels.

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 for each type of panel and accessory.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: For Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. 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.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Refer to Section 01 43 39 "Visual Mock-up Requirements" for mock-up requirements.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. 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.

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 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. Sustainability Requirements
 - 1. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre consumer recycled content not less than 29 percent.
 - 2. Environmental Product Declarations (EPD's)
 - 3. Corporate Sustainability Reporting (CSR's)
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. 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: 1.57 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: 2.86 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.

2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal wall panels.
1. Finish: Match finish and color of metal wall panels.
 2. Sealant: Factory applied within interlocking joint.
- C. Solid Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; FW-12 (with two grooves) or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Firestone Building Products.
 2. Material: Same material, finish, and color as metal wall panels.
 3. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

- a. Thickness: 0.032 inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-coat fluoropolymer.
 - d. Color: Match Architect's samples.
 4. Panel Coverage: 12 inches.
 5. Panel Height: 1.5 inches.
- D. Perforated Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; FW-12 (with two grooves) or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Firestone Building Products.
 2. Material: Same material, finish, and color as metal wall panels.
 3. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.032 inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-coat fluoropolymer.
 - d. Color: Match Architect's samples.
 4. Panel Coverage: 12 inches.
 5. Panel Height: 1.5 inches.

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, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. 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 soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are 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 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

- 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 panel manufacturer.

- D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

- 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, 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.

- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at 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 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. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.

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 07 42 93

SECTION 07 52 00 - SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. SBS-modified bituminous membrane roofing system and supplementary items necessary for installation.
- B. Related Sections:
 - 1. Section 03 30 00 "Cast-In-Place Concrete" for roofing installation over concrete roof deck.
 - 2. Section 05 31 00 "Steel Decking" for roofing installation over steel roof deck.
 - 3. Section 06 10 00 "Rough Carpentry" for installation of blocking, cants, and other wood members.
 - 4. 06 16 00 "Sheathing" for installation of cover board and deck sheathing.
 - 5. 07 27 29 "Air Barrier Coatings" for installation of air barrier below roof insulation.
 - 6. 07 62 00 "Sheet Metal Flashing and Trim" for installation of metal roof trim.

1.3 ALLOWANCES

- A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Treatment at concrete roof deck.

1.4 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing Work in this Section.
- B. Roof Edge Regions: The following definitions from ANSI/SPRI ES-1 shall be applicable to this project.
 - 1. Roof Corner Region: Based on the following:
 - a. For buildings with mean roof height of 60 ft or less, the corner region is a distance from the building corner that is 10 percent of the minimum building width or 40 percent of the building height at the eaves, whichever is smaller, but not less than 4 percent of minimum building width and not less than three feet.
 - 2. Roof Perimeter: The section of the roof edge between corner regions as defined above. The edge condition includes the roof edge device (edge flashing or coping) and the nailers or other substrate to edge device is attached.
- C. SBS: Styrene-Butadiene-Styrene.

1.5 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- C. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Show base flashings, cants, and membrane terminations.
 - 2. Show flat and sloped tapered insulation, including slopes.
 - 3. Show crickets and saddles, including slopes.
 - 4. Show roof plan showing orientation of roofing ply sheets and fastener spacing.
 - 5. Show insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 - 6. Show cold-applied adhesive pattern for insulation installation; typical pattern of a 100 square foot area.
- D. Samples for Verification Purposes: For the following products:
 - 1. Roofing membrane cap sheet, 12 in by 12 in square of color specified.
 - 2. Flashing sheets.
 - 3. Roof insulation.
 - 4. Walkways and protection course.
 - 5. Termination bars.
 - 6. Fasteners of each type, length, and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
 - 1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Concrete Roof Deck - Moisture Content Measurement: Submit recorded readings.
- D. Substrate Surface Temperature Readings at Cold Fluid-Applied Insulation Adhesive: If requested by OAR or Architect, submit recorded readings.

- E. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- F. Qualification Data for firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.
- G. Warranty: Sample of warranty.
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Insurance Certification: Assist OAR in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.
- D. Quality Standards:
 - 1. Unless otherwise recommended by roofing system manufacturer, provide roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
 - 2. Comply with FMG System Loss Prevention Data Sheet 1-49 for attachment and anchorage of nailers, blocking, and other associated members for applicable wind zone for Project.
- E. Fire-Test-Response Characteristics: Provide roofing system materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: ASTM E 108, Class A, for application and roof slopes indicated.

1.9 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. OAR
 - c. Contractor, including superintendent.
 - d. Installer, including project manager and supervisor (superintendent).
 - e. Manufacturer's qualified technical representative.
 - f. Installers of other construction interfaced with Work.
 - g. Testing agency.
 - h. Construction Manager.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications
 - g. Review deck substrate requirements for conditions and finishes, including flatness, presence of moisture, and fastening.
 - h. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - i. Review governing regulations and requirements for insurance and certificates if applicable.
 - j. Review temporary protection requirements for roofing during and after installation.
 - k. Review roof observation and repair procedures after roofing installation.
 3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver 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. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roofing membrane, roof insulation, and cover board materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with roofing membrane, insulation, and cover board

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 significant or permanent damage to deck or structural supporting members.
- E. Storage of roofing materials is not permitted inside enclosed building.

1.11 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to roofing system manufacturer's written instructions and warranty requirements.

1.12 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written "Total Roofing System" warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover boards, substrate board, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover boards, substrate board, and other components of roofing system.
 - 2. Warranty includes roof edge flashings integral with roofing system as specified in Section 07 62 00 "Sheet Metal Flashing and Trim".
 - 3. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS, GENERAL

- A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.
- B. Design Loads: Installed roofing system and base flashings shall withstand design loads including, but not limited to, requirements established by authorities having jurisdiction, applicable local building codes, and as indicated. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.
- C. Material Compatibility: Provide roofing system materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- D. Edge Systems Design: Provide edge systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to SPRI Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems ES-1.
- E. Roofing System Design: Provide roofing systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure and external fire exposure.
- F. FMG Listing: Provide roofing system, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG Approval "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG Approvals markings.
 - 1. Fire/Windstorm Classification at Roof Corner and Perimeter Region: Class 1A-180.
 - 2. Fire/Windstorm Classification at Field of Roof: Class 1A-90.
- G. Energy Performance for Low Slope Roofs: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

2.4 MODIFIED BITUMINOUS MEMBRANE ROOFING SHEET MATERIALS

- A. Base Sheet: Complying with specified products, provide one of the following as suitable for application method and performance requirements:
 - 1. ASTM D 6162, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced.
 - 2. ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced.
 - 3. ASTM D 6164, Grade S, Type I or II, polyester-reinforced.

- B. Cap Sheet for "Cool Roof": Factory-surfaced with manufacturer's standard highly reflective white flat angular pigmented polymer flakes or white acrylic-coated ceramic roofing granules that meet the "Energy Performance" requirements, subject to prior review and acceptance by Architect.
 - 1. Complying with specified products, provide one of the following as suitable for application method and performance requirements:
 - a. ASTM D 6162, Grade G, Type I or II, composite polyester and glass-fiber-reinforced.
 - b. ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced.
 - c. ASTM D 6164, Grade G, Type I or II, polyester-reinforced.
 - 2. Heat-weld Cap Sheet Products: Subject to compliance with requirements, provide one of the following:
 - a. GAF; Ruberoid EnergyCap SBS Heat-Weld Plus FR.
 - b. Johns Manville, Inc.; DynaWeld Cap FR CR.
 - c. Siplast; Paradiene CR 30 FR TG.
 - d. Soprema; Soprastar Flam 180 FR.
- C. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, metal-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:
 - 1. Foil Surfacing: Aluminum.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. GAF; Ultraclad Foil Faced SBS.
 - b. Johns Manville, Inc.; DynaClad
 - c. Siplast; Veral Aluminum System
 - d. Soprema; Sopralast series

2.5 MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
 - 1. Asphalt Primer: ASTM D 41.
- B. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application method.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- D. Liquid-Applied Reinforced Membrane Flashing: Bonded to base of pipe and stack, including roof and overflow drains, as recommended by roofing system manufacturer.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide Soprema; Allsan Flashing System products or a comparable product by one of the following:
 - a. GAF; MajorSeal Flashing System.
 - b. Johns Manville, Inc.; PermaFlash Bituminous Flashing System

c. Siplast; Parapro 123 Flashing System

- E. Metal Flashing Sheet: Refer to Section 07 62 00 "Sheet Metal Flashing and Trim".
- F. "Cool" Roofing Flakes: Highly reflective white flat angular pigmented polymer flakes that meet the "Energy Performance" requirements, color and size to match cap sheet roofing membrane.
- G. Termination Bars: ASTM A 666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in thick; predrilled at 8 in centers; with corrosive resistant, 300 series stainless steel, fasteners. Plastic bars are not allowed.
- H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 CONCRETE MOISTURE BARRIER TREATMENT

- A. Concrete Moisture Barrier Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of roofing materials.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Aquafin, Vaportight Coat SG3 or comparable approved product meeting all requirements including sustainability requirements.
 - 1. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.

2.7 ROOF INSULATION AND ACCESSORIES

- A. General: Provide preformed roof insulation boards that comply with requirements of referenced standards, selected from manufacturer's standard sizes and thicknesses. Provide accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
 - 1. Provide insulation thickness required to maintain minimum aged R-value as indicated on the Drawings.
 - 2. Insulation board thickness of individual insulation layers shall be 2 inches maximum.
 - 3. Insulation board size to be 48 by 48 inches maximum.
 - 4. Provide factory, tapered insulation boards where indicated for sloping to drain. Fabricate with 1/4 in in per 12 in (1:48) taper, unless otherwise indicated.
 - 5. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Cold Fluid-Applied Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Bead-applied, low-rise, two-component urethane adhesive.

2. Basis-of-Design Product: Subject to compliance with requirements, provide OMG, Inc., Olybond 500 or comparable approved product meeting all requirements including sustainability requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- D. Treated Wood Nailers and Cant Strips: Refer to Section 06 10 00 "Rough Carpentry".

2.8 ROOF COVER BOARDS

- A. Horizontal Roof Cover Boards: Glass-Mat Faced Exterior Gypsum Sheathing Board.
 1. Refer to Section 06 16 00 "Sheathing".
- B. Vertical Cover Boards (Back of Parapet) Glass-Mat Faced Exterior Gypsum Sheathing Board.
 1. Refer to Section 06 16 00 "Sheathing"

2.9 WALKWAYS AND PROTECTION COURSE

- A. Modified Bitumen Protection Course: SBS-modified asphalt cap sheet; granular surfaced; suitable for application method.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Siplast, Paratread System or comparable approved product meeting all requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
 2. Granule Color: As selected from manufacturer's standard colors, different from roof membrane color.
 3. Location: Pathways, surrounding rooftop-mounted equipment, and areas as indicated.
- B. Composition Protection Course: Mineral-granule-surfaced, reinforced composition pads, suitable for application method and acceptable to roofing system manufacturer, thickness as required 1/4 in minimum).
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Siplast, Trafbloc System or comparable approved product meeting all requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
 2. Granule Color: As selected from manufacturer's standard colors, different from roof membrane color.
 3. Location: Sleepers, bracings, and other rooftop equipment not mounted to roof deck.

2.10 FLASHING AND SHEET METAL

- A. Flashing and Sheet Metal: Refer to Section 07 62 00 "Sheet Metal Flashing and Trim".

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains 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 thickness of insulation.
 - 3. Cast-in-Place Concrete or Composite Metal Deck Substrates:
 - a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - b. Concrete Moisture Treatment: Perform moisture testing as required by manufacturer.
- B. Substrate Surface Temperature at Cold Fluid-Applied Insulation Adhesive: Confirm that concrete substrate or substrate board surface temperature is a minimum 50 deg F prior to application of adhesive.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
 - 4. Refer to section 01 91 15 "Facility Exterior Enclosure Commissioning" for additional requirements.
- B. All roofing Work done after all, or a portion of, the building is enclosed shall follow all Indoor Air Quality (IAQ) requirements found in Section 01 35 46 "Indoor Air Quality Management" including, but not limited to the following:
 - 1. Provide Temporary construction ventilation and maintain continuous interior ventilation while the Work is being performed.
 - 2. Sequence Work to be done prior to installation of all interior porous and fibrous materials.
 - 3. Provide temporary filters at all equipment return air and fresh air intake locations.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
- D. Pitch Pockets (aka Pitch Pans) at Roof Penetrations: Pitch pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to the drawings for allowable roof penetration details.

3.3 PREPARATION

- A. General: Comply with roofing system manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. 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.
- D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

- A. General: Comply with FMG and roofing system manufacturer's written instructions for installing roof insulation. Secure insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
- B. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 in or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 in in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 in with insulation. Cut and fit insulation within 1/4 in of nailers, projections, and penetrations.
- G. Cast-in-Place Concrete or Composite Metal Deck Substrate:
 - 1. Install and adhere base layer of insulation to substrate in a layer of cold fluid-applied adhesive. Install subsequent layers of insulation in a layer of cold fluid-applied adhesive.

3.5 ROOF COVER BOARD INSTALLATION

- A. General: Comply with FMG and roofing system manufacturer's written instructions for installing roof cover boards. Secure roof cover boards to insulation substrate according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

- B. Install roof cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6-inches in each direction. Loosely butt roof cover boards together.
 - 1. Provide one of the following fastening methods according to performance requirements:
 - a. Fasten roof cover boards through insulation into roof deck.
 - b. Adhere roof cover boards to insulation substrate in a layer of cold fluid-applied adhesive.
 - 1) Score boards, if necessary, to conform to substrate irregularities. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.
- C. Secure roof cover boards to insulation to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturer's written instructions.

3.6 MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM INSTALLATION

- A. Install roofing according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing". Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
- B. Start installation of roofing system in presence of roofing system manufacturer's technical personnel.
- C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- D. Coordinate installing roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when inclement weather is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing ply sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Install drain clamping rings immediately following installation of base sheet to prevent water damage to insulation.
 - 4. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- F. Install modified bituminous roofing base sheet and cap sheet according to roofing system manufacturer's written instructions, starting at low point of roofing system. Extend roofing sheets over and terminate beyond cants, installing as follows:
 - 1. Base Sheets:
 - a. Heat-weld: Heat-weld to substrate.
 - 2. Cap Sheets:

- a. Heat-weld: Heat-weld to substrate.
- G. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.
 - 2. Apply roofing granules/chips to cover extruded bead at laps while bead is hot.
- H. Install roofing sheets so side and end laps shed water.

3.7 BASE FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and to meet warranty requirements:
 - 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 2. Flashing Sheet Application: Install as follows and in compliance with performance requirements:
 - a. Heat-weld flashing sheet to substrate.
- B. Extend base flashing up walls or parapets a minimum of 8 in above roofing and 4 in onto field of roofing.
- C. Using termination bars, mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
- D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.
- E. Roof Drains: Set metal flashing in bed of asphalt roofing cement on completed roofing. Cover metal flashing with roofing cap-sheet stripping and extend a minimum of 4 in to 6 in beyond edge of metal flashing onto field of roofing. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring. Install stripping according to roofing system manufacturer's written instructions.
- F. Liquid-Applied Reinforced Membrane Flashings: Liquid applied reinforced membrane bonded to base at pipe and stacks. Install according to roofing system manufacturer's written instructions.
- G. Protection Course for Lightning Protection System: Apply 12 in by 12 in additional layer of base flashing material over the vertical face of parapet for lightning protection system and as recommended by manufacturer.

3.8 WALKWAY AND PROTECTION COURSE INSTALLATION

- A. Modified Bitumen Protection Course: Install roofing membrane protection course over roofing membrane. Cut sheets in five foot maximum lengths. Space with two inch gap at end joints.
 - 1. Installation Method: Use same installation method as roofing membrane cap sheet.

- B. Composition Protection Course: Install composition protection course using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions. Set with two inch gap at end joints.
 - 1. Installation Method: Use same installation method as roofing membrane cap sheet.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect Work once per week throughout installation to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection within 5 working days of inspections.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Cold Fluid-Applied Insulation Adhesive Manufacturer's Inspection: Manufacturer's qualified technical representative shall inspect Work once per week throughout installation to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection within 5 working days of inspections.
 - 1. Test Cuts: The cold fluid-applied insulation adhesive manufacturer shall perform field quality control test cuts of the cold fluid-applied insulation adhesive installation.
- C. Testing Agency: Employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Infrared Inspection: Where infrared survey indicates moisture intrusion, wet insulate on and damaged or deficient materials or construction shall be replaced in a manner to provide watertight and specified wind uplift resistant construction, and maintain the roof system warranty.
- D. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.10 REPAIR, CLEANING, AND PROTECTING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and OAR.
- 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.

END OF SECTION 07 52 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Formed roof-drainage sheet metal fabrications.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Formed roof-drainage sheet metal fabrications.
 - 4. Formed wall sheet metal fabrications.
 - 5. Formed equipment support flashing.
 - 6. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 07 52 00 "Modified Bituminous Membrane Roofing" for installation of sheet metal flashing and trim integral with roofing.
 - 3. Section 07 42 13.23 "Metal Composite Material Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
 - 4. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.
- B. Coordinate Preinstallation conference with other trades and conduct separate meetings as required and related to other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop drawings
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Include details of roof-penetration flashing.
 - 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 10. Include details of special conditions.
 - 11. Include details of connections to adjoining work.
 - 12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- E. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Flashing: 12 inches 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

- B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal coping 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, puncturing, or wind upload.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. 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.
- C. Special Weathertightness and Wind Speed Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal coping assemblies that fail to remain weathertight, including leaks, within specified warranty period. Warranty applies to damage caused by wind speeds of 150 MPH or less,
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- D. 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.
- E. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- C. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect from manufacturer's full range.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
 - 4. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).
 - 2. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. 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.

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. GCP Applied Technologies Inc. (formerly Grace Construction Products); Grace Ice and Water Shield HT.
 - b. Henry Company; Blueskin PE200 HT.
 - c. Polyguard Products, Inc.; Deck Guard HT.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- 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. 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.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Through-Wall, Ribbed, Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch intervals along length of flashing to provide integral mortar bond. Manufacture through-wall flashing with interlocking counterflashing on exterior face, of same metal as flashing.
 1. Stainless Steel: 0.016 inch thick.
- B. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
 1. Material: Stainless steel, 0.019 inch thick.
 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 5. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 6. Finish: Mill.
- C. Preformed Metal Flashing.
 1. Basis of Design: Waterproofing Specialists Inc.
 2. Material: 26 gauge stainless steel type 304, 2B finish, ASTM A240.
 3. Size: As required.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and SMACNA recommendations, 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.
 2. Use lapped expansion joints only where indicated on Drawings.
- 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.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- I. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates.
1. Joint Style: Overlapped, 4 inches wide.
 2. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- B. 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.
1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."
 2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.

3. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- C. Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
 1. Stainless Steel: 0.025 inch thick.
- D. Base Flashing: Fabricate from the following materials:
 1. Aluminum: 0.040 inch thick.
- E. Counterflashing: Fabricate from the following materials:
 1. Aluminum: 0.032 inch thick.
- F. Flashing Receivers: Fabricate from the following materials:
 1. Aluminum: 0.032 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.016 inch thick.

2.8 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.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 1. Stainless Steel: 0.016 inch thick.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 1. Aluminum: 0.040 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.019 inch thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

2. 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 staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within manufacturer's recommended exposure limit.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment.
- 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 wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- 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 07 92 00 "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 aluminum sheet.
 - 2. Do not use torches for soldering.
 - 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Anchor and loosely lock back edge of gutter to continuous cleat.
 - 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 30 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 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 2. Provide elbows at base of downspout to direct water away from building.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

- A. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- D. 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.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECx A shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.11 FABRICATION SCHEDULE

- A. Coated aluminum, 0.040-inch
 - 1. Edge Metal
 - 2. Parapet Caps
 - 3. Cover Plates
 - 4. Backer Plates
 - 5. Fascia Metal

- B. Stainless Steel, 22 Gauge.
 - 1. Hook Strips
 - 2. Cleats
 - 3. Securement Clips
- C. Stainless steel, 24 gauge
 - 1. Expansion Joint covers
 - a. Counterflashing
 - b. Skirt Flashing
 - c. Scupper
 - d. Cone Flashing/Storm Hood
 - e. Vent Pipe Sleeves and Caps
 - f. Pourable Sealer Pocket
 - g. J-Vent
- D. Coated Aluminum, 0.062 inch.
 - 1. Downspouts and Straps
 - 2. Conductor Head
- E. Mill Finish Aluminum, 0.093 inch.
 - 1. Termination Bars
 - 2. Gutter Hangers

END OF SECTION 07 62 00

SECTION 07 71 29 - MANUFACTURED ROOF EXPANSION JOINTS

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Flanged bellows-type roof expansion joints.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Expansion joint manufacturer representative shall attend the Preinstallation conference.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: For roof expansion joints.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
 - 3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.
- D. Samples: For each exposed product and for each color specified, 6 inches in size.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.7 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COMPRESSION-TYPE ROOF EXPANSION JOINTS

- A. Roof-to-Roof (REJ-A):

- 1. Basis-of-Design Product: Inpro Architectural Products, 1175 Series.
 - 2. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
 - 3. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size
 - 4. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 TORCHABLE EXPANSION JOINTS

- A. Roof-to-Wall (REJ-B)

- 1. Basis-of-Design Product: SITURA Inc.; FlamLINE 40.
 - 2. Flat, vulcanized waterproof joint integral with roofing membrane to accommodate movements up to +4-inches, -4-inches (500% at -40 degrees F.).

2.4 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended stainless steel fasteners, suitable for application and designed to withstand design loads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 - 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 - 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 3. Provide for linear thermal expansion of roof expansion joint materials.
 - 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 - 5. Provide uniform, neat seams.
 - 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance.
- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

3.3 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by certified staff and shall provide the following reports and checklists.

1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
2. Provide field inspection reports within 5 working days of inspection.

END OF SECTION 07 71 29

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Roof curbs (not specified elsewhere).
2. Equipment supports.
3. Roof hatches.
4. Pipe and duct supports.
5. Pipe portals.
6. Preformed flashing sleeves.

- B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 05 52 13 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Section 23 05 48 "Vibration Controls for HVAC" for special curbs designed to accommodate seismic and vibration controls.
5. Section 23 34 23 "HVAC Power Ventilators" for power roof-mounted ventilators.

1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and 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.

1.4 PREINSTALLATION MEETINGS

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

1.5 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. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
- C. 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.
- D. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- E. Delegated-Design Submittal: For roof curbs and equipment supports 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. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
 - 2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.6 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.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.8 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.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control", to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: As indicated on Drawings.
- D. Sustainability Requirements
 - 1. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
 - 2. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification

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, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Stainless-steel sheet, 0.078 inch thick.
 - 1. Finish: No. 2D, directional polish finish.
- D. 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. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
 - 6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 7. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
 - 8. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
 - 9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Rail-type 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, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Air Balance; a division of MESTEK, Inc.

- b. Curbs Plus, Inc.
 - c. Greenheck Fan Corporation.
 - d. Pate Company (The).
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) steel sheet, 18 ga. thick.
- D. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide under top flange on side of curb, continuous around support perimeter.
 - 3. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
 - 4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 - 5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 6. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.

2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide Babcock-Davis products or a comparable product by one of the following
 - a. Bilco Company (The).
 - b. Dur-Red Products.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Lexcor; a division of Luxsoco corp.
 - e. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - f. O'Keeffe's Inc.
 - g. Precision Ladders, LLC.
- B. Type and Size: Single-leaf lid, 30 by 36 inches unless noted otherwise.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 2. Finish: Baked enamel or powder coat.
 3. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
1. Insulation: Polyisocyanurate board.
 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Door Position Switches: Sentrol 2707AD High Security Concealed Magnetic Contacts.
1. Provide surface mount switches on secure side of hatch.
- 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.
 3. Material: Steel tube.
 4. Post: 1-5/8-inch-diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range.
- I. 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 (1060 mm) above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized-steel tube, 1-5/8 inches (41 mm) in diameter.
 3. Flat Bar: Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
 5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.

6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.

2.5 PIPE AND DUCT SUPPORTS

- A. Curb-Mounted Pipe Supports: Galvanized steel support 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; with adjustable-height roller-bearing pipe support accommodating up to 20-inch-diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
- B. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

2.6 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units 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; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.

2.7 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled stainless-steel flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and metal collar.
- B. Vent Stack Flashing: Stainless steel flashing sleeve, uninsulated, with integral deck flange.
- C. Flexible Pipe Boot: Pleated EPDM cone with corrosion resistant aluminum base and adjustable collar. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Firestone Building Products.
 2. Carlisle SynTec.
 3. Johns Manville.

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.
- C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- D. 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.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Preformed Flashing-Sleeve and Flashing Pipe Portal 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 sealant as required by roof accessory manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 1. BECx shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.

3.4 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 09 91 13 "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

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes sprayed fire-resistive materials.
- B. Related Requirements:
 - 1. Section 07 81 23 "Intumescent Fireproofing" for mastic and intumescent fire-resistive coatings.

1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive 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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.

- 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 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. Sustainability Requirements
 - 1. Low Emitting Paints & Coatings
 - a. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
 - 2. Health Product Declaration: Provide Health Product Declaration (HPD) with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard

3. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 STANDARD DURABILITY 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. Dry mix inorganic materials consisting of mineral slag wool and Portland cement are not permitted.
 1. Provide in areas where high durability spray fire-resistive material is not required.
- B. Basis of Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote MK-10/HB or comparable product by one of the following manufacturers.
 1. Carboline
 2. Isolatek International
- C. Bond Strength: Minimum 600-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
- D. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
- E. 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.
- F. Combustion Characteristics: ASTM E 1354.
- G. 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: 10 or less.
 2. Smoke-Developed Index: 10 or less.
- H. Compressive Strength: Minimum 31 lbf/sq. in. according to ASTM E 761.
- I. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- J. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- K. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.

- L. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
- M. 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.

2.3 HIGH DURABILITY 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. Dry mix inorganic materials consisting of mineral slag wool and Portland cement are not permitted.
 - 1. Provide on columns in mechanical room, electrical rooms, MDF rooms, IDF rooms, and other locations where application will be exposed.
- B. Basis of Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote Z-146 or comparable product by one of the following manufacturers.
 - 1. Carboline
 - 2. Isolatek International
- C. Bond Strength: Minimum 10,000-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
- D. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
- E. 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.
- F. Combustion Characteristics: ASTM E 1354.
- G. 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: 10 or less.
 - 2. Smoke-Developed Index: 10 or less.
- H. Compressive Strength: Minimum 500 lbf/sq. in. according to ASTM E 761.
- I. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- J. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- K. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- L. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. in 24 hours according to ASTM E 859.

- M. 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.

2.4 MEDIUM DURABILITY 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. Dry mix inorganic materials consisting of mineral slag wool and Portland cement are not permitted.
1. Provide on beams and other members located ten feet or more above finish floor in mechanical rooms, electrical rooms, MDF rooms, IDF rooms, and other locations where application will be exposed.
- B. Basis of Design Product: Subject to compliance with requirements, provide GCP Applied Technologies; Monokote Z-106/HY or comparable product by one of the following manufacturers.
1. Carbolite
 2. Isolatek International
- C. Bond Strength: Minimum 2,000-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
- D. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
- E. 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.
- F. Combustion Characteristics: ASTM E 1354.
- G. 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: 10 or less.
 2. Smoke-Developed Index: 10 or less.
- H. Compressive Strength: Minimum 100 lbf/sq. in. according to ASTM E 761.
- I. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- J. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- K. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- L. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. in 24 hours according to ASTM E 859.

- M. 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.

2.5 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.

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 in the Work area 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. Shop 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.
 - 1. Refer to Division 05 Sections.
- 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-resistive 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. 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.
- E. 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.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

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 Chapter 17 of the applicable building code.
 - 2. Shop drawings showing the minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly must be obtained from the architect.
- B. Perform the tests and inspections of completed Work in 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.
- C. 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 07 81 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes mastic and intumescent fire-resistive coatings.
- B. Related Requirements:
 - 1. Section 07 81 00 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
 - b. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Health Product Declarations (HPD's)
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

1.5 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 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 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. Low Emitting Paints & Coatings
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating for Conditioned Interior Space Application: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Carboline Company; a subsidiary of RPM International; Thermosorb VOC or comparable product by one of the following manufacturers.
 - a. International Paint, LLC

- b. Isolatek International
 - 2. Application: Designated for "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Mastic and Intumescent Fire-Resistive Coating for Exterior Application: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide; Isolatek International; CAFCO Spray Film WB5 or comparable product by one of the following manufacturers.
 - a. International Paint, LLC
 - b. Carboline Company; a subsidiary of RPM International
 - 2. Application: Designated for "exterior" use by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
- D. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.
- F. Finish: Smooth

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 required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. 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.
- D. 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.
- E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.
 - 1. Provide fireproofing manufacturer approved topcoat to match Architect's sample.

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. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- 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. 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-resistive 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, 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. 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.
- E. 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.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. 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 FBC, Subsection 17 05 .14, "Mastic and Intumescent Fire-Resistant Coatings."
- B. Perform the tests and inspections of completed Work in successive stages. 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 07 81 23

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Related Requirements:
 - 1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Paints and Coatings
 - b. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Low Emitting Materials
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- B. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide 3M Company products or a comparable product by one of the following:
 - a. Carboline Company.
 - b. GCP Applied Technologies.
 - c. Pecora Corporation.
- C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- D. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- E. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.

- b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
- c. Fire-rated form board.
- d. Fillers for sealants.
- 2. Temporary forming materials.
- 3. Substrate primers.
- 4. Collars.
- 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Low Emitting Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, 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 penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping 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 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 penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For 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. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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:
 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration 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 fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration

firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Provide approved manufacturers' systems for type of opening, construction penetrated and penetrating material. Assemblies will include, but are not limited to, the following conditions:
 - 1. With No Penetrating Items.
 - 2. Structural Items.
 - 3. Metallic Pipes, Conduit, or Tubing.
 - 4. Nonmetallic Pipe, Conduit, or Tubing.
 - 5. Electrical Cables.
 - 6. Cable Trays with Electric and Data Cables.
 - 7. Insulated Pipes.
 - 8. Miscellaneous Plumbing Penetrants.
 - 9. Miscellaneous Mechanical Penetrants
 - 10. Miscellaneous Electrical Penetrants.
 - 11. Groupings of Penetrants.
- C. Type of Fill Materials: As required to achieve ratings.

END OF SECTION 07 84 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
- B. Related Requirements:
 - 1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
 - 2. Section 07 95 13.13 "Interior Expansion Joint Cover Assemblies" and 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive architectural joint systems.
 - 3. Section 07 95 01 "Expansion Control – Parking Garage" for fire-resistive manufactured expansion-joint cover assemblies subject to vehicular traffic.
 - 4. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

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 Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.8 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.

1.9 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. Low Emitting Adhesives and Sealants
 - 1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- C. Health Product Declaration: Provide Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
- D. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- E. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 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. Hilti, Inc.; FS-One Max Firestop Sealant.
 - b. Specified Technologies, Inc.: SIL Silicone Firestop Sealant.
 - c. Tremco, Inc.; TREMstop IA+.
 - 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.
- F. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
 - 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. Hilti, Inc.; Firestop Joint Spray CFS-SP.
 - b. Specified Technologies, Inc.: AS200 Elastomeric Spray.
 - c. Tremco, Inc.; TREMstop Acrylic SP.
 - 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- G. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 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. Hilti, Inc.; FS-One Max Firestop Sealant.
- b. Tremco, Inc.; TREMstop Smoke & Sound Sealant.
- c. USG Sheetrock Brand Firecode; Smoke-Sound Sealant.
2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- H. Pre-Cut Flute Fire-Rated Insulation: Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal deck profile; use as a backer for spray material.
- I. Mineral Wool Fire-Safing Insulation: Unfaced, inorganic, noncombustible, moisture resistant mineral wool insulation.
- J. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- K. 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.

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- 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-resistive 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:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 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: Owner 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.

- 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.
- C. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
 - 1. Refer to Drawings for Basis-of-Design fire-resistive joint system assemblies.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Immersible joint sealants.
 - 5. Silyl-terminated polyether joint sealants.
 - 6. Mildew-resistant joint sealants.
 - 7. Polysulfide joint sealants.
 - 8. Butyl joint sealants.
 - 9. Latex joint sealants.
- B. Related Requirements:
 - 1. Section 32 13 73 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Sealant manufacturer technical representative shall be present at the Preinstallation conference.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Health Product Declarations (HPD's)
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. 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. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period:

- a. Exterior silicone vertical non-traffic sealant: five years from date of Substantial Completion.
 - b. All other sealants: Five years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Health Product Declaration: Provide Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
- C. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 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. Dow Corning Corporation.
- b. GE Construction Sealants; Momentive Performance Materials Inc.
- c. Pecora Corporation.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 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. BASF Corporation; Construction Systems.
 - b. Pecora Corporation.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 - 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. BASF Corporation; Construction Systems.
 - b. Pecora Corporation.
- C. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
 - 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. Tremco Incorporated.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. 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. Dow Corning Corporation.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. Pecora Corporation.

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 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. Bostik, Inc.
 - b. Pecora Corporation.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pecora Corporation.
 - b. The Sherwin Williams Company.
 - c. Tremco Incorporated.

2.7 IMMERSIBLE JOINT SEALANTS

- A. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Uses T, NT, and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corp. - Construction Chemicals; MasterSeal NP 1 (Pre-2014: Sonolastic NP1).
 - b. Sika Corporation; Joint Sealants; Sikaflex 1a.

2.8 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. Products: Subject to compliance with requirements, provide the following:
 - a. The Dow Chemical Company; Dow Corning® 123 Silicone Seal.
 - 2. Joint Seal Color: As selected by Architect from full range of industry colors.

2.9 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) 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.

2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 - a. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for requirements.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 3. Use tooling agents are not allowed.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Manufacturer shall field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints on each building elevation as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered

satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

- C. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECx A shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Tile control and expansion joints.
 - c. Joints between different materials listed above.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between metal panels.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors.
 - f. Control and expansion joints in ceilings and other overhead surfaces.

- g. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, NS, 25, NT.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and elevator entrances.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.
- F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
- G. Joint-Sealant Application: Concealed mastics.
 - 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Butyl-rubber based.
 - 3. Joint-Sealant Color: As indicated by manufacturer's designations.

END OF SECTION 07 92 00

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Health Product Declarations (HPD's)
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of acoustical 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.
- E. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Sustainability Requirements
 - 1. Low Emitting Sealants
 - a. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
 - 2. Health Product Declaration: Provide Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
 - 3. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - a. Product specific declarations in accordance with ISO 1404
 - b. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - c. Industry Wide Product Specific Type III EPD Third Party Certification

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard paintable, nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide STI; Smoke N Seal acoustic sealant products or a comparable product by one of the following:
 - a. Acoustical Surfaces, Inc., AS-29 AcoustiSeal Acoustical Sealant
 - b. Henkel Corporation, OSI SC175 Acoustical Sound Sealant
 - c. Saint-Gobain Ceramics & Plastics, Inc., Green Glue Noiseproofing Sealant.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- 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 acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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 ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

- 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 acoustical joint sealants and of products in which joints occur.
- A. Reference Specification 01 74 23 for additional requirements.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

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 (including all sustainability requirements), 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. Sustainable Design Submittals:
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Recycled content
 - 2. Product Certificates: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Cradle to Cradle Certification
- C. 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.
- D. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.
- E. 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.
- F. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.
- G. 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.
7. Fire-resistance ratings.

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. 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.
- B. Expansion Joint Design Criteria:
 1. Type of Movement: Thermal.
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.

2.3 FLOOR EXPANSION JOINT COVERS

- A. Floor-to-Floor (FEJ-1):
 1. Basis-of-Design Product: Construction Specialties, Inc., SSR series.
 2. Design Criteria:
 - a. Load Capacity:
 - 1) Uniform Load: 150 lb/sq. ft.
 - 2) Concentrated Load: 2000 lb.
 - 3) Maximum Deflection: 0.5 inch.
 - b. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 3. Type: Pan.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring, 1-inch minimum.
 - 2) Pan shall include a lateral slide mechanism to allow the system to move along the Y-axis in conjunction with the movement occurring along the X-axis
 - b. Metal: Aluminum, extruded.
 - 1) Finish: Mill.
- B. Floor-to-Floor (FEJ-2):
 1. Basis-of-Design Product: Construction Specialties, Inc., GFT series.
 2. Type: Elastomeric seal.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.

- b. Seal Material: CS Thermoplastic Rubber (TPR).
 - 1) Color: As selected by Architect from manufacturer's standard range.
 - 2) Gaskets to be dual durometer and have a flat profile that is free of ridges/reveals that collect dirt.
 - 3. Attachment Method: Mechanical anchors.
 - 4. Load Capacity: Standard duty.
 - C. Floor-to-Floor (FEJ-3):
 - 1. Basis-of-Design Product: Construction Specialties, Inc. model SJPFM
 - 2. Type: Cover plate.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: C/S #3 brushed, non-slip finish.
 - 3. Cover Plate Design: Recessed to accept field-applied finish materials.
 - a. Recess Depth: 1/8" minimum.
 - 4. Attachment Method: Mechanical anchors.
 - 5. Load Capacity: Standard duty.
 - D. Floor-to-Floor (FEJ-4):
 - 1. Basis-of-Design Product: Construction Specialties, Inc. model SJPFM
 - 2. Type: Cover plate.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.
 - 3. Cover Plate Design: Plain
 - 4. Attachment Method: Mechanical anchors.
 - 5. Load Capacity: Standard duty.

2.4 WALL EXPANSION JOINT COVERS

- A. Wall-to-Wall (WEJ-1):
 - 1. Basis-of-Design Product: Construction Specialties, Inc. model FWF, FWFC, FWF-Mod
 - 2. Type: Flat seal.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.
 - b. Seal Material: Santoprene.
 - 1) Color: As selected by Architect from manufacturer's standard range.
 - 3. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction. *(delete if not required)*
- B. Wall-to-Wall Joint Systems (WEJ-2)
 - 1. Basis-of-Design Product: Construction Specialties, Inc. model ASM
 - 2. Type: Snap-on cover.
 - a. Exposed Metal: Stainless Steel.
 - b. Finish: Class II, clear anodic.
 - 3. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

2.5 CEILING EXPANSION JOINT COVERS

- A. Ceiling-to-Ceiling (CEJ-1):

1. Basis-of-Design Product: Construction Specialties, Inc. model FWF, FWFC
2. Type: Flat seal.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.
 - b. Seal Material: Santoprene.
 - 1) Color: As selected by Architect from manufacturer's standard range.

2.6 FIRE RESISTIVE JOINT COVERS

- A. Wall and Floor Fire Barriers (FEJ-F)
 1. Basis-of-Design Product: Construction Specialties, Inc.; HFR Series
 - a. Performance Standards: ASTM E1966, ASTM E119, ASTM E 1399, and UL 2079.
 - b. Material: Silicone faces on each side of a fire retardant impregnated foam sealant.
 - c. Fire Resistance Rating: Match floor requirements.

2.7 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. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- 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. 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.

2.8 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 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. 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 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.
- G. Moisture Barrier Drainage: If indicated, provide drainage fittings 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. 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

SECTION 07 95 13.16 - EXTERIOR 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes exterior building expansion joint cover assemblies.
- B. Related Requirements:
 - 1. Section 07 71 29 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion joint cover assemblies.
 - 2. Section 07 95 01 "Expansion Control - Parking Garage" for expansion joint cover assemblies subject to vehicular traffic.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Expansion joint cover manufacturer representative shall attend.

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 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. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.
- F. 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.
7. Fire-resistance ratings.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace expansion joint covers 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 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. 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.
- B. Expansion Joint Design Criteria:
1. Type of Movement: Thermal.
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

- A. Wall-to-Wall (WEJ-A):
1. Basis-of-Design Product: Emseal Joint Systems, LTD., COLORSEAL
 2. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
 3. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size
 4. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating.
 - a. Color: As selected by Architect from manufacturer's full range.

- B. Safety flex
- C. Canopy-to-Wall (CEJ-A):
 - 1. Basis-of-Design Product: MM Systems Corporation, WJL Series.
 - 2. Design Criteria:
 - a. Base and frame material: extruded aluminum.
 - b. Splice Cap: Formed aluminum.
 - c. Moisture barrier: Continuous elastomeric sheet.
- D. Flexible Gutter System:
 - 1. Basis-of-Design Product: MM Systems Corporation, FGS.
 - 2. Design Criteria:
 - a. Continuous fabric reinforced 60-mil EPDM rubber bellow.
 - b. Aluminum mounting plates.
 - c. Flexible downspout drain tubes.

2.4 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
- 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. 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.
- G. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

- A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 07 71 29 "Manufactured Roof Expansion Joints." Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.5 FIELD QUALITY CONTROL

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.

- a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
- b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
2. Provide field inspection reports within 5 working days of inspection.

3.6 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 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
 - c. Regional material requirements
 - 2. Product Certificates: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide Steelcraft; an Allegion brand products or a comparable product by one of the following:
 1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.
- C. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At all interior locations UON.
 - 1. Physical Performance: Level C 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: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.
- D. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard, polystyrene, polyurethane, polyisocyanurate, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.
- E. Security Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
- 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.093 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard, polystyrene, polyurethane, polyisocyanurate, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.093 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.
- C. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At all exterior locations.
 - 1. Physical Performance: Level B 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 0.042 inch, with minimum A40 coating.

- d. Edge Construction: Model 2, Seamless.
- e. Core: Manufacturer's polystyrene, polyurethane, polyisocyanurate, or vertical steel-stiffener core at manufacturer's discretion.
- 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.042 inch.
- B. Construction: Full profile welded.
- C. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch 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.
- 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.

2.7 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- 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 08 80 00 "Glazing."

2.8 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, 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 and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors 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 and Transom Bar 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.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 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) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 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 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.

- 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.

2.10 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch 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.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 5. 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: 3/4 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 08 80 00 "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 as specified in sections 09 9113 "Exterior Painting" and 099 123 "Interior Painting".
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.
- G. Refer to section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 08 11 13

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.
- B. Related Requirements:
 - 1. Section 06 42 16 "Flush Wood Paneling" for requirements for veneers from the same flitches for both flush wood doors and flush wood paneling.
 - 2. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

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. 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.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 - 2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - 3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
 - 4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 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 bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 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.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eggers Industries.
 - 2. Graham Wood Doors; ASSA ABLOY Group company.
 - 3. Mohawk Flush Doors, Inc.
 - 4. VT Industries Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.
- G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Match WD2, Refer to Section 09 00 01 "Finish Key".
3. Assembly of Veneer Leaves on Door Faces: Center-balance match.
4. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
5. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
6. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
7. Core: Particleboard.
8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

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.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Grade: Custom.
 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish.
 3. Staining: None required.
 4. Sheen: Satin.

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 08 71 00 "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. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. 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

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.3 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. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- D. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

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 and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES, GENERAL

- A. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.

2.3 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges AD-1:

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. Babcock-Davis.
 - b. Larsens Manufacturing Company.
 - c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 3. Locations: Wall and ceiling.
 4. Door Size: As indicated.
 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Latch and Lock: Cam latch, key operated with interior release.
- B. Flush Access Doors with Concealed Flanges AD-2:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Larsens Manufacturing Company.
 - c. Milcor; Commercial Products Group of Hart & Cooley, 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. Door Size: As indicated.
 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 6. Frame Material: Same material and thickness as door.
 7. Latch and Lock: Cam latch, key operated with interior release.
- C. Exterior Flush Access Doors AD-3:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Larsens Manufacturing Company.
 2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick fiberglass insulation.
 3. Locations: Wall.
 4. Door Size: As indicated.
 5. Aluminum Sheet for Door: Nominal 0.045 inch, with manufacturer's standard baked-enamel or powder-coat finish.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Latch and Lock: Cam latch operated by handle, with keyed lock in handle; with interior release.
- D. Floor Flush Access Doors AD-4
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. Babcock davis
 - b. JL Industries

- c. Williams Brothers Corporation of America
2. Description: Aluminum smooth cover plate and frame with recess to accept carpet and hold-open bar.
3. Locations: Baggage claim deck.
4. Door Size: As indicated.
5. Aluminum Sheet for Door: Nominal 1/4-inch, mill finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Slamlock with threaded plug and removable outside key.

2.4 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges AD-1FR:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Larsens Manufacturing Company.
 - c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
2. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Wall.
4. Door Size: As indicated.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by key with interior release.

B. Fire-Rated, Flush Access Doors with Concealed Flanges AD-2FR:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Nystrom, Inc.
2. Description: Door face flush with frame, uninsulated; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall.
4. Door Size: As indicated.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, operated by key, with interior release.

2.5 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Aluminum Extrusions: ASTM B 221, Alloy 6063.
- E. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- F. Frame Anchors: Same material as door face.
- G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.6 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.

2.7 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.
 - 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
 - a. Color: As selected by Architect from full range of industry colors.

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 10 - SECURITY GRILLES

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 (including all sustainability requirements), apply to this Section.

1.2 SECTION INCLUDES

- A. Side Folding Security Grilles, manually operated.
- B. Overhead Rolling Security Grilles, electrically operated.

1.3 RELATED SECTIONS

- A. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years' experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

- C. Store materials in a dry, warm, ventilated weathertight location.

PART 2 - PRODUCTS

2.1 SECURITY GRILLES, GENERAL

A. Manufacturer

1. Basis of Design Manufacturer: Subject to compliance with the requirements, provide products by MobilFlex, Inc. or a comparable product by one of the following:
 - a. Cookson Company.
 - b. Dynamic Closures Corporation.
 - c. McKeon Rolling Steel Door Company, Inc.
 - d. Overhead Door Corporation.

2.2 SIDE FOLDING SECURITY GRILLES

A. Side-Folding Perforated Metal Panel Grilles

1. Basis of Design Product: MobilFlex, Inc.; AeroFlex.
2. The top and bottom of each section is fitted with an aluminum panel 4" high (102mm). This panel consists of an aluminum extrusion 1/16" (1,6mm) thick and composed of modules with a 15° angle between them to facilitate the operation of the closure. The curtain is constructed of 6" (152mm) wide modules linked together by a continuous aluminum hinge. These hinges hold steel perforated panels with 3/16" (5mm) diameter holes providing a 51% visibility and ventilation through the panels.

B. Grille Finish: Clear anodized.

C. Accessories

1. Pocket Door:
 - a. Door
 - 1) Material: A36 HR steel
 - 2) Thickness: USS 12-gauge
 - 3) Finish: Manufacturer's standard primer for field finish paint.
 - 4) Size: Rough opening minus 13/16" (20.6 mm)
 - b. Frame
 - 1) Material: A36 HR steel
 - 2) Thickness: USS 12-gauge steel
 - 3) Finish: Manufacturer's standard primer for field finish paint.
 - 4) Size: Overlaps opening 2" (50.8 mm) with a 5/8" (15.9 mm) projection off wall
 - c. Hinges: 3" (76.2 mm) non-mortise type
 - d. Lock: 1" (25.4 mm) security mortise cylinder; See Section 08 71 00 "Door Hardware" for cylinder.

D. Locking

1. Lead post shall be equipped with a hook bolt lock with cylinders each side.
2. Lead post shall engage a full height wall jamb.
3. Trailing post shall be self-locking at the top and bottom inside the storage pocket.

4. Free floating intermediate posts shall be located at all curves and at recommended intervals of 10 feet (3m) or 5 feet (1,5m) for counter top units. Intermediate posts shall be equipped with self-adjusting spring-loaded drop bolts activated from the inside only. Drop bolts shall engage dustproof stainless-steel receptacles.
- E. Track
 1. Curtain shall be hung from an overhead track 1-5/16" (33mm) wide by 1-9/16" (40mm) high. Track shall be tempered aluminum alloy 6063-T5.
 2. Curves where required shall be 14" (356mm) radius standard.
- F. Stacking
 1. Stacking shall not exceed a depth of 1.15" per foot of closure width plus 3" for each post (lead, end or intermediate). (95mm/lin. m + 76mm per post). Full egress doors add 7" (178mm).

2.3 OVERHEAD ROLLING SECURITY GRILLES

- A. Rolling Security Grille
 1. Basis of Design Product: MobilFlex, Inc.; Roll-126.
 2. Curtain shall be constructed of horizontal sections of full width, concealed 5/16 inch diameter rods spaced at 2-1/2 inches high on center by 5/8 inch by 3-1/8 inches vertical links spaced at 9 inch intervals. All horizontal rods shall be covered by 7/16 inch diameter aluminum horizontal spacer tubes resulting in 2 1/16 inches spacing between tubes.
- B. Support Structure:
 1. Supports: HSS 3x3x1/8 supplied by Security Grille Supplier; pre-drilled and tapped for guides and end plates.
- C. End Plates:
 1. Provide steel plates not less than 3/16 inch thick (with dimensions appropriate to coil size) to support the ends of the barrel assembly with sealed, self-aligning shaft bearings. End plates bolted to support tubes.
- D. Barrel:
 1. Minimum 6-5/8 inches diameter by 0.188 inch wall steel pipe barrel designed to carry curtain load with a maximum allowable deflection of 0.03 inches per foot of closure width. Barrel shall house a torsion spring counter-balance assembly to counter-balance the curtain.
- E. Counter Balance:
 1. Oil tempered, helical torsion spring(s) pre-lubricated and secured around a continuous, solid, cold rolled steel inner shaft will act as counter balance within barrel. Shaft shall bear on self-aligning, permanently lubricated ball bearing assemblies. Counterbalance assembly shall be designed for a minimum life of 20,000 cycles. Spring to be site tensioned by attached, accessible charging wheel.
- F. Electric Motor Operator:
 1. Motor operator shall be industrial duty, jackshaft type. Primary reduction shall be heavy-duty belt drive with chain-and-sprocket secondary reduction.

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Mechanism shall be self-locking when torque is applied to output shaft. Operator shall have an adjustable, torque limiting friction clutch. The motor operator shall have a built-in interlock that will prevent the grille from being damaged if operated electrically when in the locked position.

- a. Emergency Egress Release: Supply a flush manually activated emergency egress device to disengage motor in case of an emergency.
 - b. Electric Key Switch: Control station shall be two position, open/close, constant pressure type for flush mounting. Standard electrical enclosure and 24V wiring provided by section 16000. (key switch to replace push button set).
- G. Guides: Extruded aluminum 1-5/8 inch wide by 2-3/4 inches deep vertical curtain guides with nylon brush seal to allow smooth operation. Top stoppers shall be installed on each guide to stop upward movement of curtain at secured position.
- H. Bottom Bar: Heavy duty extruded aluminum section, bell-shaped to provide reinforcement.
- I. Material & finish: Standard aluminum 6063-T5 clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.4 ADJUSTING

- A. Test security grilles for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION 08 33 10

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Service doors.
 - 2. Fire-rated service doors.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
 - 2. Baggage handling system (by others) for in-line shutters.

1.2 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.
 - 3. Include description of automatic closing device and testing and resetting instructions.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Recycled content
- C. 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. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- E. 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.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

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.
 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- C. Regulatory Requirements: Comply with applicable provisions in Florida Building Code Fifth Edition - Accessibility.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- 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 design wind loads.

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E 330.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide Best Rolling Doors products or a comparable product by one of the following:
 - a. Cookson Company.
 - b. Overhead Door Corporation.
 - c. Raynor Door.
- 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 1.0 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.
- D. Door Curtain Material: 20 Ga. Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel or aluminum extrusions and finished to match door.
- G. Curtain Jamb Guides: Galvanized steel Aluminum with exposed finish matching curtain slats.
- H. Hood: Match curtain material and finish.
 1. Shape: Round.
 2. Mounting: As shown on Drawings.
- I. Electric Door Operator:
 1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 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.
 4. Motor Exposure: Exterior, wet, and humid.
 5. Emergency Manual Operation: Chain type.
 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

- a. Sensor Edge Bulb Color: Black.
- 7. Control Station(s): Interior mounted.
- J. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color matching Architect's sample.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.
- K. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements

2.4 FIRE-RATED DOOR ASSEMBLY

- A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
 - 1. Basis of Design Manufacturers: Subject to compliance with requirements, provide Best Rolling Doors products or a comparable product by one of the following:
 - a. Cookson Company.
 - b. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. 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.
 - 1. Include tamperproof cycle counter.
- C. Fire Rating: As indicated.
- D. Door Curtain Material: 20 ga. galvanized steel.
- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: As shown on Drawings.
- H. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
 - 2. Operator Location: As shown on Drawings.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
 - 4. Motor Exposure: Interior.
 - 5. Emergency Manual Operation: Chain type.
 - 6. Obstruction Detection Device: Automatic photoelectric sensor.
- I. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.
- J. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements

2.5 FIRE-RATED BAGGAGE SHUTTER ASSEMBLY

- A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airport Equipment Specialists, Inc.
 - b. Vigneaux Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. 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. Fire Rating: As indicated.
- D. Door Curtain Material: 20 ga. galvanized steel.
- E. Electric Door Operator:
 1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
 2. Operator Location: As shown on Drawings.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
 4. Motor Exposure: Interior.
 5. Emergency Manual Operation: Chain type.
 6. Obstruction Detection Device: Automatic photoelectric sensor.
 7. Control Station(s): Interlink with Baggage Handling System.

2.6 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.

2.7 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. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.
- 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.

2.8 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. Stainless Steel: 0.025-inch-thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 3. Aluminum: 0.040-inch-thick aluminum sheet complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 4. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 5. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.9 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
- C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without

retensioning the counterbalancing mechanism Automatic-closing device shall be designed for activation by the following:

1. Building fire-detection, smoke-detection, and -alarm systems.

2.10 COUNTERBALANCING 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 or welded 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.
 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- 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.

2.11 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 with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 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 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. For fire-rated doors, activation delays closing.
 - 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: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 - 2. 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.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- 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 regulatory requirements for accessibility.

2.12 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.

2.13 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.
- B. 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 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 regulatory requirements for accessibility.
- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.
- F. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform 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. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.5 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 53 - BULLET RESISTANT HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bullet resistant hollow metal doors and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated including brochures, specifications, and frame profiles.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
- C. Shop Drawings: All drawings are required to be drawn to scale based on-site field measurements.
 - 1. Show location of each item, size, type and spacing of frame anchors.
 - 2. Reinforcement size and locations.
 - 3. Details of joints and connections.
- D. Samples for Verification: Where material finish and colors are indicated submit the following:
 - 1. Steel Door and frame profiled, for each type.
- E. Product Certificates:
 - 1. Welding details and printed data in sufficient detail to indicate compliance with the contract documents. The provider of this door must be ISO 9001:2008.
 - 2. Certified by an accredited registrar and furnish proof of such. Provide proof of possession of PRODUCT LIABILITY INSURANCE in an amount not less than five million U.S. dollars. Submit manufacturer's instructions for installation of the door and cleaning of glazing material if present. Provide verification of compliance with ASTM E 119.00a One Hour Fire Rating for the ballistic protection barrier from a recognized testing laboratory.
- F. Product test reports.
- G. Research/evaluation reports.
- H. Maintenance data.

- A. UNDERWRITERS LABORATORY UL 752 11th Edition dated Sept. 5, 2005
Standard for Bullet Resistant Equipment

1.5 QUALITY ASSURANCE

- A. Furnish Door and Frame assembly as a complete unit produced by one manufacturer including hardware, accessories, mounting and installation components.

1.6 WARRANTY

- A. All materials and workmanship shall be warranted against defects for a period of one (1) year from date of receipt at job site.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Safeguard security services, LTD Armortex Bullet resistant hollow metal door model SSTW-21, Ballistic Level, UL-Level 8. Stainless steel frame and tray.
 - 1. Diebold, Inc.
 - 2. Ross Engineering
 - 3. Norshield Security Products
- B. Shall be of the "non-ricochet type" as shown on the contract drawings and schedules complete with 16 ga. face plates, foam insulation and fiberglass core. The 16 ga. rails and stiles are to be welded to face plates and provide a flush surface on all edges. Door unit shall be supplied pre hung with a Continuous Gear Hinge in a steel frame. Door and frame shall be mortised and reinforced at the factory for template hardware in accordance with the approved hardware schedule. Doors for a protection level 4 or higher can utilize HI Hard Anti ballistic steel for the protective core.

2.2 BULLET RESISTANT HOLLOW METAL DOOR & FRAME ASSEMBLY

- A. Templates are to be provided to the door manufacturer by the hardware contractor. Drilling and taping for surface mounted hardware shall be performed at the jobsite by the installing contractor. If bullet resistant transparent armor is required for the door vision panel, the vision panel shall be furnished by the door manufacturer and be UL Listed material of the same ballistic level as the door. Door and frame Assemblies shall be manufactured by Armortex, Schertz, Texas. Phone: (210)-661-8306, 800-880-8306 Fax: 210-661-8308. If in compliance with all aspects of this specification products by these manufacturers may be acceptable:
 - 1. Diebold, Inc
 - 2. Ross Engineering
 - 3. Norshield Security Products

- A. Frames shall be a protection level equal to the door. Frame shall be of a "non-ricochet type" design, constructed of 16 ga. commercial grade steel lined with UL LISTED Bullet Resistant Composite. Steel shall be free of scale, pitting, coil breaks or other surface defects. Finish work shall be neat and free of defects. Frames shall be welded. Knocked down and mechanical joints are unacceptable. All exposed welds shall be ground flush, finished smooth and free of defects. Standard manufacturing tolerances shall be +/- 1/16" for frame opening width, height, diagonal dimensions and overall width and height (outside to outside).

2.4 FINISH

- A. Cold rolled steel is factory prime painted gray. The continuous hinge is clear anodized aluminum. Field paint and finish in accordance with and as directed in the Finish Section 9 of these specifications.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine substrate and conditions under which window frames are to be installed and notify the Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION

- A. General: Install door units and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.
- B. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Install & secure for manufacturers instructions.

3.3 PROTECTION

- A. Touch up scratches or disfigurement caused by shipping and handling of the product. Properly store all the frames, glazing material etc. in a dry location and covered to protect from damage before and after installation.

3.4 CLEANING

- A. Upon completion, clean exposed surfaces of frames and glazing products thoroughly in accordance with manufacturer's instructions. Remove mastic smears and other unsightly marks.
- B. Final Adjustments: leave work in complete and proper operating condition. Remove and replace defective work, including frames which are warped, bowed or otherwise damaged.

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END OF SECTION 08 34 53

BULLET RESISTANT HOLLOW METAL DOORS AND FRAMES

SECTION 08 34 53

SECTION 08 34 63 - DETENTION DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Swinging detention doors.
 - 2. Detention frames.
- B. Related Requirements:
 - 1. Section 08 71 63 "Detention Door Hardware" for door hardware for detention doors.

1.3 DEFINITIONS

- A. Minimum-Thickness Steel: Indicated as the specified minimum thicknesses for base metal without coatings, according to NAAMM-HMMA 803.
- B. Nominal-Thickness Stainless Steel: Indicated as the specified thicknesses for which over- and under-thickness tolerances apply, according to ASTM A 480/A 480M.

1.4 COORDINATION

- A. Coordinate installation of anchorages for detention frames. 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 adjacent construction. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, label compliance, and finishes for each detention door and frame type specified.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
 - c. Regional material requirements
 2. Product Certificates: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- C. Shop Drawings: In addition to requirements below, provide a schedule using same reference numbers for details and openings as those on Drawings:
1. Elevations of each door type.
 2. Direction of swing.
 3. Inmate and non-inmate sides.
 4. Details of doors, including vertical and horizontal edge details, and metal thicknesses.
 5. Details of frames, including dimensioned profiles, and metal thicknesses.
 6. Locations of reinforcement and preparations for hardware.
 7. Details of each different wall opening condition.
 8. Details of anchorages, joints, field splices, and connections.
 9. Details of vision panels.
 10. Details of moldings, removable stops, and glazing.
- D. Samples for Verification:
1. For each type of exposed finish required, prepare Samples not less than 3 by 5 inches.
 2. For "Detention Doors" and "Detention Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Detention Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Detention Frames: Show profile, welded corner joint, welded hinge reinforcement, grout-cover boxes, floor and wall anchors, and silencers. Include separate section showing fixed steel panels and glazing if applicable.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.

- C. Product Test Reports: For each type of detention hollow-metal door and frame assembly including vision and side lights, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Examination reports, documenting inspection of substrates, areas, and conditions.
- E. Anchor inspection reports, documenting inspections of built-in and cast-in anchors.
- F. Field quality-control reports, documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.
- G. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 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. Security Fasteners: Furnish not less than one box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.
 - 2. Tools: Provide two sets of tools for installing and removing security fasteners.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver detention hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver detention frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store detention 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Apex Industries.
 - 2. Sweepers Metal Fabricators Corp.
 - 3. Trussbilt
- B. Source Limitations: Obtain detention doors and frames from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 DETENTION DOOR AND FRAME ASSEMBLIES

- A. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Refer to Section 01 81 13.14 "SUSTAINABLE DESIGN REQUIREMENTS - LEED V4 BD+C" for additional recycled content requirements.
- B. Detention Door and Frame Assemblies: Provide detention door and frame assemblies that comply with the following, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project:
 - 1. Security Grade: Assemblies pass testing requirements in ASTM F 1450 for security grades specified.

2.4 DETENTION DOORS

- A. General: Provide flush-design detention doors of seamless hollow construction, 2 inches thick unless otherwise indicated. Construct detention doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
 - 1. For single-acting swinging detention doors, bevel both vertical edges 1/8 inch in 2 inches.
- B. Core Construction: Provide the following core construction of same material as detention door face sheets, welded to both detention door faces:
 - 1. Steel-Stiffened Core: 0.042-inch-thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches apart, spot

welded to face sheets a maximum of 3 inches o.c. Fill spaces between stiffeners with insulation.

- C. Vertical Edge Channels: 0.123-inch-thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel. Noncontiguous channel is permitted to accommodate lock-edge hardware only if lock reinforcement is welded to and made integral with channel.
- D. Top and Bottom Channels: 0.123-inch-thick metal channel of same material as detention door face sheets, spot welded, not more than 4 inches o.c., to face sheets.
 - 1. Reinforce top edge of detention door with 0.053-inch-thick closing channel, welded so channel web is flush with top door edges.
- E. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention door face sheets to comply with the following minimum thicknesses:
 - 1. Full-Mortise Hinges and Pivots: 0.187 inch thick.
 - 2. Strike Reinforcements: 0.187 inch thick.
 - 3. Lock Fronts, Concealed Holders, and Surface-Mounted Closers: 0.093 inch thick.
 - 4. All Other Surface-Mounted Hardware: 0.093 inch thick.
 - 5. Lock Pockets: 0.123 inch thick at non-inmate side, welded to face sheet.
- F. Interior Detention Doors: Construct interior doors to comply with materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances indicated in NAAMM-HMMA 863 and as specified.
 - 1. Security Grade 4: Provide doors with face sheets of 0.067-inch-minimum-thickness, cold-rolled steel.

2.5 DETENTION FRAMES

- A. General: Provide fully welded detention frames with integral stops, of seamless construction without visible joints or seams. Fabricate detention frames with contact edges closed tight and corners mitered, reinforced, and continuously welded full depth and width of detention frame.
- B. Stop Height: Provide minimum stop height of 0.625 inch for detention door openings and minimum stop height of 1-1/4 inches in security glazing or detention panel openings unless otherwise indicated.
- C. Interior Detention Frames: Construct interior frames to comply with materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances indicated in NAAMM-HMMA 863 and as specified.
 - 1. Security Grade 4: Provide frames fabricated from 0.067-inch-minimum-thickness, cold-rolled steel.
- D. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention frame to comply with the following minimum thicknesses:

1. Hinges and Pivots: 0.187 inch thick by 1-1/2 inches wide by 10 inches long.
 2. Strikes and Closers: 0.187 inch thick.
 3. Surface-Mounted Hardware: 0.093 inch thick.
 4. Lock Pockets: 0.123 inch thick at non-inmate side, welded to face sheet.
Provide 0.123-inch-thick, lock protection plate for attachment to lock pocket with security fasteners.
- E. Jamb Anchors: Weld jamb anchors to detention frames near hinges and directly opposite on strike jamb or as required to secure detention frames to adjacent construction.
1. Number of Anchors: Provide two anchors per jamb plus the following:
 - a. Detention Door Frames: One additional anchor for each 18 inches, or fraction thereof, above 54 inches in height.
 2. Masonry Anchors: Adjustable, corrugated or perforated, strap-and-stirrup anchors to suit detention frame size; formed of same material and thickness as detention frame; with strap not less than 2 inches wide by 10 inches long.
- F. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material and thickness as detention frame, and as follows:
1. Monolithic Concrete Slabs: Clip anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions with at least four spot welds per anchor.
- G. Rubber Door Silencers: Except on weather-stripped detention doors, drill stops in strike jambs to receive three silencers on single-detention-door frames and drill head jamb stop to receive two silencers on double-detention-door frames. Keep holes clear during construction.
- H. Grout Guards: Provide factory-installed grout guards of same material as detention frame, welded to detention frame at back of hardware cutouts, silencers, and glazing-stop screw preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

2.6 MOLDINGS AND STOPS

- A. Provide fixed moldings on inmate side of glazed openings and removable stops on non-inmate side.
1. Height: As required to provide minimum 1-inch glass engagement, but not less than 1-1/4 inches.
 2. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093 inch thick, and spot welded to face sheets a maximum of 5 inches o.c.
 3. Removable Stops: Formed from 0.123-inch-thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 6 inches o.c. and not more than 2 inches from

each corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.

- B. Coordinate rabbet width between fixed and removable stops with glass or panel type and installation type indicated.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
- D. Masonry Anchors: Fabricated from same steel sheet as door face.
- E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- F. Glazing: Bullet resistant glazing complying with Section 08 80 00 "Glazing".
- G. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.
- H. Insulation: Slag-wool-fiber/rock-wool-fiber or glass-fiber blanket insulation. ASTM C 665, Type I (unfaced); with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Minimum 1.5-lb/cu. ft. density.
- 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.
- J. Waterborne Asphaltic Emulsion Coating: Minimum 2.5-mil dry film thickness.

2.8 FABRICATION

- A. Fabricate detention doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. 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. Tolerances: Fabricate detention doors and frames to comply with manufacturing tolerances indicated in NAAMM-HMMA 863.
- C. Removable Jamb Faces: Provide removable jamb faces where required for access to embedded anchors. Fabricate to allow secure reattachment of removable face with security fasteners.

- D. Fabricate multiple-opening detention frames with mullions that have closed tubular shapes and with no visible seams or joints.
- E. Exterior Detention Doors: Provide weep-hole openings in bottoms of detention doors to permit entrapped moisture to escape. Seal joints in top edges of detention doors against water penetration.
- F. Hardware Preparation: Factory prepare detention doors and frames to receive mortised hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final Door Hardware Schedule and templates provided by detention door hardware supplier.
 - 1. Reinforce detention doors and frames to receive surface-mounted door hardware. Drilling and tapping may be done at Project site.
 - 2. Locate door hardware according to NAAMM-HMMA 863.
- G. Factory cut openings in detention doors.
- H. Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM-NOMMA 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish detention doors and frames after assembly.

2.10 STEEL SHEET FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling".
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified in "Shop Primer" Subparagraph below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mil.
 - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with SDI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

2.11 SECURITY FASTENERS

- A. Operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific fastener type. Provide drive-system type, head style,

material, and protective coating as required for assembly, installation, and strength, and as follows:

1. Drive-System Type: Pinned Torx.
2. Fastener Strength: 120,000 psi.
3. Socket Button Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835.
4. Socket Flat Countersunk Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835.
 - b. Stainless steel, ASTM F 879, Group 1 CW.
5. Socket Head Cap Fasteners:
 - a. Heat-treated alloy steel, ASTM A 574.
 - b. Stainless steel, ASTM F 837, Group 1 CW.

2.12 SEALANTS

- A. Polyurethane Security Sealants: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement.
- B. Epoxy Security Sealants: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with no movement.

2.13 ACCESSORIES

- A. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
- B. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch thick; with minimum 1/2-inch-diameter, headed studs welded to back of plate.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

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 of detention frame connections before detention frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- D. Inspect embedded plate installations before installing detention frames to verify that plate installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace plates where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Before installation and with shipping spreaders removed, adjust detention frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of face.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

- A. General: Install detention doors and frames plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings, schedules, and manufacturer's written instructions.
- B. Anchorage: Set detention frame anchorage devices according to details on Shop Drawings and according to anchorage device manufacturer's written instructions.
 - 1. Masonry Anchors: Coordinate frame installation to allow for solidly filling space between frames and masonry with grout.
 - 2. Embedded Anchors: Install embedded plates in wall surrounding frame openings to match frame angle locations.
 - 3. Postinstalled Anchors: Drill holes in existing construction at locations to match bolt locations, and install bolt expansion shields or inserts.
- C. Where detention frames are fabricated in sections due to shipping limitations, assemble frames and install angle splices at each corner, of same material and thickness as detention frame, and extend at least 4 inches on both sides of joint.
 - 1. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.

2. Continuously weld and finish smooth joints between faces of abutted, multiple-opening, detention frame members.
3. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. 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. Shop apply bituminous waterborne asphaltic emulsion coating to backs of frames before filling with grout.
- E. Placing Detention Frames: Install detention frames of sizes and profiles indicated. Set detention 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.
 1. Embedded Anchors: Remove jamb faces from detention frames and set detention frames into opening. Weld steel connector angle to frame angle and to embedded plate with 1-inch-long welds at each end of connector angle to form a rigid frame assembly that is solidly anchored. Reinstall jamb faces using security fasteners.
 2. Postinstalled Anchors: Install bolt. After bolt is tightened, weld bolt head to provide nonremovable condition. Grind, dress, and finish smooth welded bolt head.
 3. At fire-rated openings, install detention frames according to NFPA 80.
 4. Install detention frames with removable stops located on non-inmate side of opening.
- F. Grout: Fully grout detention frame jambs and heads. Completely fill space between frames and adjacent substrates. Hand trowel grout and take other precautions, including bracing detention frames, to ensure that frames are not deformed or damaged by grout forces.
- G. Security Sealant: Apply polyurethane security sealant at all exposed gaps between detention frames and adjacent substrates.
- H. Swinging Detention Doors: Fit non-fire-rated detention doors accurately in their frames, with the following clearances:
 1. Between Doors and Frames at Jambs and Head: 1/8 inch.
 2. Between Edges of Pairs of Doors: 1/8 inch.
 3. At Door Sills with Threshold: 3/8 inch.
 4. At Door Sills without Threshold: 3/4 inch.
 5. Between Door Bottom and Nominal Surface of Floor Covering: 1/2 inch.
- I. Fire-Rated Detention Doors: Install with clearances as specified in NFPA 80.

- J. Installation Tolerances: Comply with installation tolerances indicated in NAAMM-HMMA 863.
- K. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Detention work will be considered defective if it does not pass tests and inspections.
- C. Perform additional inspections to determine compliance of replaced or additional work.
- D. Prepare field quality-control certification that states installed products comply with requirements in the Contract Documents.
- E. For verification that construction complies with requirements, select one detention door at random from detention doors delivered to Project and have it cut in half or otherwise taken apart.
 - 1. Test Method: Verify weld strength by prying or chiseling door apart at edge seams, end channels, or stiffeners. Not more than 5 percent of welds may fail test.
 - a. If tested door fails, replace or rework all detention doors to bring them into compliance at Contractor's expense.
 - b. If tested door passes, replace tested door at Contractor's expense.
- F. Prepare test and inspection reports.

3.5 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 detention doors and frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off detention doors and frames immediately after installation.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.
- D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 - 1. After finishing smooth field welds, apply air-drying primer.

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DETENTION DOORS AND FRAMES

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- E. Stainless-Steel Surfaces: Clean surfaces according to manufacturer's written instructions.

END OF SECTION 08 34 63

SECTION 08 34 73.13 - METAL SOUND CONTROL DOOR 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes metal sound control door assemblies.

1.3 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.

1.4 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, and finishes.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
 - 2. [Product Certificates](#): Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for the following:
 - a. Corporate Sustainability Reporting (CSR's)
- C. 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 moldings, removable stops, and glazing.
10. Include details of conduits and preparations for power, signal, and control systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- 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 manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 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.
- 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.

1.10 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: Five 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 when calculated by ASTM E 413 when tested in an operable condition according to ASTM E 90.

2.2 STEEL SOUND CONTROL DOORS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide Ceco Door; ASSA ABLOY products or a comparable product by one of the following:
 1. Curries Company; ASSA ABLOY.
 2. Krieger Specialty Products
 3. 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. 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.
 2. Core: Manufacturer's standard sound control core.
 3. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
 4. 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.
 5. 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. Glazing: As required by sound control door assembly manufacturer to comply with sound control requirements.
- 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. Head Reinforcement: Metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness.
 5. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch nominal-thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
 - b. 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.
 6. 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.
 7. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch-wide uncoated steel unless otherwise indicated.
 8. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch thick.
- B. Materials:
 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 2. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

3. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
 4. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
- 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, 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. 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 08 71 00 "Door Hardware."

2.5 SOUND CONTROL ACCESSORIES

- A. Glazing: Manufacturers' standard factory-installed glazing.

- B. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.
- C. 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.

2.6 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. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
 - 2. 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.
 - 3. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
 - 4. 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."
 - 5. 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. Masonry 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) Two anchors per jamb up to 60 inches in height.
 - 2) Three anchors per jamb from 60 to 90 inches in height.
 - 3) Four anchors per jamb from 90 to 96 inches in height.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.
- 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) 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. Head Reinforcement: For grouted frames more than 48 inches wide, weld continuous head reinforcement to back of frame at head full width of opening.
6. 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."
7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound control seal preparations to close off interior of openings in frames to be grouted.
8. 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. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

- B. 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. At fire-rated openings, install frames according to NFPA 80.
 - b. At openings requiring smoke and draft control, install frames according to NFPA 105.
 - c. 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.
 - d. Install sound control frames with removable glazing stops located on secure side of opening.
 - e. Remove temporary braces only after frames or bucks have been properly set and secured.
 - f. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply corrosion-resistant coating to backs of frames to be filled with mortar, grout, and plaster 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 powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.

4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 5. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. 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 the following clearances:
 - a. Jambs: 1/8 inch.
 - b. Head with Butt Hinges: 1/8 inch.
 - c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch.
 - d. Sill: Manufacturer's standard.
 - e. Between Edges of Pairs of Doors: 1/8 inch.
 2. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.
- 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. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 07 92 00 "Joint Sealants."
- F. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with sound control door assembly 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 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. Grouted Frames: Clean grout off sound control door frames immediately after installation.
- D. 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.
- E. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

END OF SECTION 08 34 73.13

SECTION 08 35 13.23 - ACCORDION FOLDING FIRE 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes horizontal, accordion folding fire doors.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
 - 2. Section 09 91 23 "Interior Painting" for field painting track, soffit, chain guide and wall mounted striker posts.
 - 3. Division 26 Sections for electrical connections.

1.3 QUALITY ASSURANCE

- A. Installation shall be performed by factory trained and certified installers with a minimum of three years' experience installing electrically operated accordion folding fire doors.
- B. Fire doors shall be listed by Underwriters Laboratories for ratings as indicated, when tested in accordance with the requirements of UL 10B and NFPA 252.
- C. Automatic closing system shall be listed by Underwriters Laboratories in accordance with the requirements of UL 864 and be listed for use with assembly in compliance with NFPA 80, Chapter 9. Motor operator shall be rated for continuous use with unlimited cycle duty.
- D. Fire doors used for smoke and draft control shall bear the "S" mark on the fire door label and shall have an air leakage of less than 3 ft³/ft² at 0.1 inch of water column pressure when tested in accordance with UL 1784 with an artificial bottom seal.
- E. Fire doors used at the point of access to an elevator shall bear the "SE" mark on the fire door label and shall have an air leakage of less than 3 ft³/ft² at 0.1 inch of water column pressure when tested in accordance with UL 1784 without an artificial bottom seal.
- F. Fire Door shall be capable of resisting an air pressure differential up to 0.05 inches of water column.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's technical literature; include UL listing data.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stacking depth, height of header above finished floor, and requirements for anchorage and support of each door.
- D. Operation and Maintenance Data: Operating manual, troubleshooting and repair methods, and wiring diagrams shall be provided as part of project close out procedure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to the job site in manufacturer's original, unopened package.

1.6 COORDINATION BY GENERAL CONTRACTOR

- A. Coordinate with the following:
 1. Fire Alarm System.
 2. Electrical.
 3. Pocket cover door (if required).
 4. Floor and ceiling finish.
- B. Assure accurate installation of header, jamb, and trim. Provide "As-Built" dimensions for opening and storage pocket. Supervise unloading and handling of materials.
- C. Permanent power shall be in-place and ready for final connection when fire doors are erected. Assure access to and proper clearance for motor operators.
- D. After testing the fire alarm system, automatic-closing fire doors shall be re-set to the original position.
- E. Store boxes flat (not more than three high) in a dry area and protect from elements that may damage materials. Replace damaged materials at no cost to the owner.

1.7 WARRANTY

- A. Materials and installation shall be warranted against defects in workmanship for a period of one (1) year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCORDION FIRE DOORS - GENERAL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Won-Door Corporation, FireGuard or comparable approved product meeting all requirements including sustainability requirements.
 1. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.

- B. Provide power operated self-closing fire doors of configurations indicated on the drawings.
 - 1. Fire rating as indicated.
- C. Fire Rating: Fire Doors shall be listed by Underwriters Laboratory as special purpose fire doors having a fire protection rating as indicated in accordance with the requirements of UL 10B and NFPA 252.
- D. Closing and Opening Operation: Automatic Closing System including motor operator and releasing devices shall be a Microprocessor-based system rated to UL864 (Releasing Device Control Unit) and shall commence closing upon activation by fire alarm system and/or by low battery charge.
 - 1. Obstruction Detection: Contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition.
 - 2. Motor-assisted opening: While the door is opening under motor power, constant pressure to the leading edge in the direction of opening shall cause the door to continue to open until the leading edge is released.
 - 3. Constant pressure to the leading edge while not under motor power shall prevent motor operation and allow the door to be opened manually.
- E. Exit Hardware Operation: Provide fire exit hardware on both sides of door.
 - 1. In emergency mode, a slight pressure on the hardware will cause the door to open a minimum of 32 inches, pause for 3 seconds, and then automatically close.
 - 2. The open distance shall be field programmable, up to the entire opening width.
 - 3. The pause before re-close shall be field programmable up to 30 seconds.
 - 4. The exit hardware shall have the ability when not in the emergency (fire) mode to be used to open the door and move it back into the storage pocket.

2.2 COMPONENTS

- A. Door Construction: Two parallel, accordion-type walls of panels independently suspended with no floor tracks, pantographs, or interconnections except at the lead-post.
 - 1. Panels shall be formed of 24-gauge enamel coated steel V-grooved for strength and resilience. Panels shall be connected by full height 24-gauge enamel coated steel hinges. Panels shall be modular in design and capable of in-place repair.
 - 2. Perimeter Seals: shall consist of continuous extruded vinyl sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.
 - 3. Hanging weight shall be 5.5 pounds per square foot when extended across the opening.
 - 4. Finish: All steel parts factory applied enamel.
 - 5. Color: Manufacturer's standard.
 - 6. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - a. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.

- B. Suspension System: Two tracks, on 8 inch centers, attached to overhead structural support.
 - 1. 0.125-inch aluminum.
 - 2. Panel hangers: Panels supported from a steel hanger pin and a ball bearing roller.
 - 3. Lead Post hangers: 8-wheel ball bearing trolley.
- C. Power Supply: 120-volt power source to power supply for main power. On loss of AC power, the 12v/24v battery back-up system shall provide full operation capability.
- D. Automatic Closing System shall be listed to UL864 including capability to send and receive signals from the Fire Control Panel and shall consist of the following:
 - 1. Microprocessor based Electronic Control box with these features:
 - a. Ability to monitor dual power sources continually for peak performance including:
 - 1) Detect a missing battery, bad battery, or low battery condition.
 - 2) Detect if the charging circuit is bad.
 - 3) Detect fuse failures.
 - 4) Detect high or low AC conditions.
 - b. Ability to monitor the health of the drive train.
 - c. Ability to monitor inputs including: Sticky door block, exit hardware, and patron hardware.
 - d. Ability to run a "watch dog" monitoring circuit which will force a software restart in the event the software hangs, including the ability to track the number of resets that occur for diagnostic purposes.
 - e. Ability to withstand voltages up to 120 volts AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, "no voltage" circuit when errant voltages are applied to the circuit.
 - f. Ability to communicate with other microprocessors in the assembly via an internal buss system.
 - g. Ability to indicate trouble or supervised information both locally and at a remote location.
 - 2. Motor Operator Assembly including: A DC gear-motor, drive sprocket, clutch, and position sensors. The motor shall drive the fire door by means of a chain attached to a stabilizer bar.
 - 3. Leading Edge Obstruction Detector: shall be pressure sensitive such that each contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition. The leading edge obstruction detector shall be fully functional at all times, including during the initial closing cycle.
 - 4. Exit Hardware will be located on both sides of the fire door.
- E. A key switch module shall be provided.

2.3 RELATED CONSTRUCTION

- A. Track Support Construction: Provide supports attached to structure and mounting surface for tracks; comply with door manufacturer's instructions and recommendations. Headers shall be parallel with the finished floor within +/- 1/8" tolerance over the entire length of the opening.

- B. Pocket Construction: Provide pocket for concealment of accordion folding fire door when open; comply with door manufacturer's instructions and recommendations to ensure pocket and soffit are built to the dimensions specified, plumb and level.
- C. Pocket Door: Maintain full pocket clear width when pocket door is open.
- D. Striker Recess: mount 16-gauge steel striker in wall recess deep enough to prevent striker from protruding beyond face of wall; construct recess to maintain fire rating of wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that adjacent construction is suitable for installation of door.
- B. Verify that electrical utilities have been installed and are accessible.
- C. Verify that door opening is plumb and header is level and of correct dimensions.
- D. Notify Architect of any unacceptable conditions or varying dimensions.

3.2 INSTALLATION

- 1. Install fire doors in accordance with manufacturer's instructions, shop drawings, and NFPA 80.
- 2. Install fire doors plumb and level.
- 3. Installation shall be performed by factory trained and certified installers with a minimum of three years' experience installing electrically operated accordion folding fire doors.

3.3 ADJUSTING

- 1. Adjust door installation to provide uniform clearances and smooth, quiet, non-binding operation.
- 2. Test that all operations are functional and meet the requirements of local codes.

3.4 PROTECTION AND CLEANING

- 1. Protect installed work from damage.
- 2. Clean surfaces using manufacturer's recommended means and methods.
 - a. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

END OF SECTION 08 35 13.23

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings..

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence 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 fewer than 10 seconds.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems 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 8.00 lbf/sq. ft. (300 Pa).
- H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) when tested according to AAMA 1503.
- K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems 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.
- L. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- 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 aluminum-framed systems, made from 12-inch(300-mm) lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- G. Other Action Submittals:
1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- H. Delegated-Design Submittal: For aluminum-framed 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.
1. Detail fabrication and assembly of aluminum-framed systems.
 2. Include design calculations.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Preconstruction Test Reports: For sealant.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- C. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. 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. 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 revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.
 - 1. Test a minimum five samples each of metal, glazing, and other material.
 - 2. Prepare samples using techniques and primers required for installed systems.
 - 3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.
- F. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 and 2010 Florida Accessibility Code.

- G. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- H. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.
- I. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.
- J. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
- K. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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 caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.
 - f. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Trifab VG 451T Front Plane Thermally Broken Aluminum-Framed Storefront" (Florida Product Approval Number – FL10008-R2) by Kawneer North America, an Alcoa company or comparable product by one of the following:
 - 1. Arch Aluminum & Glass Co., Inc.
 - 2. EFCO Corporation.
 - 3. Tubelite.
 - 4. YKK AP America Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. 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.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Structurally glazed.
 - 2. Glazing System: Retained by structural sealant at vertical edges and mechanically with gaskets at horizontal edges.
 - 3. Glazing Plane: Front.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. 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.
- D. 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.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
 - 1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 08 80 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
 - 1. Structural Sealant: ASTM C 1184, single-component neutral-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 a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 - a. Sealants used inside the weatherproofing system shall have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Color: Matching structural sealant.
 - 3. Sealant used inside the weatherproofing 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" and additional requirements found in Section 01 81 13.14 "Sustainable Design Requirements – LEED v4 BD+C".
 - a. Health Product Declaration: Provide Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
 - b. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1) Product specific declarations in accordance with ISO 1404
 - 2) Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3) Industry Wide Product Specific Type III EPD Third Party Certification

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation with Florida Product Approval.

1. Door Construction: 1-3/4-inch(44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches(255 mm) above floor or ground plane.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Section 08 71 00 "Door Hardware."

2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 92 00 "Joint Sealants."
1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil(0.762-mm) thickness per coat.
1. Shop applied only.

2.7 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. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

- F. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-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.
 - 1. Color and Gloss: Match Architect's sample.

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:
 - 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.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Section 08 80 00 "Glazing."
 1. Structural-Sealant Glazing:
 - 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.
 - b. 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.
- 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.
- H. Install perimeter joint sealants as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements. Testing shall be performed prior to installation of interior finishes.
1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
 - a. Destructive Test Method A, "Hand Pull Tab (Destructive)," in ASTM C 1401, Appendix X2, shall be used.
 - 1) A minimum of four areas on each building face shall be tested.
 - 2) Repair installation areas damaged by testing.
 2. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C 1401.
 3. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
 4. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. (200 Pa), and shall not evidence water penetration.
 5. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet(23 m) by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 2. Provide field inspection reports within 5 working days of inspection.
- D. Repair or remove work if test results and inspections 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.
- F. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches(75 mm) from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

SECTION 08 41 20 - STRUCTURAL GLASS FIN WALL

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes: Glass, glazing and connections for interior structural point supported glass wall in accordance with the Contract Documents.
- B. Related Sections:
 - 1. Section 07 92 00 "Joint Sealants" – Sealants for glazing
 - 2. Section 08 80 00 "Glazing" - Glass and Glazing
 - 3. Section 05 12 00 "Structural Steel Framing" – Steel Supports
 - 4. Section 05 50 00 "Metal Fabrications" – Steel connections

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Glass, glazing, system design, and accessories shall be provided by single manufacturer.
- B. Single Source Installation: Provide installation by installer acceptable to the system manufacturer.
 - 1. The installer shall supply and erect the complete structural glazing system, coordinate and maintain tolerances between structure and glazing system with individual suppliers and manufacturers, and install glazing system.
- C. Where safety glass is indicated or required by authorities having jurisdiction, provide type of products which comply with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201 for category II materials.
- D. Pre-Installation Meeting: Meet at the project site with the representatives of the glass and glazing materials manufacturers, architectural exposed structural steel fabricator and erector, sealant manufacturer, the glazing installer, Architect's representative and Owner's representative. Review the glazing procedure and schedule, including the method of delivering and handling glass, and installing glazing materials. The chemical compatibility of all glazing materials and framing sealants with each other and with like materials used in glass fabrication shall be established.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Structural Performance: Structural glass fin wall shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

- a. Lateral Loads:
 - 1) Uniform load of 50 lbf/ ft. applied horizontally.
 - 2) Concentrated load of 200 lbf applied horizontally.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - 4) Safety Glazing Impact load: Glazing shall comply with CPSC 16 CFR 1201 criteria for Category II.
- b. Deflection Limits: Deflection normal to glazing plane is limited to 1/360.
- c. Delegated Design: Design structural glass fin walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- 2. Structural Glass Fin Wall System.
 - a. Integral fittings shall be provided. Exterior fittings and plates are not permitted.
- 3. Spring plate members shall prevent high stress concentration at the hole positions and must accommodate:
 - a. Negative and positive wind loading
 - b. Seismic loads
 - c. Thermal movement
 - d. Construction tolerances
 - e. Live load and dead load movements
- 4. Movement diaphragms of stainless steel and durable flexible discs must be incorporated in connections to accommodate oversize holes in spring plate members which allow for thermal movement and glass manufacturing tolerances.
- 5. The system shall provide unitized pre-fixing of all items to glass prior to erection.

1.5 SUBMITTALS

- A. Product Data: Material description and installation instructions for tapes, compounds, gaskets and other materials.
- B. Shop Drawings: Shop drawings shall clearly indicate materials and methods, indicate coordination with other trades.
- C. Coordination Drawings: Clearly indicate locations and sizes of steel plates and shapes necessary for installation.
- D. Samples:
 - 1. Submit sample of glass and glazing materials required for the Project. Samples of glass shall be 12" x 12", samples of sealant or gasket shall be 12" long.
 - 2. Submit sample of spring plate complete with glass, bolt and accessories.
- E. Delegated-Design Submittal: For all-glass 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.
 - 1. Detail fabrication and assembly of all-glass systems.
- F. Test Reports: Submit test reports from an independent laboratory in the United States certifying that the fully suspended structural glazing system proposed for use

has been tested. The system tested must be similar in type of materials including face glass and glass fins and design indicated, utilizing integral bolted attachments into the glass.

- G. Letter signed by the glass manufacturer clearly stating the glass and fittings to be used on the project are part of the manufacturer's system and are acceptable to the manufacturer and that they have reviewed the contract documents and will issue a project specific 12-year warranty including the entire system. Letters signed by the subcontractor for this section are not acceptable. System, including fittings and glazing, must be manufactured from one source.

1.6 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of the structural glass fin wall systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty shall cover design integrity, weatherability and durability of the structural glass fin wall.
 - 2. Partial multiple warranties of various project elements are not allowed. Warranty must include all aspects of the system including engineering, glass and fittings.
 - 3. Warranty Period: 12 years.
- B. **Installer Warranty:** Installer's standard form in which the installer agrees to replace or repair components of the structural glass fin wall system that do not comply with the requirements or that fail in workmanship within the specified warranty period.
 - 1. Warranty Period: 5 years.
- C. The Warranties submitted under this Section shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and the laws of governing jurisdictions and is in addition to and runs concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLASS FIN WALL SYSTEM

- A. **Basis of Design Product:** Subject to compliance with requirements, provide Pilkington; PLANAR system or a comparable product by one of the following:
 - 1. C.R. Laurence Company Co., Inc.
 - 2. J.E. Berkowitz
 - 3. Oldcastle Glass, Inc.

2.2 MATERIALS

- A. **Laminated Integral Bolt Structural Glass:**
 - 1. All glass must be fully tempered and heat soaked.
 - 2. Laminated Glass (SLG1):
 - a. Outer Leaf: Pilkington Optiwhite fully tempered and heat soaked glass.
 - 1) Thickness: 6 mm

- b. Inner Layer: DuPont Sentryglas
 - 1) Thickness: 1.52mm
 - c. Inner Leaf: Pilkington Optiwhite, tempered and heat soaked glass.
 - 1) Thickness: 10 mm.
 - 3. Glass must be certified to be tempered to a minimum compressive strength of 16,000 PSI.
 - 4. All glass must be horizontally tempered eliminating tong marks.
 - 5. All tempered glass must be heat soak tested to convert nickel sulfide inclusions from the alpha phase to the beta phase so that the glass will fracture in the test. Heat soak must comply with the European Din standard.
 - 6. All edges will be ground flat with a frosted appearance unless otherwise noted.
 - 7. All edgework, holes and notches in the tempered glass panels will be completed before tempering and shall comply with the requirements of Pilkington Architectural as stated below:
 - a. Dimensional tolerance on panel size will be ± 1 mm of the theoretical dimension required.
 - b. Squareness of each panel will be within 3 mm.
 - c. Bow allowance is 0.1%.
 - d. The positional tolerances on all holes will be ± 1 mm from a single datum point.
 - 8. Flatness of glass: Average rollerwave distortion must be certified not to exceed an average of 0.0008 inches when measured from peak to valley. A site inspection for roller wave and bow tolerances should be from a minimum distance of 3 meters.
 - 9. All glass must be manufactured in a factory where the quality control procedures are created under the terms of ISO 9000 and are independently monitored.
 - 10. Prestress glass around holes to a level which is compatible with the design and use of the fittings. Check by differential surface refractometer on stress level.
- B. Fittings:
- 1. Integral fittings shall be manufactured from stainless steel Grade 316.
 - a. Basis of Design: Pilkington PLANAR Type 905 J.
 - b. Countersunk bolts or Rotoule fittings are not permitted.
 - c. 3. Finish: "As Machined".
 - 2. Spring plates shall provide a tolerance capability to accomodate the full range of movements shown below:
 - a. Thermal movements occurring as a result of differential coefficients of thermal expansion within the range specified. The components used within the system shall noiselessly withstand all thermal movements without any buckling, distortion, cracking, failure of joint seals or undue stress on the glass or fixing assemblies.
 - b. Deflection of edge beams due to loading applied after erection of the cladding to magnitude specified.
 - c. Maximum side sway of structure due to wind load to the magnitude specified or seismic movement to the degree specified.
 - d. Deflection due to self-weight of the structural glass fin wall system.
 - e. Inward and outward movements due to the design wind loads specified.
 - 3. Exterior plates, caps, disks or buttons are not allowed.

4. Bushings: Nylatron Polyamide.
5. Gaskets: Fully vulcanized fiber, neoprene or precured silicone.

C. Rail Fittings

1. Material: Stainless-steel-clad aluminum.
2. Height:
 - a. Top Rail: As indicated.
 - b. Bottom Rail: As indicated.
3. Profile: As indicated.
4. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.

2.3 MISCELLANEOUS MATERIALS

- A. Applied Decorative Film: Pressure sensitive vinyl film suitable for application to glass substrates.
1. Basis of Design Product: Provide 3M; Crystal Glass Finishes – Dusted (7725SE-314) or approved product meeting all requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces receiving the Work. Verify dimensions of in-place and subsequent construction. Follow FGMA recommendations for inspection procedures. Do not begin work until unsatisfactory conditions have been corrected. Installation of work shall constitute acceptance of the related construction.

3.2 INSTALLATION OF GLASS:

- A. Install in accordance with manufacturer requirements and shop drawings.
- B. Employ only experienced glaziers who have had previous experience with the materials and systems being installed. Use tools and equipment recommended by the glass manufacturer.
- C. Plate to plate joints of glass are sealed with silicone sealant. Joint dimensions shall be designed to be compatible with sealant properties and live load movement of the structure.
- D. Bolt Torque: Torque bolts as specified on shop drawings using calibrated tool. Lock torqued bolts into position to prevent back-off. Reset calibrations regularly to ensure accurate torquing.
- E. Maintain a minimum temperature of 40 degrees F. during glazing unless the manufacturer of the glazing material specifically agrees to application of this material at lower temperature. If job progresses or other conditions require glazing work when temperature is below 40 degrees F. (or below the minimum temperature recommended by the manufacturer), consult the manufacturer and establish the minimum provisions required to ensure satisfactory work.
- F. Clean glazing connectors receiving glazing materials of deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's

instructions for final wiping of surfaces immediately before application of primer and glazing sealants. Wipe metal surfaces with xylol or toluol.

- G. Inspect each unit of glass immediately before installation. Glass which has significant impact damage at edges, scratches or abrasion of faces, or any other evidence of damage shall not be installed.
- H. Sealants: Prime surfaces to receive glazing sealants where required, in accordance with manufacturer's recommendations, using recommended primers.
- I. Locate setting blocks, if required by the drawings, at the quarter points of sill, but no closer than 6 inches to corners of glass. Use blocks of proper sizes to support the glass in accordance with manufacturer's recommendations.
- J. Provide spacers to separate glass from spring plates.
- K. Set glass in a manner which produces greatest possible degree of uniformity in appearance. Face all glass, which has dissimilar faces, with matching faces in the same direction.
- L. Use masking tape or other suitable protection to limit coverage of glazing materials to the surfaces intended for sealants.
- M. Tool exposed surfaces of glazing materials.
- N. Clean excess sealant from glass and support members immediately after application, using solvents or cleaners recommended by manufacturers.

3.3 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Applied Decorative Film: Apply decorative film according to manufacturer's requirements.
 - 1. Locations: Provide decorative film as indicated in the Drawings.

3.4 CURING, PROTECTION, AND CLEANING

- A. Cure sealants in accordance with the manufacturer's instructions to attain maximum durability and adhesion to glass.
- B. Clean all surfaces after installation, leaving all in a clean and workmanlike manner.
 - 1. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 08 41 20

SECTION 08 41 26 - ALL-GLASS INTERIOR STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. All glass storefront glazing.
 - 2. Metal all glass storefront fittings.
- B. Related Sections:
 - 1. Division 05 Section "Structural Steel Framing" for steel support for all-glass systems.
 - 2. Division 08 Section "Glazing" for general glass requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: All-glass systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: All-glass systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1. Lateral Loads:
 - a. Uniform load of 50 lbf/ ft. applied horizontally.
 - b. Concentrated load of 200 lbf applied horizontally.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - d. Safety Glazing Impact load: Glazing shall comply with CPSC 16 CFR 1201 criteria for Category II.
 - 2. Deflection Limits: Deflection normal to glazing plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller.
- C. Delegated Design: Design all-glass systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".

1. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
- C. Shop Drawings: Show fabrication and installation details, including the following:
 1. Plans, elevations, and sections.
 2. Details of fittings and glazing, including isometric drawings of patch fittings.
 3. Door hardware locations, mounting heights, and installation requirements.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Finishes: 6-inch- long sections of patch fittings, accessory fittings, and other items.
 2. Glass: 6 inches square, showing exposed-edge finish.
- E. Fabrication Sample: For all-glass systems, made from 12-inch lengths of full-size components and showing details of the following:
 1. Joinery.
 2. Anchorage.
 3. Glazing.
- F. Delegated-Design Submittal: For all-glass 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.
 1. Detail fabrication and assembly of all-glass systems.
- G. Qualification Data: For qualified Installer and testing agency.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for all-glass systems.
- I. Field quality-control reports.
- J. Maintenance Data: For all-glass systems to include in maintenance manuals.
- K. Warranty: Sample of special warranty.

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. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Engineering Responsibility: Prepare data for all-glass systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Source Limitations: Obtain all-glass systems from single source from single manufacturer.
- E. Source Limitations for Glass: Obtain laminated glass from single source from single manufacturer for each glass type.

- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 1. Build mockup of typical 25-foot bay including supporting structure.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Designer specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with all-glass systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems 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 excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 years.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated- glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturers: Subject to compliance with requirements, provide C. R. Laurence all-glass storefront products or a comparable product by one of the following:
1. ACI Distribution; a division of Vitro America, Inc.
 2. Alpha Door & Rail, Inc.
 3. Arch Aluminum & Glass Co., Inc.
 4. Blumcraft of Pittsburgh.
 5. Oldcastle Glass, Inc.
 6. Pilkington
 7. Virginia Glass Products Corporation; a subsidiary of Virginia Mirror Company.
 8. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

2.2 GLASS AND GLAZING MATERIALS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
1. Glass Color: Ultra-Clear, Low Iron.
 2. Thickness: As required by structural loads, but not less than 12.0 mm.
- B. Laminated Glass (LG1): ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and an interlayer.
1. Kind: LT (laminated tempered).
 2. Glass Color: Ultra-Clear, Low Iron.
 3. High Strength Interlayer:
 - a. Basis of Design: DuPont™ SentryGlas® Plus, as manufactured by DuPont™ Building Innovations™; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 0Hwww.DuPont.com/safetyglass
 - b. Thickness: 0.060 inch
 - c. Color: Clear
 - d. Interlayer Physical Properties:
 - 1) Young's Modulus: 43 kpsi, when tested in accordance with ASTM D5026
 - 2) Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
 - 3) Elongation: 400%, when tested in accordance with ASTM D638
 - 4) Flex Modulus: 50 kpsi, when tested in accordance with D790.
 - 5) Heat Deflection Temperature at 0.46 MPa: 110 deg F, when tested in accordance with D648.
 4. Glass Plies: Thickness required by structural loads, but not less than 6.0 mm thick, each.
- C. Laminated Glass (LG2): ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and an interlayer.

1. Kind: LT (laminated tempered).
 2. Glass Color: Ultra-Clear, Low Iron.
 3. High Strength Interlayer:
 - a. Basis of Design: DuPont™ SentryGlas® Plus, as manufactured by DuPont™ Building Innovations™; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 0Hwww.DuPont.com/safetyglass
 - b. Thickness: 0.060 inch
 - c. Color: Match IG2. Refer to Section 09 00 01 "Finish Key" for additional requirements.
 - d. Interlayer Physical Properties:
 - 1) Young's Modulus: 43 kpsi, when tested in accordance with ASTM D5026
 - 2) Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
 - 3) Elongation: 400%, when tested in accordance with ASTM D638
 - 4) Flex Modulus: 50 kpsi, when tested in accordance with D790.
 - 5) Heat Deflection Temperature at 0.46 MPa: 110 deg F, when tested in accordance with D648.
 4. Glass Plies: Thickness required by structural loads, but not less than 6.0 mm thick, each.
- D. Back-Painted Glass (IG2)
1. Basis of Design: S.A. Bendheim, Ltd.; Back-Painted Glass or approved substitute.
 2. Description: Ultra-clear low-iron float glass.
 3. Color: Match P1 as indicated in Section 09 00 01" Finish Key".
 4. Thickness: Not less than 1/4 inch.
 5. Edge treatment: Flat polished.
- E. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.
- F. Glazing Gaskets: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.
- G. Low Emitting Adhesives and Sealants
1. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 2. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.

2.3 METAL FITTINGS

- A. Rail Fittings
1. Material: Stainless-steel-clad aluminum.
 2. Height:

- a. Top Rail: As indicated.
 - b. Bottom Rail: As indicated.
- 3. Profile: As indicated.
- 4. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
- B. Door Rail Systems: Provide door rail systems matching metal and finish of door fittings and rail fittings. Door rails shall allow for jamb adjustment in or out with standard hardware. System shall include, but not limited to, end caps, blocking, and preparation.
 - 1. Profile: Square
 - 2. Height: As indicated on drawings

2.4 PIVOT DOOR HARDWARE

- A. General: Provide heavy-duty hardware units as indicated, scheduled or required for operation of each type of door, including the following items of sizes, numbers and type recommended by the manufacturer for the type of service required. Provide metal and finish for exposed parts to match the finish of the door rails.
- B. Overhead Concealed Closer
 - 1. Basis of Design: Provide C.R. Laurence Co.; 9100 Series Medium Duty extended spindle Overhead Concealed Door Closers and 9200 Series Heavy-Duty extended spindle or comparable product meeting all requirements.
 - 2. Double acting to fit into 4-1/2" x 1-3/4" headers.
 - 3. Secure to the center hung arm in the top door rail.
 - 4. Provide top adjustable arm, bottom adjustable pivot and finished cover plate if required.
 - 5. Comply with manufacturer's recommendations for closer size, depending upon door size and anticipated frequency of use.
- C. Panic Handles
 - 1. Basis of Design: Provide C.R. Laurence Co.; PA100 or PA110
 - 2. Description: interior operating panic handle in combination with exterior fixed pull handles designated by letters. Panic mechanism shall be concealed within stainless steel tubing. Entrance from exterior by a keyed cylinder.

2.5 FABRICATION

- A. Factory assemble components and factory install hardware and fittings to greatest extent possible.

2.6 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

- A. Applied Decorative Film: Pressure sensitive vinyl film suitable for application to glass substrates.
 - 1. Basis of Design Product: Provide 3M; Crystal Glass Finishes – Dusted (7725SE-314) or approved product meeting all requirements.

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. Install all-glass systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Install joint sealants as specified in Division 07 Section "Joint Sealants".

END OF SECTION 08 41 26

SECTION 08 42 29.23 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes exterior and interior, sliding, power-operated automatic entrances.
- B. Related Requirements:
 - 1. Section 08 71 13 "Automatic Door Operators" for automatic door operators furnished separately from doors and frames.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. IBC: International Building Code.
- D. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- E. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

1.4 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, dimensions of individual components and profiles, and finishes for automatic entrances.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 - 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
- C. Shop Drawings: For automatic entrances.
 - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 - 2. 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.
 - 4. Indicate locations of activation and safety devices.
 - 5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
 - 1. Include Samples of hardware and accessories involving color or finish selection.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Delegated-Design Submittal: For automatic entrances.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and Certified Inspector.
- B. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.
- C. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.

- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a Certified Inspector.
 - 1. Maintenance Proximity: Not more than a 60-mile radius from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship 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 AUTOMATIC ENTRANCE ASSEMBLIES

- A. Source Limitations: Obtain sliding automatic entrances from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Power-Operated Door Standard: BHMA A156.10.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to provide structural design of Automatic Sliding Entrance systems including details, shop drawings, and calculations complying with performance criteria.
- B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Seismic Loads: As indicated on Drawings.
2. Wind Loads: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F.
- E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance-system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..
- F. Opening Force:
 1. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.
 2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.
- G. Entrapment-Prevention Force:
 1. Power-Operated Sliding Doors: Not more than 30 lbf required to prevent stopped door from closing.

2.3 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.
- B. Sliding Automatic Entrance:
 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. Biparting-Sliding Units:
 - 1) Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
 - 2) DORMA Automatics; Division of DORMA Group North America.
 - 3) Stanley Access Technologies, LLC; Division of Stanley Security Solutions.
 2. Configuration: Biparting-sliding doors with two sliding leaves and sidelites where indicated.
 - a. Traffic Pattern: Two way.
 - b. Emergency Breakaway Capability: Sliding leaves and sidelites.
 - c. Mounting: Between jambs.
 3. Operator Features:
 - a. Power opening and closing.
 - b. Drive System: Chain or belt.
 - c. Adjustable opening and closing speeds.
 - d. Adjustable hold-open time between zero and 30 seconds.
 - e. Obstruction recycle.

- f. On-off/hold-open switch to control electric power to operator, key operated.
- 4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
 - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
- 5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.
 - a. Configuration: No threshold across door opening and recessed guide-track system at sidelites.
- 6. Controls: Activation and safety devices according to BHMA standards.
 - a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
 - b. Safety Device: Presence sensor mounted to underside of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
 - c. Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening.
 - d. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.
- 7. Finish: Finish framing, door(s), and header with high-performance organic finish (two-coat fluoropolymer).
 - a. Color: As selected by Architect from full range of industry colors and color densities.

2.4 ENTRANCE COMPONENTS

- A. Framing Members: Extruded aluminum, minimum 0.125-inch-thick and reinforced as required to support imposed loads.
 - 1. Nominal Size: As indicated on Drawings.
 - 2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.
- B. Sidelite(s): 1-3/4-inch-deep sidelite(s) with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members matching door design.
- C. Headers: Fabricated from minimum 0.125-inch-thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - 1. Mounting: Concealed, with one side of header flush with framing.
 - 2. Capacity: Capable of supporting doors up to 175 lb per leaf over spans up to 14 feet without intermediate supports.
 - a. Provide sag rods for spans exceeding 14 feet.

- D. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Signage: As required by cited BHMA standard.
 - 1. Application Process: Silk-screened.
 - 2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221.
 - 2. Sheet: ASTM B 209.
- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
- C. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- E. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.
- F. Glazing: As specified in Section 08 80 00 "Glazing."
- G. Sealants and Joint Fillers: As specified in Section 07 92 00 "Joint Sealants."
- H. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; containing no gypsum, of consistency suitable for application.
- I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
 - 1. Apply in shop.
- J. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.

2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.
 1. Provide capability for switching between bidirectional and unidirectional detection.
 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.
- G. Door Position Sensors: Where required by the Access Control System, equip each operable panel, including breakaway sidelights, with high security surface mounted magnetic contacts.
 1. Basis of Design Product: Provide Interlogix; 2707AD-L high security contacts with armored cable.

2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
- B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.
- C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch-long throw bolt; BHMA A156.5, Grade 1.
 1. Cylinders: As specified in Section 08 71 00 "Door Hardware."
 - a. Keying: Integrate into building master key system.

2.8 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 1. Form aluminum shapes before finishing.

2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing, fabricated from stainless steel.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 3. Form profiles that are sharp, straight, and free of defects or deformations.
 4. Provide components with concealed fasteners and anchor and connection devices.
 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
 6. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
 7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 8. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors.
- G. Controls:
1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
 - a. Top Beam: 48 inches.
 - b. Bottom Beam: 24 inches.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 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 conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 2. Where aluminum will contact dissimilar metals, protect against galvanic action by shop-painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 3. Where aluminum will contact concrete or masonry, protect against corrosion by shop-painting contact surfaces with bituminous coating.

- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 4. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel.
- E. Glazing: Install glazing as specified in Section 08 80 00 "Glazing."
- F. Sealants: Comply with requirements specified in Section 07 92 00 "Joint Sealants" to provide weathertight installation.
 - 1. Set bottom-guide-track system, framing members and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- G. Signage: Apply signage on both sides of each door as required by cited BHMA standard for direction of pedestrian travel.
- H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Automatic entrances will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in Section 08 80 00 "Glazing" for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 08 42 29.23

SECTION 08 44 13 - GLAZED CURTAIN WALLS

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 including sustainability requirements, apply to this Section.

1.2 SUMMARY

- A. Provide labor, materials, equipment and related items for work of this Section. Provide listed items, and those not specifically mentioned but necessary for a complete installation.
 - 1. Extruded aluminum frames for exterior curtain walls, punched windows and skylights.
 - 2. Extruded aluminum interior trim for curtain walls and punched windows.
 - 3. Glass and glazing for systems provided under this Section.
 - 4. Aluminum sheet panels and parapet caps.
 - 5. Anchorage to building structure, including bracing of primary building structure if required for support of forces applied by work of this Section, and patching of fireproofing at anchors.
 - 6. Sealants within work of this Section and at boundaries with work of other sections.
 - 7. Thermal insulation at spandrel glass and other opaque materials within work of this Section.
 - 8. Safing insulation and smoke seal at floor and roof edges, at work within this Section.
 - 9. NFRC certification of all transparent glazing systems supplied under this Section.
 - 10. Preconstruction testing.
 - 11. Four performance mock-ups.
 - 12. Visual mock-ups.
 - 13. Source quality control testing.
 - 14. Field quality control testing.
 - 15. Florida Product Approval: systems specified in this Section, and specific products listed in this Section, are acceptable contingent on their having current Florida Product Approval, and their conformance to specified requirements.
- B. Coordinate with work of other sections.
 - 1. Section 01 25 00 Substitution Procedures.
 - 2. Section 01 43 39 Visual Mock-up Requirements.
 - 3. Section 01 74 19 LEED V4 Construction Waste Management and Disposal.
 - 4. Section 01 74 23 Final Cleaning.

5. Section 01 81 13.14 Sustainable Design Requirements – LEED V4 BD+C.
6. Section 07 95 13.16 Exterior Expansion Joint Cover Assemblies.
7. Section 07 42 13.23 Metal Composite Material Wall Panels.
8. Section 08 41 13 Aluminum-Framed Entrances and Storefronts.
9. Section 08 42 29.23 Sliding Automatic Entrances.
10. Section 08 71 13 Automatic Door Operators.
11. Section 08 80 00 Glazing.

1.3 REFERENCES

- A. Except as otherwise specified, comply with listed references. Where the building code incorporates a different edition of a reference, the building code governs.
- B. Aluminum Association
 1. Aluminum Design Manual 2010.
 2. Aluminum Standards and Data 2013.
- C. American Institute of Steel Construction (AISC): Specification for Structural Steel Buildings ANSI/AISC 360-10.
- D. American Iron and Steel Institute (AISI), S100-2007 North American Specification for the Design of Cold-Formed Steel Structural Members.
- E. American Society of Civil Engineers (ASCE)
 1. ANSI/ASCE 8-02 Specification for the Design of Cold-Formed Stainless Steel Structural Members.
 2. ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures.
- F. American Welding Society (AWS) D1.1/D1.1M-04 Structural Welding Code--Steel.
- G. American Concrete Institute (ACI) 318-11 Building Code Requirements for Structural Concrete.
- H. American National Standards Institute (ANSI) Z97.1-2009 Safety Glazing Material Used in Buildings-Safety Performance Specifications and Methods of Test.
- I. Glass Association of North America (GANA) Glazing Manual 2008.
- J. United States General Services Administration TT-P-645B 1990 Primer, Paint, Zinc-Molybdate, Alkyd Type.
- K. American Architectural Manufacturers Association (AAMA)
 1. AAMA 501.1-05 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
 2. AAMA 2603-15 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2605-13 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 4. AAMA TIR A9-14 Metal Curtain Wall Fasteners.

L. ASTM International

1. A36/A36M-08 Standard Specification for Carbon Structural Steel.
2. A123/A123M-15 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. A500/A500M-13 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. A501/A501M-14 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
5. A653/A653M-08 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. B449-93(2015) Standard Specification for Chromates on Aluminum.
7. C509-00 Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
8. C794-01 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
9. C864-05 Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
10. C1036-01 Standard Specification for Flat Glass.
11. C1048-97b Standard Specification for Heat-Treated Glass--Kind HS, Kind FT Coated and Uncoated Glass.
12. C1087-00(2011) Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
13. C1115-00 Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
14. C1172-14 Standard Specification for Laminated Architectural Flat Glass.
15. C1248-08(2012) Test Method for Staining of Porous Substrate by Joint Sealants.
16. C1376-15 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
17. C1401-14 Standard Guide for Structural Sealant Glazing.
18. C1521-13 Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
19. D2244-15a Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
20. D4214-07(2015) Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
21. E283-04 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
22. E330-02 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

23. E331-00(2009) Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 24. E783-02(2010) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 25. E1105-15 Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
 26. E1300-04e1 Standard Practice for Determining Load Resistance of Glass in Buildings.
 27. E2188-10 Standard Test Method for Insulating Glass Unit Performance.
 28. E2189-10e1 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 29. E2190-10 Standard Specification for Insulating Glass Unit Performance and Evaluation.
 30. E2203-02 Standard Specification for Dense Thermoplastic Elastomers Used for Compression Seals, Gaskets, Setting Blocks, Spacers and Accessories.
- M. International Firestop Council: Recommended IFC Guidelines for Evaluating Firestop Systems Engineering Judgments (EJ's), February 2007.
- N. Insulating Glass Certification Council (IGCC) Certified Products Directory February 2016.
- O. National Fenestration Rating Council (NFRC)
1. ANSI/NFRC 100-2014 Procedure for Determining Fenestration Product U-Factors.
 2. ANSI/NFRC 200-2014 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- P. Comply with the referenced codes, or where required by this Section exceed the codes. Nothing in this Section shall be construed as allowing or requiring noncompliance with codes.
1. 2014 Florida Building Code.
 2. 2014 Florida Energy Conservation Code.
 3. 2016 Code of the City of Orlando, Florida, amendments to the 2014 Florida Building Code.

1.4 SYSTEM DESIGN AND PERFORMANCE

- A. Contract Documents define design intent and performance requirements. Details show preferred profiles. Provide final design.
- B. Unless otherwise defined by Contract Documents, appearance of exposed elements, including width and depth, shall be consistent throughout project.
- C. Unless otherwise defined by Contract Documents, overall thickness of each glass type, and component thicknesses of multiple layer glass types, shall be consistent throughout project.

- D. Provide anchor adjustment capability for full range of specified tolerances for building structure. Minimum required adjustment is 0.5 inch (12.7 mm) in all directions at connections to wind girts, and one inch (25.4 mm) in all directions at all other locations.
- E. Provide internal gutters and weep system to collect and drain water leakage and condensation to the exterior. Coordinate gutter and weep systems with other sections.
 - 1. Unitized curtain walls shall have continuous spliced gutters at horizontal stack joints, with sealed end caps at termination conditions. Provide two continuous lines of weatherstrips at entire perimeter of each unit, in the planes of the outboard and inboard boundaries of stack gutters.
 - 2. Stick built curtain walls and punched windows shall have an isolated gutter cavity at each glass perimeter, so that leakage is confined to and weeped from the opening of leakage origin.
 - 3. Curtain walls that have two-piece interlocking vertical mullions shall have continuous subsills at starter conditions that collect and drain water to the outdoor side.
 - 4. At skylights, provide internal gutters for control of water leakage. Provide continuous condensation gutters at glass perimeters. Condensation gutter intersections shall have sealed overlaps. Gutters shall convey water leakage and condensation to lowest point and drain water to exterior.
- F. Glazing details shall permit glass replacement after initial construction, shall permit reuse of original gaskets, shall permit replacement glass of same nominal size as original glass, and shall not require cutting of framing members or removal of interior finishes. Vision glass in conventional frames shall be replaceable from interior. Spandrel glass shall be replaceable from exterior. Silicone supported vision glass shall be replaceable from exterior and/or interior.
- G. Requirements of this Section apply equally to performance mock-ups, test specimens, and actual building. Variations in criteria over the surface of building, such as wind pressure, are taken into account in testing requirements. Test parameters and pass/fail criteria required for specific test conditions of mock-ups and specimens also apply to the actual building, without reduction or adjustment, for specified conditions and for equivalent conditions of equal or lesser severity.

1.5 MOVEMENTS

- A. Net joint size is nominal joint size plus and minus fabrication tolerance and field tolerance. Assumed combined fabrication and field tolerance for joint design shall not be less than 0.1875 inch (4.8 mm). Provide movement joints with net sizes that allow for specified movements due to temperature change, story drift, and building structure live load deflection without exceeding movement capacities of joints or materials that seal them. Design for full values of all movements occurring simultaneously. No reductions shall be applied to individual movements or to combinations of movements.
- B. Joint Movement Capacities

1. Sealant capacity in tension and compression shall be values published by the manufacturer, but not more than 50 percent of net joint size. Sealant capacity in shear shall be the value published by the manufacturer, but not more than 100 percent of net joint size.
 2. A stack is a horizontal composed of interlocking frames. Stack closing capacity is the amount of movement relative to net joint size that would cause the frames to be in contact.
 3. Stack opening capacity is maximum amount of movement relative to net joint size that maintains weather seals and structural integrity. Opening capacity shall be based on at least 0.375 inch (9.5 mm) overlap of metal parts after movement has occurred.
 4. Where movements reduce joint size, movement capacity is (a) sealant capacity, (b) stack closing capacity or (c) the smaller value if both are applicable.
 5. Where movements increase joint size, movement capacity is (a) sealant capacity, (b) stack opening capacity, or (c) the smaller value if both are applicable.
 6. Where movements affect glass bite and edge clearance, bite shall not be less than 0.375 inch (9.5 mm) and edge clearance shall not be less than 0.25 inch (6.4 mm) after movement has occurred. Requirements for nominal bite are in Part 3 of this Section.
- C. Thermal component of joint movement shall be based on minimum material temperature increase of 100 Fahrenheit degrees (55.6 Centigrade degrees) and decrease of 70 Fahrenheit degrees (38.9 Centigrade degrees) relative to nominal condition. Assume entire cross section of framing member has uniform temperature. Assume temperature of supporting structure does not change.
- D. Story Drift
1. Design story drift is $H/400$ for airside and landside.
 2. At the GTF pedestrian bridge, north/south drift between pedestrian bridge level and roof is 0.7 inch. East/west drift is negligible.
 3. At the GTF within grids T5 to T8 and N1 to N4, drift between pedestrian bridge level and roof is 0.5 inch.
 4. Cladding shall be designed for floor-to-floor relative displacement in any direction equal to story drift, except for GTF pedestrian bridge where drift is north/south only.
 5. At any floor, design story drift shall be assumed to occur while floors immediately above and below are not displaced. For design story drift, glass shall not crack. Glass or other materials shall not fall to the indoor or outdoor side. There shall be no failure of, or damage to, framing members, anchors or non-glass infill materials. No structural component, trim component, or elastomeric gasket shall disengage, partially or completely. Weather sealants and structural sealants shall not fail adhesively or cohesively.
- E. Structure Vertical Deflection

1. At airside and landside clerestories below the Boulevard skylight, design curtain wall top connection for 2.0 inches up and down structure movement. At the base of clerestory curtain walls, structure movement is 0.5 inch up and down, except 1.25 inch up and down between grid lines L13 and L15.
2. Airside design differential structure vertical deflection between successive floors, and between floor and roof, is $L/360$, not to exceed 0.5 inch.
3. Landside Structure Vertical Deflection
 - a. At north and south elevations between grids L11 and L12, and between grids L16 and L17, design differential structure vertical deflection between successive floors is 0.5 inch. Design top connection at roof for 1.5 inch up and down structure movement.
 - b. For punched windows at north and south elevations, support weight of windows on steel stud frames, not on beams or floor edges. Design vertical movement of steel stud frames is 3.0 inches downward relative to floor edges. Design vertical movement of steel stud frames is 2.0 inches downward and 3.0 inches upward relative to roof edges.
 - c. At the east elevation along grid 17, design differential structure vertical deflection is 0.5 inch. Design top connection at roof for 1.5 inch up and down structure movement.
 - d. At curtain walls that are parallel to grids N1 and S1, between grids L17 and L18, design differential structure vertical deflection between successive floors is 0.5 inch. Design top connection at Boulevard skylight for 2.0 inches up and down structure movement.
 - e. At the sloping Prow curtain wall, design differential structure vertical deflection between successive floors is 0.5 inch. Design top connection at Boulevard skylight for 2.0 inches up and down structure movement.
 - f. At landside west elevation between grids N1 and S1, design differential structure vertical deflection is 0.5 inch. Design top connection at Boulevard skylight for 2.0 inches up and down structure movement.
 - g. At vestibule curtain walls, design differential structure vertical deflection is zero.
4. GTF Structure Vertical Deflection
 - a. Live load deflection of pedestrian bridge level beams at grids N1 and S1 is 0.4 inch.
 - b. Live load deflection of pedestrian bridge roof beams at grids N1 and S1 is 0.5 inch.
 - c. Live load deflection of floor and roof edges at west elevation along grid T5, between grids N1 and N4, is 0.4 inch.
5. Deflection at a given floor or roof shall be assumed to occur while floors immediately above and/or below do not deflect.
6. Cladding shall be designed so that movement due to structure vertical deflection, plus curtain wall thermal movement and tolerances, does not exceed joint movement capacities defined in this Section.

F. Wind Girt Deflections

1. At steel stud frames, wind girt deflection is L/360 inward and outward for design wind pressures.
2. At curtain walls, wind girt deflection is L/240 inward and outward for design wind pressures.
3. Wind girt vertical deflection is 1.0 inch up and down.

1.6 THERMAL PERFORMANCE

A. Winter Design Conditions: For conditions listed below, condensation formation on indoor surfaces (including surfaces covered by insulation) is acceptable only if resulting water would be contained and drained to exterior without wetting insulation, and without wetting indoor surfaces visible to building occupants.

1. Night
2. Outdoor air temperature: 32 °F (0.0 °C).
3. Wind speed 12.3 mph (5.5 m/s).
4. Indoor air temperature: 70 °F (21.1 °C).
5. Indoor relative humidity: 60 percent (50 percent nominal plus 10 percent tolerance).

B. U-Values

1. Overall U-factors for walls based on an area-weighted analysis shall not exceed values in the Energy Model Report for transparent and opaque areas.
2. Overall U-factors for skylights based on an area-weighted analysis shall not exceed values in the Energy Model Report.
3. Determine U-factors with THERM software for winter design conditions specified in this Section. Use glass and metal areas that apply to this project, not the model sizes of NFRC 100. U-factors determined in this way will not match the values determined for NFRC certification.

C. Solar Heat Gain Coefficients shall not exceed values in the Energy Model Report for walls and skylights.

D. Surface Temperature and U-factor Determination by Analysis

1. Submit surface temperature and dew point analysis performed with THERM software, showing compliance with specified thermal performance. Analytical models shall include adjacent materials, including metal and concrete, regardless of whether those materials are included in this Section. Exterior film coefficient shall be 4.579 Btu/h ft² F, and the radiation model shall be set to Black Body Radiation. Interior film coefficient (convection only) shall be 0.579 Btu/h ft² F, and the radiation model shall be set to Automatic Enclosure Model. For sloped glazing, comply with instructions for skylights in the THERM NFRC Simulation Manual. Identify temperatures for all surfaces, not just surfaces exposed to view. Analyze all details, by direct analysis or by comparison to representative details for which analysis is submitted. Required data includes:
 - a. Identification of dew point temperature for specified indoor air temperature and indoor relative humidity.

- b. Color infrared plot with color legend.
 - c. Isothermal plot with maximum temperature set at dew point.
 - d. Locations of, and values for, coldest indoor surface temperatures at glass, metal, gaskets, sealants.
 - e. Tabulation identifying solid materials, conductivities and emissivities.
 - f. Tabulation identifying cavity dimensions, temperatures and emissivities.
 - g. Tabulation identifying boundary condition temperatures and film coefficients.
 - h. Tabulation of all shop drawing details, listing each detail that is analyzed correlated with other details whose performance is implied by comparison to the analyzed detail.
 - i. Computation of overall U-factors based on area-weighted averages of THERM U-factor results.
- E. Outdoor Surface Temperatures: For a surface temperature range of 32 °F (0.0 °C) to 160 °F (71 °C), there shall be no failure as defined under "WARRANTY" in this Section.

1.7 NFRC CERTIFICATION

- A. Obtain NFRC Certification for transparent areas of all glazed systems supplied under this Section, using the "certified product" option or the "certified project" option.
- B. Certification shall include ratings for U-factor, Solar Heat Gain Coefficient, and Visible Transmittance.
- C. Certification shall include ratings for Air Leakage and Condensation Resistance.
- D. Submit Certification Label Certificate for each certified system.

1.8 AIR AND WATER LEAKAGE

- A. Air leakage test shall conform to ASTM E283 (laboratory) and ASTM E783 (field), modified to include measurement of exfiltration. Differential static test pressure shall be 6.24 PSF (299 Pa). Air infiltration and exfiltration of fixed wall area shall not exceed 0.06 CFM/ft² (1.10 m³/hr-m²) of projected exterior surface.
- B. Water Leakage
 - 1. Condensation is acceptable during water leakage tests. Water leakage is acceptable only if all of the following conditions are satisfied: (a) water is contained and drained to exterior; (b) there is no wetting of a surface that would be visible to building occupants; (c) there would be no staining or other damage to completed building or its furnishings. This definition of water leakage governs over other definitions in referenced documents.
 - 2. Static water leakage test shall conform to ASTM E331 (laboratory) and ASTM E1105 Procedure A (field). Differential test pressure shall be 12 PSF (574 Pa). There shall be no unacceptable water leakage as defined in this Section.
 - 3. Dynamic water leakage test shall conform to AAMA 501.1 except as otherwise specified in this Section. Differential test pressure shall be 12 PSF (574 Pa). There shall be no unacceptable water leakage as defined in this Section.

4. Completed portions of the building are required to pass chamber tests and hose tests as specified in Part 3 of this Section. There shall be no unacceptable leakage as defined in this Section.

1.9 LOADS

A. Wind Pressures

1. Cladding design wind pressures as determined by wind tunnel tests are shown on Drawings. Except as specified in this Section, these pressures shall not be reduced for any reason.
2. For surfaces not addressed by wind tunnel study, wind pressures shall be to ASCE/SEI 7-10, Chapter 30, Part 3: Buildings With $h > 60$ ft. using the data below, but not less than values required by Structural Drawings.
 - a. Basic wind speed: 150 mph (67.0 m/sec).
 - b. Risk category: III.
 - c. Exposure category: C.
 - d. Directionality factor: 1.0.
 - e. Internal pressure coefficient: plus and minus 0.18.
 - f. Width of Landside wall zone 5: to Code, but not less than 60 feet.
 - g. Width of Airside wall zone 5: to Code, but not less than 12 feet.
 - h. Width of GTF wall zone 5: to Code, but not less than 8 feet.
 - i. Width of roof zones 2 and 3 at skylights: to Code, but not less than 8 feet.
 - j. Landside building height to Code, but not less than: areas 1 to 4 and 9 to 12, 105 feet; areas 5 to 8, 125 feet.
 - k. Airside building height to Code, but not less than: areas 14 to 17, 24 and 25, 115 feet; areas 13, 18 to 23, and 26 to 33, 72 feet.
 - l. GTF building height to Code, but not less than 75 feet.
3. Lateral wind pressures on vertical fins and fork extrusions are shown in the wind tunnel report. Pressures on fins and fork extrusions occur simultaneously with pressures on adjacent wall surfaces. Do not reduce simultaneous pressures.
4. Design wind pressures for computation of deflections are 1.0 times ASD pressures. Except as specified in this Section, do not reduce pressures for computation of deflections for any reason, even if such a reduction is permitted by code.
5. Wind pressures act perpendicular to flat surfaces, regardless of surface orientation. Wind pressures act perpendicular to tangents of curved surfaces.
6. For framing at corners and at other edges formed by intersecting planes that supports load from both faces, design for three cases.
 - a. Apply 85 percent of outward pressures at both faces simultaneously.
 - b. Apply 95 percent of inward pressures at both faces simultaneously.

- c. Apply 75 percent of outward pressure (and separately inward pressure) on one face simultaneously with 75 percent of inward pressure (and separately outward pressure) on the other face.
 - d. These reductions do not apply to glass, and do not apply to near-edge framing that supports load only from one face.
- 7. Air-permeable cladding has an outer surface with unsealed joints, open joints or openings that permit air flow, and an inner surface that is sealed against air flow. Both surfaces shall be designed for full design wind pressures.
- B. Seismic Loads: Design of cladding for seismic loads is not required.
- C. Concentrated Load: 200 pounds on skylight frames.
- D. System shall be designed to support its own weight in combination with other specified pressures and loads.
- E. Load combinations shall comply with the more stringent of code and ASCE/SEI 7.

1.10 STRUCTURAL CRITERIA

- A. At pressures and loads from zero to 150 percent of design values:
 - 1. Framing member residual deflection after pressure or load is removed shall not exceed 1/1000 times distance between supports or 2/1000 times cantilever length.
 - 2. At anchors, framing member deflection relative to building structure shall not exceed 0.187 inch (4.7 mm), nor 0.125 inch (3.2 mm) after pressure or load is removed.
 - 3. Upon reversal of pressure or load direction, relative movement between two components that are fastened or clamped together shall not exceed 0.187 inch (4.7 mm).
 - 4. There shall be no disengagement, failure or gross permanent distortion of any component, including glass and gaskets.
- B. At 50 percent of design pressures, glass maximum deflection relative to supported glass edges shall not exceed one inch (25.4 mm).
- C. At 100 percent of design pressures and loads:
 - 1. Net deflection perpendicular to enclosure surface for framing members shall not exceed: within one glass opening, 1/175 times length of glass edge, not to exceed 0.75 inch (19mm); 1/175 times distance between supports for spans less than 162 inches (4115 mm); 1/240 times distance between supports plus 0.25 inch (6.35 mm) for spans exceeding 162 inches; 2/175 times cantilever length, not to exceed 0.375 inch (9.5 mm).
 - 2. Net deflection of framing members parallel to enclosure surface shall not exceed smaller of: 0.125 inch (3.2 mm) due to dead load; 1/360 times distance between supports, not to exceed 0.375 inch (9.5 mm) for wind and seismic load (includes vertical members at corners).
 - 3. Net deflection parallel and perpendicular to enclosure surface for framing members at perimeter sealant joints shall not exceed smallest of: values

specified above; 50 percent of nominal joint width, regardless of whether sealant is in tension, compression or shear; movement capacity of sealant.

4. Maximum deflection of a metal panel, with or without stiffeners, shall not exceed 0.01 times the shorter panel dimension.
5. Interior window sill trim shall not deflect more than 0.125 inch (3.2 mm) when subjected to a concentrated force of 25 pounds (111 N) at any point. Residual deflection after force is removed shall not exceed 0.062 inch (1.6 mm).

1.11 STRUCTURAL DESIGN METHOD

- A. Except as otherwise specified, allowable stress design (ASD) and load and resistance factor design (LRFD) are acceptable.
- B. For allowable stress design, allowable stress shall not be increased by 1/3 or any other value for individual loads or load combinations, regardless of whether such an increase is permitted by code or other references.
- C. Allowable stress design (ASD) shall be used for structural silicone.

1.12 COMPONENT DESIGN AND PERFORMANCE

- A. Framing Members
 1. Glass, sealants and interior finishes shall not be assumed to contribute to framing member strength, stiffness or lateral stability.
 2. Compression flanges of flexural members shall be assumed to receive effective lateral bracing only from (a) anchors to building structure and (b) intersecting members that restrain the compression flange against lateral movement or twisting. Points of contraflexure shall not be regarded as lateral braces or as end points of an unbraced length; unbraced length shall be the distance between effective lateral braces.
 3. Only true tubes shall be analyzed as tubes for determination of allowable stress (ASD) or factored limit state stress (LRFD). True tubes have a continuous boundary of solid metal (no joints) enclosing a hollow cavity.
 4. Flexural strength for lateral-torsional buckling of an individual open (non-tubular) shape, or two or more open shapes that are constrained between brace points to deflect and rotate together, may be determined by the Direct Strength Method using finite strip analysis with the material specifications in Part 1 of this Section. Determine critical stress with CUFSM software. For multiple shapes, determine moment and stress in each shape based on relative flexural stiffness of additive (not composite) sections. Determine separate critical stresses for front and back flanges in compression. Multiple open shapes that are not constrained to move together shall be designed as independent beams.
 5. Where a framing member reaction is resisted by a continuous element, maximum assumed effective length of resisting element shall be four times the bearing length, but not more than one foot (305 mm).
 6. Splice joints that permit movement shall be assumed to have zero moment capacity.
 7. Where a framing member runs continuously past a deflecting support, combined deflection of member and support shall not exceed specified limits.

8. Thermal breaks shall be assumed to have no ability to transfer shear stress for composite action of flexural members. Elements joined by a thermal break shall be assumed to act separately.
- B. Fasteners
 1. General Requirements
 - a. Tension shall be taken as sum of direct tension plus tension due to prying.
 - b. Allowable shear shall be reduced for a fastener with nominal diameter "d" that is not slip-critical, is loaded in shear (with or without tension), and passes through a shim stack or other filler with total thickness "t." For nominal diameter less than 0.25 inch, minimum reduction shall be zero percent for $t=d$, varying linearly to 100 percent for $t=2d$. For nominal diameter 0.25 inch or greater, minimum reduction shall be 15 percent for $t=0.25$, varying linearly to 100 percent for $t=2d$. Such reduction shall be in addition to other applicable reductions. An acceptable alternative method is to assume that shims provide no resistance to fastener bending, compute fastener bending stress with cross sectional properties based on root diameter, add bending stress to tension stress, and evaluate tension/shear interaction. Allowable stress for bending shall be the same as allowable stress for tension.
 - c. Unless otherwise specified, combined tension and shear shall be evaluated according to an interaction formula in which each term equals the square of actual force divided by the square of allowable force. Sum of terms shall not exceed 1.0.
 2. Steel Bolts and Screws
 - a. For allowable stress design, capacities of carbon steel and stainless steel bolts and screws shall be based on the more stringent of code and AAMA TIR-A9 Metal Curtain Wall Fasteners.
 - b. For stainless steel fasteners, design shall be based on yield stress of 30 ksi (207 N/mm²) and ultimate tensile stress of 75 ksi (517 N/mm²). Approval to use greater strength may be requested by submitting manufacturer's data sheets and certifications.
 3. Cast-in and Post-Installed Anchors in Concrete and Concrete Masonry Units
 - a. For evaluation of anchor capacity, comply with the most stringent of: ACI 318; ICC-ES Report; manufacturer design rules. It is acceptable to determine anchor capacity with software provided by the manufacturer. Assume cracked concrete.
 - b. Products that self-drill are not acceptable. Screws in plugs and powder actuated fasteners are not acceptable. Acceptable products that self-thread are identified in Part 2 of this Section.
 4. Aluminum fastener capacities shall comply with Aluminum Design Manual.
- C. Weatherproofing sealants shall not experience adhesive or cohesive failure. Sealants shall withstand movements up to the limits prescribed by manufacturers. Exposed sealant surface shall not crack or bubble. Sealant and primers shall not stain adjacent materials. Sealants shall be used only if manufacturers' adhesion, compatibility and

stain tests yield favorable results. Sealants shall not be placed against edge of laminated glass interlayer.

D. Structural Silicone

1. Wind pressure shall be supported in tension or shear, but not tension and shear simultaneously.
2. Stress in structural silicone due to dead load shall not exceed 1.0 psi (6.89 kPa).
3. Stress in structural silicone due to all loads shall not exceed 20 psi (0.138 MPa) at design pressures and loads. There shall be no load reduction for load combinations.
4. Structural silicone shall not be applied to edges of insulating glass or to edges of laminated glass.
5. A glass or panel unit shall not be attached by structural silicone on both sides of a movement joint.
6. Ultimate tensile strength of structural silicone and the substrates to which it adheres for static loading at 160 degrees F (71 degrees C) shall be at least 60 psi (0.414 MPa).
7. Where a mock-up is tested to 1.5 times design pressures and loads, structural silicone and related structural components shall not fail.
8. On the building, structural silicone shall not experience adhesive or cohesive failure.
9. If structural silicone products other than those specified are proposed, perform preconstruction testing as required by this Section.

E. Glass

1. Wind pressure shall be treated as short duration load, and gravity loads shall be treated as long duration load, as defined by ASTM E1300.
2. Probability of glass breakage upon first application of design pressures shall not exceed 8/1000 for vertical glass, and 1/1000 for sloped and horizontal glass. Glass strength shall comply with code and ASTM E1300.
3. Provide heat treated glass. Annealed glass is not acceptable.
4. Where insulating glass is supported by structural silicone, tensile stress at narrowest point of secondary seal shall not exceed 20 psi (0.138 MPa) at design pressure. If secondary seal products other than those specified are proposed, perform preconstruction testing as required in this Section. Glass lamination, coating and ceramic frit shall withstand specified design and test pressures without failure.
5. Glass provided for performance mock-ups shall be identical (including strength) to glass provided for corresponding zone on building. Mock-up glass is required to support up to 1.5 times design pressures without breakage. It is recognized that any one glass plate can break at any pressure. A limited amount of breakage of mock-up glass is acceptable, provided that replacement glass with the same nominal strength eventually passes all tests. If glass in a specific mock-up opening breaks twice during attempts to complete one test, or 3 times for any combination of tests, the mock-up fails, redesign of the framing and/or

glazing system is required, and testing must be repeated from the beginning of the test sequence.

6. Insulating glass shall be qualified to ASTM E2190.
 7. Insulating glass in vision and spandrel areas shall not experience fogging, wetting or staining within the sealed space, spacer corrosion, spacer migration, adhesive or cohesive failure of primary or secondary edge seal.
 8. Insulating glass shall not experience decrease in the air space dimension due to chemical reaction of desiccant with entrapped air.
 9. Glass lamination shall not delaminate, stain or discolor.
 10. Glass coating shall not crack, peel, stain or discolor.
 11. Glass shall not experience spontaneous breakage.
 12. Glass maximum deflection relative to supported edges at 50 percent of specified design pressures shall not exceed one inch. Glass deflection at 1.5 times design pressures shall be limited to prevent disengagement from frame.
 13. Spandrel glass opacifier shall not crack, peel, wrinkle, delaminate, stain or discolor.
- F. Snap-engaged components shall be secured against migration, and shall not serve any structural function, such as retention of glass or panels. Joints in continuous snap covers and other continuous trim shall have splice sleeves of same material and finish as cover or trim. Snap-engaged metal components shall not disengage when subjected to a concentrated force of 10 pounds (44.5 N) or during mock-up structural tests. Snap-engaged plastic components are not permitted, except as nonstructural thermal improvement for interior trim.
- G. Fins and Fork Extrusions: Fins and fork extrusions that project to the outdoor side of vertical mullions may have snap engagements, but must be fastened with screws to prevent vertical migration and disengagement. The attachments shall allow removal and reinstallation of the extrusions without causing damage.
- H. Skylights
1. Provide internal gutters for control of water leakage. Provide continuous condensation gutters at glass perimeters. Condensation gutter intersections shall have sealed overlaps. Gutters shall convey water leakage and condensation to lowest point and drain water to exterior.
 2. Provide continuous bearing of exterior glass retainers on rafters and cross bars.
 3. Provide continuous recessed pockets for wet seals at glass perimeters.
 4. Structural silicone shall adhere to glass indoor surface, not to glass edge.
- I. Thermal Breaks
1. Dead load of glass and panels shall not be carried through thermal breaks.
 2. Pour-and-debridge thermal breaks in sill or gutter shall be capped with sealant, including six inch (15.2 cm) vertical sealant return at jambs.
 3. Thermal breaks shall not split, crack or fracture. Thermal breaks shall not experience shrinkage or other deformation to the extent that frames are distorted or water leakage occurs. Extruded aluminum frames with integral

thermal breaks shall conform to specified tolerances for one-piece aluminum extrusions.

1.13 PRECONSTRUCTION TESTING

A. Structural Silicone and Insulating Glass Secondary Seal

1. If structural silicone products or insulating glass secondary seal products other than those specified are proposed, perform tensile tests. Provide test specimens and pay laboratory fees. Pay fees and expenses for one observer to witness tests. Prior to scheduling tests, submit technical data for proposed silicones and request approval to proceed with tests.
 - a. Specimens shall consist of a single line of silicone with dimensions 2.0x0.5x0.5 inch bonded to two glass rectangles. Proposed spacer material shall be in contact with one 2.0x0.5 inch surface. Fully cure specimens at room temperature. Immerse specimens in water for 7 days.
 - b. Test minimum of 3 specimens each at 75 +/- 5 degrees F (24 +/- 3 degrees C) and 160 +/- 5 degrees F (71 +/- 3 degrees C). Increase tensile stress in silicone to 60 psi (0.414 MPa) in one minute or less. Maintain 60 psi for minimum of one minute.
 - c. Specimens shall not experience adhesive or cohesive failure, partial or total. All specimens must pass.
 - d. Submit laboratory report for approval.

B. Adhesion, Compatibility and Stain Tests

1. Provide to sealant manufacturers samples of all substrates that are in contact with sealant, regardless of whether adhesion must be achieved.
2. For substrates that must support adhesion, submit for record sealant manufacturers' reports of adhesion tests conducted in accordance with ASTM C794. Report shall specifically acknowledge suitability for structural silicone application where applicable.
3. For substrates that are in contact with sealant, submit for record sealant manufacturers' reports of compatibility tests for sealants and primers conducted in accordance with ASTM C1087.
4. For concrete, masonry and other porous materials submit for record sealant manufacturers' reports of stain test performed in accordance with ASTM C1248.

C. Spandrel Shadow Box

1. Spandrel shadow box assembly shall demonstrate by test that appearance is not affected by formation of residue on indoor glass surface.
2. Construct two identical test specimens, each consisting of a full size spandrel glass unit in its aluminum frame, mounted in a test chamber with the same back-up materials intended for the building. Glass, glazing materials, aluminum finish, insulation, backup material, and backup finish shall be identical to production material, except that glass shall be uncoated. Store one specimen indoors; this is the control. Subject the second specimen to a cycled test.

3. Test shall consist of alternate heating and cooling. Mount thermocouples on center of outdoor glass surface, at center of air space midway between glass and backup, and on center of back-up surface. Heat source shall be infrared lamps mounted on a rack in a rectangular grid. With specimen and light rack standing vertically and parallel to each other, turn on lamps and adjust distance to specimen so that air space temperature stabilizes at 200 degrees F plus or minus 10 degrees F (93 degrees C plus or minus 6 degrees C). Maintain stabilized temperature for minimum one hour. Record thermocouple readings. Turn lamps off and allow specimen to cool until glass temperature is 80 degrees F (27 degrees C) or cooler. Record thermocouple readings. Turn lamps on and repeat for 300 cycles. Examine specimen at 50 cycle intervals and record any residue on indoor glass surface or change in outdoor appearance. At 100 cycle intervals, photograph specimen and control side by side, indoors with artificial light and outdoors with sunlight. After 300 cycles, remove specimens from chamber; record and photograph any residue on indoor glass surface or on aluminum frame.
4. The specimen passes only if there is no visible change in outdoor appearance and no residue forms on the indoor glass surface. If specimen fails, revise glass type and/or spandrel details and retest.

1.14 INFORMATIONAL SUBMITTALS: Provide the following submittals for information only. Promptly provide additional information and clarifications upon request.

- A. Provide scope drawings with bid packages. Quality and content of scope drawings shall be same as required for shop drawing submittals. Scope drawings shall include partial elevations, partial plans, wall sections, and details listed below.
 1. Curtain wall and punched window mullions at vision and spandrel, typical, inside corner, outside corner, and jamb.
 2. Curtain wall and punched window horizontals at vision and spandrel, starter sill, intermediate, head with movement joint and stack.
 3. Parapet cap.
 4. Curtain wall and punched window fixed and expansion anchors.
 5. Curtain wall vertical fins and fork extrusions.
 6. Single pitch and Boulevard skylights, GTF pedestrian bridge skylight: rafters, crossbars, ridge, valley, curbs, anchors.
- B. Prior to submitting documents for approval, submit itemized list of deviations from Contract Documents. Identify specification page and paragraph, or architectural drawing sheet, elevation, plan, section or detail for each item. If there are no deviations, provide written statement of full compliance with architectural drawings and specifications. Failure to provide an itemized list of deviations or statement of full compliance shall, at reviewers' discretion, be cause for return of submittals without review.
- C. Submit with structural calculations scale drawings of aluminum extrusions, with sufficient dimensions to permit verification of section properties.
- D. Submit with shop drawings scale drawings of gaskets and weatherstrips, with dimensions and identification of materials.

- E. Submit full size dimensioned drawing of insulating glass edge with identification of primary and secondary seals.
 - F. Submit sealant manufacturers' test reports confirming sealant adhesion, compatibility and absence of staining, and acceptability for structural silicone application, based on test specimens submitted for this project. Submit application and quality control procedures for sealants.
 - G. Submit reports for quality control uniform pressure tests of shop applied structural silicone.
 - H. Submit reports for field hose tests and chamber tests.
 - I. Submit reports for field adhesion tests of weatherproofing sealants.
 - J. Submit reports for adhesion tests of field applied structural silicone.
 - K. Submit reports for field tests of internal gutters.
 - L. Submit qualification of insulating glass to ASTM E2190.
 - M. Submit NFRC Certification Label Certificate for transparent area of each glazing system supplied under this Section.
 - N. Submit laboratory test reports for shadow box spandrel assembly.
 - O. Submit reports for tests of shop assembled units for resistance to water leakage with static air pressure.
 - P. Submit quality control heat soak test reports for tempered glass, as required in Source Quality Control.
 - Q. Submit off-line quality control color measurement data for heat-treated coated visual mock-up glass and production glass, as required in Source Quality Control.
 - R. Submit roll wave and millidiopter data for heat-treated visual mock-up glass and production glass, as required in Source Quality Control.
 - S. Submit bow and warp data for heat-treated visual mock-up glass and production glass, as required in Source Quality Control.
 - T. Sustainable Design Submittals: Provide informational submittals to Section 01 8113.14 "Sustainable Design Requirements – LEED V4 BD+C."
- 1.15 ACTION SUBMITTALS: Action submittals shall be complete and in required form. Resubmittals shall include requested corrections and shall respond to previous comments. Each revised sheet shall bear a revision date and number. Revisions shall be flagged with conspicuous revision symbols and numbers. Failure of submittals to be complete, in the proper form, responsive to comments, or identify revisions shall be cause for disapproval and return of documents without review. Failure of review comments to note a noncompliance with plans and specifications shall not relieve the Contractor from his obligation to comply. Failure of review comments to note a noncompliance on a given submittal shall not preclude a directive to comply on future submittals.
- A. Submit shop drawings showing materials in place on building. Drawings shall include elevations, floor plans, sections and full size details. Details shall be fully drawn (not outlined) and annotated. Provide scaled drawings with scale identified. Paper drawings shall be printed to correct scale on 24x36 inch paper. Electronic drawings

shall be formatted to print to correct scale on 24x36 inch paper. Drawings shall include the following information.

1. Joinery and internal seals.
 2. Glass and metal thicknesses.
 3. Metal alloy, temper and finish.
 4. Glass strength, tint, coating, frit pattern, and frit color.
 5. Fastener alloy, strength, finish, diameter, length and spacing.
 6. Glazing materials identification.
 7. Sealants identification by product name and color.
 8. Relative layout of walls, beams, columns and slabs with dimensions noted.
 9. Dimensioned position of glass edge relative to metal daylight.
 10. Provisions for movements; details for movement joints in maximum open and closed positions.
 11. Gutter and weep system.
 12. Locations of, and details for, embedded anchors.
 13. Identification of, and details for, thermal insulation, safing insulation and smoke seal.
 14. Weld information and weld symbols conforming to AWS conventions.
 15. Glazing details applicable to replacement glass, with outline of procedure for glass replacement.
 16. Provisions for adjustment of anchors relative to tolerances of building structure; details for anchors in maximum up/out and in/down positions.
 17. Florida Product Approval report numbers.
- B. Submit structural calculations prepared in compliance with referenced documents and this Section. Calculations shall be legible and shall be cross-referenced to shop drawings to make calculations readily understandable and reviewable. Test reports are not an acceptable substitute for calculations. Calculations shall include:
1. Table of contents.
 2. Sequentially numbered pages.
 3. Calculation of design loads.
 4. Input and output for analyses performed by software.
 5. Analysis of framing members and metal panels.
 6. Analysis of anchors, including anchors embedded in concrete.
 7. Section property computations for framing members.
 8. Analysis of stress in structural silicone.
 9. Seal and signature of professional engineer licensed in Florida. Provide seal and signature on first page of every submittal, not just on a final or record submittal.
- C. Perimeter Fire Containment Engineering Judgments

1. Submit a separate Engineering Judgment for each unique perimeter fire containment condition on this project.
 2. Engineering Judgments shall comply with International Firestop Council (IFC) Guidelines, and shall be provided by a firestop manufacturer's qualified technical personnel, a Fire Protection Engineer, or an independent testing agency that provides listing services for firestop systems.
 3. In addition to compliance with IFC Guidelines, Engineering Judgments shall be cross-referenced to specific shop drawing details for this project.
- D. Submit glass strength analysis for compliance with ASTM E1300. For cold-bent glass, point-supported glass, and other glass that is beyond the scope of ASTM E1300, submit finite element analysis. Stress induced by cold-bending shall be treated as long-duration stress. Stresses determined by finite element analysis shall not exceed allowable stresses for glass surfaces and glass edges in the appendices of ASTM E1300.
- E. Submit shop drawings and structural calculations for performance mock-ups. The required content is the same as for actual building.
- F. Submit laboratory reports for performance mock-ups, including as-built shop drawings.
- G. Submit request to waive reglazing demonstration on mock-ups (Contractor option).
- H. Submit request to perform tensile test on substitute structural silicone or insulating glass secondary seal silicone (if Contractor makes a substitution request). Submit laboratory report if test is performed.
- I. Submit surface temperature and dew point analysis performed with THERM software, and computation of overall U-factors.
- J. Sustainable Design Documentation Submittals: Refer to Section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C."
1. Product Data: Documentation for Leadership Extraction Practices in the following: Leadership Extraction Practices for Recycled Content.
 2. Product Data: Documentation for Low Emitting Materials.
 - a. Low Emitting Materials for Paints and Coatings.
 - b. Low emitting Materials for Adhesives and Sealants.
 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's).
 - b. Corporate Sustainability Reporting (CSR's).
- K. Samples
1. Submit for approval 3 sets of labeled samples of each type and color of metal finish, on 12 inch (305 mm) long sections of extrusion shapes and 12 inch (305 mm) squares of sheet aluminum. Samples shall show extremes of color and texture variation. Samples will be reviewed for color and texture only. Compliance with other requirements is the responsibility of the Contractor.

2. Submit for approval 3 sets of labeled 12 inch (305 mm) square samples of each type of glass. Provide at project site visual mock-up using full size glass, for evaluation of color range and distortion of reflected image.
3. Submit on request samples that show fabrication techniques and workmanship for component parts.
4. Provide production material conforming to approved samples.

1.16 QUALIFICATIONS

- A. Aluminum Fabricator: Company specializing in fabrication of architectural aluminum extrusions and sheet with minimum 10 years of experience. Engineer who does structural design shall have minimum 10 years of experience designing architectural aluminum.
- B. Glass Supplier and Fabricator: Companies specializing in manufacture of flat glass and fabrication of architectural glass with minimum 10 years of experience.
- C. Gasket Supplier: Company specializing in manufacture of products specified in this Section with minimum 10 years of experience.
- D. Sealant Supplier: Company specializing in manufacture of products specified in this Section with minimum 10 years of experience.
- E. Installer: Company specializing in performing work of this Section with minimum 10 years of experience.

1.17 MOCK-UPS

- A. Performance Mock-ups
 1. Provide labor and materials to build and test four performance mock-ups as shown on Drawings.
 - a. Mock-up #1: Airside north elevation at grid A4, approximate dimensions 16 feet wide by 29 feet high, no corner return.
 - b. Mock-up #2: Boulevard skylight and clerestory, south elevation at grid L14, approximate dimensions 17 feet wide by 13 feet high vertical surface, 17 feet wide by 23 feet sloping surface, no corner return.
 - c. Mock-up #3: Skylight at curtain wall corner, south and east elevations at grids L17 and S7.5, approximate dimensions south elevation 20 feet wide by 26 feet high, east elevation 20 feet wide by 26 feet high, projected roof area 20 feet by 16 feet.
 - d. Mock-up #4: GTF pedestrian bridge north elevation curtain wall and skylight, approximate width 16 feet (starting at grid line T3 and extending four glass bays to the east), approximate height of curtain wall 30 feet (starting at elevation 121'-8", extending upward three glass openings plus the sloping skylight gutter), approximate length of skylight along slope 20 feet (starting at gutter and extending three glass openings up the slope).
 2. Mock-ups shall accurately represent project conditions including joint sizes, anchors, materials, finishes and seals, except there shall be no indoor seal at boundaries of test specimen and chamber, even if a seal is intended for the

- actual building. Install sufficient thermal insulation and safing insulation to demonstrate details of installation.
3. Each mock-up shall be glazed with one consistent set of gaskets. Use of multiple gasket profiles and/or thicknesses at Contractor's discretion is not permitted.
 4. Prior to tests, remove and reglaze selected glass units, using the details and procedures intended for glass replacement on the actual building. Reglazed units must satisfy test criteria. Contractor may submit for approval request to waive this requirement for glass supported by structural silicone.
 5. Provide at least one extra glass unit for each type and size on mock-ups. Glass that breaks during testing shall be replaced with the same type glass. If glass in a specific mock-up opening breaks twice during attempts to complete one test, or 3 times for any combination of tests, the mock-up fails, redesign of the framing and/or glazing system is required, and testing must be repeated from the beginning of the test sequence.
 6. Construct mock-ups in accordance with approved shop drawings. Deviations from or additions to details shown on drawings are subject to approval.
 7. Pay laboratory fees. Coordinate chamber availability, shipping schedules and mock-up construction schedules with laboratory.
 8. Minimum Content of Laboratory Reports for Performance Mock-ups
 - a. For air infiltration and exfiltration tests: numerical value of air flow readings; allowable values.
 - b. For water tests that result in leakage: schematic elevation with identification of leak locations; descriptions of leaks.
 - c. For structural tests: schematic elevation with identification of gage locations; explanation of gage reference surface (chamber steel or test specimen component); numerical data for maximum deflection and residual deflection; allowable values.
 - d. As-built shop drawings of test specimen.
 9. If failures occur, revise and retest mock-ups. Modifications shall be realistic in terms of project conditions, shall maintain standards of quality and durability, and are subject to approval.
 10. If failures necessitate retests, pay fees and expenses for Architect and consultant to witness retests.
 11. Mock-ups are subject to observation by Owner, Architect and their consultants during construction and testing. Provide notification at least two weeks before beginning construction of mock-ups. Provide materials and personnel for prompt continuous construction of mock-ups. Delays in mock-up construction due to lack of materials or personnel could result in the Contractor being charged for fees and travel expenses of observers.
 12. The testing laboratory shall not perform any of the following functions.
 - a. Act as consultant to a contractor for this project.
 - b. Modify Contract Document requirements.

- c. Modify mock-up configuration.
 - d. Dismantle mock-ups until notified that no further testing is required.
 - 13. Undocumented tests are not permitted. All test results and all remedial work shall be documented in the laboratory report.
 - 14. Mock-up Design Pressures
 - a. Mock-up #1: 40 psf outward and 45 psf inward.
 - b. Mock-up #2: 30 psf inward and outward.
 - c. Mock-up #3: 40 psf inward and outward.
 - d. Mock-up #4: 45 psf inward and outward.
 - 15. Maximum test pressures are 1.5 times design pressures.
- B. Performance Mock-up Tests
 - 1. Testing Sequence
 - a. Uniform air pressure at 50% of inward design pressure, 10 second hold.
 - b. Air leakage inward and outward.
 - c. Resistance to water leakage with static pressure.
 - d. Resistance to water leakage with dynamic pressure; this may require multiple steps with wind generator at different locations.
 - e. Structural tests at 50% and 100% of inward design pressure, 10 second holds.
 - f. Structural tests at 50% and 100% of outward design pressure, 10 second holds.
 - g. Repeat resistance to water leakage with static pressure. If this test results in failure, after corrections are made repeat structural tests at 50% and 100% inward design pressure, and 50% and 100% outward design pressure, then repeat this test.
 - h. Structural tests at 75% and 150% of inward design pressure, 10 second holds.
 - i. Structural tests at 75% and 150% of outward design pressure, 10 second holds.
 - 2. For air leakage tests, inward chamber air leakage shall be accurately determined, not estimated. Outward chamber air leakage may be assumed to be the same as inward leakage.
 - 3. For water leakage tests, there shall be no unacceptable water leakage as defined in this Section.
 - 4. Where test sequence or test failure requires successive water leakage tests, the only means used to drain water from internal cavities shall be gravity drainage through weep system for a minimum of 15 minutes. Air pressure, removal of parts or other means of draining water shall not be used.
 - 5. For dynamic water tests, wind generator shall have a minimum of three blades, and minimum propeller diameter of 12 feet (3.7 m). Width of area tested shall

not exceed two times propeller diameter. Perform separate test for each two-diameter segment, or fraction thereof. For a mock-up with two vertical faces meeting at an outside corner, perform separate tests on each face with the engine centerline perpendicular to the glass planes.

6. Structural tests shall conform to ASTM E330. Pressures shall be held for at least 10 seconds. Deflection gages shall be set to zero prior to each application of pressure. Deflection gage readings shall be recorded after each application of pressure. Specified deflection and set limitations apply to one application of pressure, not to cumulative effects of two or more loadings.

C. Glass Visual Mock-ups

1. Comply with applicable requirements of Section 01 43 39 Visual Mock-up Requirements.
2. Provide at project site visual mock-ups using full size glass, for evaluation of color and appearance of reflected image. Samples shall have production size (maximum), thickness, tint, coatings and heat treatment. For transparent spandrels, provide production backup surface. Provide color, roll wave, millidiopter and bow/warp data for mock-up glass. Color, roll wave, millidiopter and bow/warp data for approved mock-up glass shall be used as a pass/fail benchmark for production glass, subject to limitations in Source Quality Control of this Section.
3. Mount each sample in a separate frame, in a nominally vertical position. Each frame shall have provision for rotation about horizontal and vertical axes. Frame mounted samples shall be in an open area that is not shaded from sunlight. Outdoor surfaces of samples shall face southeast, south or southwest. Rotate samples as needed for design team to evaluate glass appearance for a variety of lighting conditions.
4. Provide zebra board with diagonal stripes of alternating black and white color. Width of stripes shall be 4 to 6 inches (10 to 15 cm) and shall be uniform. Provide unobstructed viewing area of at least 50 feet (15 m) between glass and zebra board. Bottom edge of zebra board shall be level with bottom edge of glass. Dimensions of zebra board shall be at least 8 feet wide by 8 feet high (2.4 m by 2.4 m). Position zebra board as needed for design team to evaluate reflected image. Maintain viewing area, samples and zebra board in unobstructed condition throughout construction.
5. Design team shall evaluate glass samples for color and appearance of reflected image. Accepted glass samples shall be retained as a standard for production material. Provide additional samples if requested by design team.

D. Visual Mock-ups: Provide visual mock-ups as shown on Drawings, to Section 01 43 39 Visual Mock-up Requirements.

E. Protect materials in transit and stored materials from damage.

F. Replace damaged materials.

1.18 SEQUENCING

- A. Coordinate with requirements of material and personnel hoists. Defer installation at obstructed areas, and install materials when obstructions are removed.

1.19 WARRANTY

- A. Provide written warranty agreeing to repair or replace defective materials and workmanship during warranty period. Defective materials and workmanship include, but are not limited to:
 - 1. Water leakage.
 - 2. Air leakage exceeding specified limits.
 - 3. Structural failure.
 - 4. Sealant (including structural silicone) loss of adhesion, loss of cohesion, cracking or discoloration.
 - 5. Disengagement of gaskets, weatherstrips, trim or other components.
 - 6. Deterioration or discoloration of metal finish.
 - 7. Glass breakage including: secondary breakage caused by falling glass; spontaneous breakage of heat treated glass.
 - 8. Failure of insulating glass edge seal as evidenced by frost, condensation, water, dust, corrosion or coating damage within sealed air space.
 - 9. Insulating glass spacer migration.
 - 10. Delamination or discoloration of laminated glass or panels.
 - 11. Cracking, peeling or discoloration of glass coating.
 - 12. Delamination, cracking, wrinkling, peeling, discoloration or staining of glass opacifier.
 - 13. Loss of glass bite due to shifting of glass.
 - 14. Loss of glass bearing on setting blocks due to shifting of glass and/or blocks.
 - 15. Collapse of thermal insulation or safing insulation.
- B. Warranty does not include damage caused by vandalism, or natural conditions exceeding the performance requirements. Warranty and its enforcement shall not deprive Owner of other action, right or remedy.
- C. Warranty period for entire system shall be 5 years from date of substantial completion. System warranty includes materials and labor.
- D. Certain materials are required to have special warranties. Special warranties shall not limit or reduce requirements of system warranty. Special warranties may originate, in part or in whole, with manufacturers or fabricators and pass through Contractor to Owner. Warranties as written or interpreted by manufacturers or fabricators shall not limit or reduce special warranty requirements of this Section.
 - 1. Insulating glass that experiences failure of edge seal as defined in this Section shall be replaced at no charge (material only) for minimum 10 year period beginning on date of manufacture.
 - 2. Insulating glass that has a structural edge seal (a seal that transfers load from outer glass ply to inner glass ply) that experiences adhesive or cohesive failure of the structural bond between glass substrates shall be replaced at no charge (material only) for a minimum 10 year period beginning on date of manufacture.

3. Glass whose coating cracks, peels or discolors shall be replaced at no charge (material only) for minimum 10 year period beginning on date of manufacture.
4. Laminated glass that delaminates shall be replaced at no charge (material only) for minimum 10 year period beginning on date of manufacture.
5. Spandrel glass and ceramic silk-screened glass whose opacifier delaminates, cracks, peels, discolors, or stains shall be replaced at no charge (material only) for minimum 10 year period beginning on date of manufacture.
6. Paint that cracks, peels, fades in excess of specified limits or chalks in excess of specified limits shall be replaced at no charge (material and labor) for minimum 5 year period beginning on date of application.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel

1. Hot rolled shapes and plates shall conform to ASTM A36/A36M.
2. Tubing shall conform to ASTM A500 or A501.
3. Stainless steel bars and sheet shall be 300 series alloy. Minimum thickness is: 0.062 inch (1.5 mm) for frames; 0.031 inch (0.79 mm) for trim covers; 0.012 inch (0.30 mm) for concealed flashing; 0.015 inch (0.38 mm) for exposed flashing.
4. Non-tubular cold formed carbon steel with thickness 0.168 inch (4.27 mm) or less shall conform to ASTM A653/A653M.

B. Aluminum

1. Acceptable alloy and temper combinations for extrusions subject to fabrication, finish and structural requirements are: 6063-T5; 6063-T6; 6061-T6. Other alloys of the 6xxx series and other tempers may be submitted for approval. Nominal wall thickness of 0.125 inch (3.2 mm) or greater is acceptable for structural extrusions; wall thickness less than 0.125 inch (3.2 mm) may be acceptable and is subject to approval. Minimum nominal wall thickness for nonstructural trim is 0.062 inch (1.6 mm).
2. Acceptable alloy and temper combinations for sheet and plate subject to fabrication, finish and structural requirements are: 3003-H14; 5005-H14. Other alloys of the 3xxx, 5xxx and 6xxx series and other tempers may be submitted for approval. Minimum nominal thickness is 0.04 inch (1.02 mm) for flashing and 0.125 inch (3.2 mm) for parapet caps and all other applications.

C. Glass

1. Glass shall conform, as a minimum, to the following standards.
 - a. Flat glass shall conform to ASTM C1036, quality q3.
 - b. Heat-treated flat glass shall conform to ASTM C1048, except that surface compression of heat strengthened glass shall be 4000 to 7000 psi (27.6 to 48.3 MPa) for 6 mm thickness, 5000 to 8000 psi (34.5 to 55.2 MPa) for

8 mm and 10 mm thicknesses. Direction of roll wave shall be consistent for the entire project.

- c. Tempered and laminated glass shall conform to ANSI Z97.1.
 - d. Coated glass shall conform to ASTM C1376.
 - e. Laminated glass shall conform to ASTM C1172.
- 2. Provide safety glazing as required by code.
 - 3. Provide heat strengthened vision and spandrel glass. Provide fully tempered glass only where safety glass is mandatory, where design pressures exceed capacity of heat strengthened glass, and where required by this Section. Annealed glass is not acceptable.
 - 4. Glass Edge Treatment: Heat treated glass shall have seamed edges.
 - 5. Insulating glass shall have double edge seals. Primary seal shall be extruded polyisobutylene continuously bonded to glass surfaces and stainless steel spacer, including corners. Minimum width of primary seal shall be 0.062 inch (1.6 mm). Secondary seal shall be Momentive IGS 3723 or Dow Corning 982. Secondary seal shall completely cover spacer with no gaps or voids, and shall be continuously bonded to both plates of glass. Unfilled spaces between primary and secondary seals shall not exceed one inch long by 3/32 inch wide. At least 50 percent of spacer internal volume shall contain desiccant. All desiccant may be at two sides of a unit. Where insulating glass is supported by structural silicone, secondary seal shall be designed to transfer specified pressures from outdoor glass to indoor glass. Insulating glass shall be qualified to ASTM E2190. Each unit shall be labeled to IGCC Certified Products Directory minimum label requirements, and to Florida Building Code Section 2406.3. Each insulating unit shall have an STC rating of 39 or greater.
 - 6. Laminated glass shall consist of two layers of heat strengthened glass with equal thickness. Tempered glass is acceptable only if design requirements exceed capacity of heat strengthened glass. Minimum interlayer nominal thickness shall be 0.060 inch (1.52 mm).
 - a. Basis of design at vision glass: Kuraray SentryGlas.
 - b. Basis of design at spandrel glass: Eastman Saflex.
 - 7. Heat treated glass shall be subjected to quality control measures to minimize inclusions that could result in spontaneous breakage. Such inclusions are defined as material defects by this Section. Installed heat treated glass that experiences spontaneous breakage shall be replaced (material and labor) under warranty provisions. Perform heat soak test on all tempered glass as required in Source Quality Control of this Section.
 - 8. Spandrel glass and ceramic silk-screened glass shall be opacified with ceramic frit.
 - 9. Each glass unit shall be identified in accordance with Florida Building Code Section 2403.1. Safety glazing shall be identified in accordance with Florida Building Code Section 2406.3.

D. Glass Schedule

1. Silk Screen Frit Density, Color and Dot Diameter
 - a. Frit #1 density: 20%, basis of design Viracon V-175 High Opacity White, 1/16 inch diameter.
 - b. Frit #2 density: 40%, basis of design Viracon V-175 High Opacity White at vertical glass, V-903 Subdued Gray at skylight glass, 1/16 inch diameter.
 - c. Frit #3 density: 60%, basis of design Viracon V-903 Subdued Gray, 1/8 inch diameter.
2. Insulating Glass Spacer: black stainless steel.
3. Glass Heat Treatment: All glass is heat treated. Annealed glass is not acceptable. Provide heat strengthened glass, except provide fully tempered glass only where required for safety or performance. Perform heat treatment before low-e coating is applied.
4. Glass Type GL-1 basis of design: Insulating, laminated, all glass layers PPG Starphire 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 13-63, 13.2 mm air space, laminated indoor, two layers of Starphire, 1.52 mm clear SentryGlas interlayer.
5. Glass Type GL-2 basis of design: Insulating, laminated, all glass layers PPG Starphire 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 13-63, frit #2 V-175 High Opacity White on surface #2, 13.2 mm air space, laminated indoor, two layers of Starphire, 1.52 mm clear SentryGlas interlayer.
6. Glass Type GL-3 basis of design: Insulating, laminated, all glass layers clear 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 1-63, 13.2 mm air space, laminated indoor, two layers of clear glass, 1.52 mm clear SentryGlas interlayer.
7. Glass Type GL-4 basis of design: Insulating, laminated, all glass layers clear 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 1-63, no frit zero to 8 feet, frit #1 V-175 High Opacity White on surface #2 above 8 feet, 13.2 mm air space, laminated indoor, two layers of clear glass, 1.52 mm clear SentryGlas interlayer.
8. Glass Type GL-4A basis of design: Laminated, both glass layers clear 6 mm (minimum) thickness, 1.52 mm clear SentryGlas interlayer.
9. Glass Type GL-5 basis of design: Insulating, laminated, all glass layers clear 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 1-63, frit #2 V-175 High Opacity White on surface #2, 13.2 mm air space, laminated indoor, two layers of clear glass, 1.52 mm clear SentryGlas interlayer.
10. Glass Type GL-6 basis of design: Insulating, laminated, all glass layers clear 6 mm (minimum) thickness, monolithic outdoor, Viracon VNE 1-63, frit #2 V-903 Subdued Gray on surface #2, 13.2 mm air space, laminated indoor, two layers of clear glass, 1.52 mm clear SentryGlas interlayer, VLT 36%.
11. Glass Type GL-7 basis of design: Insulating, laminated, all glass layers 6 mm (minimum) thickness, monolithic outdoor Optigray, Viracon VNE 30-63, frit #3

V-903 Subdued Gray on surface #2, 13.2 mm air space, laminated indoor, 1.52 mm clear SentryGlas interlayer, outboard layer Optigray, inboard layer clear glass, VLT 12%.

12. Glass Type GL-8 basis of design: Insulating, laminated, all glass layers 6 mm (minimum) thickness, monolithic outdoor Gray, Viracon VNE 3-63, frit #3 V903 Subdued Gray on surface #2, 13.2 mm air space, laminated indoor, 1.52 mm clear SentryGlas interlayer, outboard layer Gray, inboard layer clear glass, VLT 6%.
13. Glass Type GL-9 basis of design: Insulating, laminated, all glass layers PPG Starphire 6 mm (minimum) thickness, monolithic outdoor Viracon VNE 13-63, Frit #2 V-175 High Opacity White on surface #2, 13.2 mm air space, laminated indoor, two layers of Starphire, 1.52 mm clear PVB interlayer, Medium Gray Viraspan full surface frit on surface #6.
14. Glass Type GL-10 basis of design: Insulating, laminated, all glass layers PPG Starphire 6 mm (minimum) thickness, monolithic outdoor Viracon VNE 13-63, 13.2 mm air space, laminated indoor, two layers of Starphire, 1.52 mm clear PVB interlayer, Medium Gray Viraspan full surface frit on surface #6.
15. Glass Type GL-11 basis of design: Insulating, laminated, all glass layers clear 6 mm (minimum) thickness, monolithic outdoor Viracon VNE 1-63, Frit #2 V-175 High Opacity White on surface #2, 13.2 mm air space, laminated indoor, two layers of clear glass, 1.52 mm clear PVB interlayer, Medium Gray Viraspan full surface frit on surface #6.
16. Glass Type GL-12 basis of design: Insulating, laminated, all glass layers PPG Starphire 6 mm (minimum) thickness, monolithic outdoor Viracon VNE 13-63, frit #2 V-903 Subdued Gray on surface #2, 13.2 mm air space, laminated indoor, two layers of Starphire, 1.52 mm clear SentryGlas interlayer, VLT 40%.

E. Glazing System

1. Gasket system shall consist of a dense gasket against one glass face, and a cellular gasket against the other glass face, or dense gaskets against both glass faces. Refer to Glazing Materials and Glazing regarding injection molded corners and sealing of gasket corner joints.
2. Structural silicone system shall consist of structural silicone at interior glass face, and an exterior silicone weather seal. Where glass is not supported by structural silicone, provide gasket system; either or both gaskets may be replaced by a recessed backer and silicone seal. Refer to FABRICATION regarding shop assembly of four-side structural silicone system.
3. Weight of each glass unit shall rest on setting blocks that are supported by a metal frame. Stacking of glass units over a shared dead load support is not acceptable.

F. Elastomers

1. Gaskets, weatherstrips, glazing blocks and other elastomeric components shall conform to the following standards.
 - a. Cellular neoprene and EPDM: ASTM C509, test for resistance to flame propagation not required.

- b. Dense neoprene and EPDM: ASTM C864.
 - c. Dense silicone: ASTM C1115, Type C for glazing, Type T for expansion joints.
 - d. Dense thermoplastic rubber: ASTM E2203.
 - e. Straightness tolerance for extended legs of wiper gaskets is 0.062 inch in a one foot gage length (1.5 mm in 30 cm). Waviness or rippling exceeding this tolerance is not acceptable.
2. Gaskets and Weatherstrips Except at Structural Silicone
- a. Cellular gaskets shall be extruded black neoprene or EPDM with hardness of 40 +/- 5 durometer. Design cellular gaskets to provide 20% to 35% compression.
 - b. Dense gaskets shall be black extrusions with Shore A hardness of 75 +/- 5 for hollow profiles and 60 +/- 5 for solid profiles. Gaskets shall be silicone, neoprene, EPDM or thermoplastic rubber.
 - c. Provide glazing gaskets with injection-molded corners where gaskets can be installed to metal frame before glass is set.
 - d. Compression gaskets shall be designed to produce a force against the glass surface of 4 to 10 pounds per linear inch (0.70 to 1.75 N/mm).
3. Glazing gaskets, sealant backers, and glass spacer pads in contact with structural silicone shall be black extruded dense silicone.
4. Gaskets that maintain glass face clearance while serving as a backer for a silicone weather seal may have a friction fit. All other gaskets and weatherstrips, including backers for structural silicone, shall have a continuous spline or a continuous groove that engages a matching groove or leg on the aluminum frame.
5. Expansion Joints at Walls
- a. Provide continuous aluminum extrusions with pockets to receive continuous elastomeric snap-in primary and secondary gaskets. Basis of design is Balco type FCVS Silicone.
 - b. Primary gasket shall be extruded dense silicone or thermoplastic. Secondary gasket shall be extruded dense EPDM or thermoplastic.
 - c. Minimum rated movement capacity is 50 percent of nominal joint width in compression, and 50 percent of nominal joint width in tension.
 - d. Provide primary gasket color as selected by Architect.
6. Setting Blocks
- a. Setting blocks shall be dense extruded silicone with hardness of 85 +/- 5 durometer Shore A. Minimum length is 0.1 inch for each square foot (27 mm for each square meter) of glass area, but not less than 4 inches (102 mm). Minimum width is glass unit thickness. Setting blocks shall be equidistant from glass centerline, with block centerlines between glass eighth points and quarter points. Distance from vertical glass edge to

- nearest edge of setting block shall not be less than 6 inches (152 mm) where glass width is at least 32 inches (813 mm).
- b. Shims used in conjunction with setting blocks shall be of the same material, hardness, length and width as the blocks.
 - c. Setting blocks and chairs shall be secured against migration.
7. Side Blocks
- a. Provide side blocks at both jambs, between midheight and top corner of glass. Blocks shall be 55 +/- 5 durometer Shore A dense silicone. Block width shall be 0.125 inch (3 mm) less than nominal glass edge clearance.
 - b. Side blocks are not required where glass is continuously sealed with silicone at two or more edges.
- G. Glazing Tape: Saint-Gobain Performance Plastics V2100 Thermalbond Tape is acceptable as a glass spacer pad when used in conjunction with structural silicone, subject to compatibility tests.
- H. Anchors in Concrete and Masonry
- 1. Anchors embedded in concrete and masonry shall be prime painted or hot dip galvanized rolled steel, or hot dip galvanized cold formed steel.
 - 2. Strength of embedded anchors shall be developed by integral projections, welded deformed bars, or headed studs.
 - 3. At masonry, through bolts are acceptable provided that bearing plates are used at both masonry surfaces. Expansion bolts are acceptable provided they are designed for use in masonry.
 - 4. Expansion bolts are acceptable in concrete.
 - 5. Hilti Kwik HUS-EZ and Powers Wedge-Bolt are acceptable in concrete.
 - 6. Fasteners that are self-drilling are not acceptable. Screws in plugs and powder actuated fasteners are not acceptable.
- I. Fasteners
- 1. Fastener requirements are applicable to screws, bolts, nuts, washers, rivets and pins.
 - 2. Stainless steel 300 series fasteners are required at the following locations, and are acceptable at all locations.
 - a. Locations with exposure to outdoor air.
 - b. Joinery of aluminum frames, regardless of exposure.
 - c. Glazing pockets.
 - d. Internal cavities that act as gutters, or that potentially contain water resulting from leakage or condensation.
 - 3. Carbon steel and 400 series stainless steel fasteners with zinc plating, cadmium plating or Stalgard coating are acceptable at locations where 300 series stainless steel is not required. Mill finish carbon steel and mill finish 400 series stainless steel fasteners are not acceptable.

4. Aluminum bolts are acceptable for fastening aluminum parts. Provide alloy and temper 2024-T4, 6061-T6, or 7075-T73. Finish for exposed aluminum fasteners shall be the same as for the aluminum parts being fastened.
 5. Provide helical spring washer, nylon patch, or liquid thread lock at all bolted connections.
 6. Powder actuated fasteners are not acceptable.
- J. Shims
1. Separate surfaces designed for relative movement with friction reducing pads. Pads shall have minimum 0.062 inch (1.6 mm) thickness, shall reduce friction to permit movement, shall be resistant to wear, and shall be positively retained in position (open ended slots are not acceptable). Pads shall not be subjected to heat damage from welding or cutting, or to excessive pressure from overtightening of bolts.
 2. Shims that transfer shear forces (tending to slide one shim against another) shall be steel plates, set in a staggered pattern and fillet welded to each other and to adjacent steel surfaces. Shims and welds shall be structurally designed to support applied loads.
 3. Plastic shims are acceptable at static connections for which shims transfer only compressive forces.
 4. Wood shims are not acceptable.
- K. Provide weep hole filters if needed to comply with performance requirements. Weep hole filters shall be 20 to 45 pores per inch PVC coated open cell urethane foam.
- L. Sealants: Listed products are acceptable subject to tests. Provide colors as selected by Architect.
1. Sealants required for non-structural exposed outdoor seals at perimeters of metal panels and stone panels, and acceptable for other non-structural seals.
 - a. Momentive Silpruf NB.
 - b. Dow Corning 756 SMS.
 2. Sealants acceptable for non-structural seals at locations other than perimeters of metal panels and stone panels.
 - a. Momentive Silpruf, Silpruf LM.
 - b. Dow Corning 790, 791, 795.
 - c. Tremco Spectrem 1 and Spectrem 2.
 3. Sealants acceptable for shop-applied structural seals.
 - a. Momentive UltraGlaze SSG4400, SSG4600.
 - b. Dow Corning 983.
 - c. Tremco Proglaze II.
 4. Sealants acceptable for shop-applied and field-applied structural seals.
 - a. Momentive Silpruf, UltraGlaze SSG4000.
 - b. Dow Corning 795, 995.

5. Oil base sealants are not acceptable.
6. Sealant back-up materials shall be polyethylene foam, urethane foam or extruded silicone as recommended by sealant manufacturer. Back-up shall not absorb water, and shall not emit gas, even if punctured.
7. Coordinate with other sections to assure compatibility of intersecting sealants.

M. Thermal Breaks

1. Thermal breaks that are integral to extruded aluminum frames shall be continuous polyamide nylon 66 or continuous polyurethane. Minimum separation of outdoor and indoor metal shall be 0.37 inch (9.5 mm); increase separation as required to comply with specified thermal performance.
 - a. Polyamide nylon 66 shall be reinforced with minimum 25 percent glass fibers and shall be mechanically locked to extrusions with closely spaced crimps.
 - b. Polyurethane shall be poured into a cavity of a single extrusion. The extrusion shall be debridged after the polyurethane hardens. The cavity shall have closely spaced indentations to mechanically lock the polyurethane against slippage in the cavity.
2. Thermal breaks that are fastened and clamped between two layers of metal shall be rigid PVC or one of the materials specified for glazing gaskets in this Section.

N. Thermal Insulation

1. Insulate spandrels and other nonvision areas with Thermafiber FireSpan 90, Roxul CurtainRock 80, or approved equal having 3.0 inch (76 mm) minimum nominal thickness. Minimum R-value for insulation alone shall be 12.6 (ft²·h·°F)/Btu (2.2 {m²·K}/W). Provide FSP or FSK adhered vapor barrier consisting of minimum 0.0005 inch (12.7 micron) aluminum foil, fiberglass scrim, and polyethylene film or Kraft paper. Locate foil surface flush with innermost surface of vertical framing members. Butt joints are acceptable provided that both pieces of insulation are attached to, and are in contact with, continuous steel reinforcement located on the outboard side of insulation. Each piece of insulation shall be retained at a minimum of two opposite edges.
2. Framing Covers
 - a. Apply above and below safing insulation, for full height of insulated openings, minimum 2.0 inch (51 mm) thick and minimum 8 inch (203 mm) wide strips of insulation (framing covers) against vertical framing members, with minimum 1.0 inch overlaps of adjacent insulation.
 - b. Each framing cover shall be retained at a minimum of two points with steel impaling pins (see "Attachment of Insulation"), steel fasteners with washers, or Thermafiber Impasse Spiral Anchors.
 - c. Framing covers shall also be placed against any intermediate horizontal or vertical framing members within an insulated opening, where the framing would otherwise be unprotected from fire on the indoor side.
3. Attachment of Insulation

- a. Steel impaling pins are acceptable. Pins may be welded to steel framing or to steel sheet. Pins may have integral bases that are fastened with steel screws. Attachment of pins with adhesive is not acceptable.
 - b. Thermafiber Impasse Hangers are acceptable. Hangers shall be fastened to framing with steel screws.
 - c. Attachment of insulation with tape or adhesive is not acceptable.
 - d. Maintain 1.0 inch (25 mm) nominal air space between insulation and glass.
4. Provide continuous horizontal metal brace against outboard surface of thermal insulation, at the level of safing insulation. Fasten brace to vertical frames. Brace shall have sufficient stiffness to prevent bowing of thermal insulation.
 5. Seal edges, joints, punctures and tears in vapor barrier with aluminum foil tape. Tape insulation to framing before placement of framing covers. Apply tape over clinch shields, washers, spiral anchors and other hardware at penetrations of foil backing. Apply tape at perimeters of framing covers.
- O. Safing Insulation and Smoke Seal
1. Fill void at floor and roof edges with Thermafiber Safing Insulation, Roxul Safe, or approved equal. Thickness shall be four inches (102 mm) minimum top to bottom. Cut safing insulation wider than opening to provide compression fit recommended by manufacturer.
 2. Completely coat top surface of safing insulation with 3M FireDam Spray 200, SpecSeal AS200 Elastomeric Spray, Hilti CP 672 Firestop Joint Spray or approved equal. Coating shall overlap floor and wall a minimum of 0.5 inch (13 mm). Provide minimum wet thickness 0.125 inch (3 mm). Comply with manufacturer requirements for temperature and condition of substrates at time of installation.
 3. The smoke-sealed joint shall be tested to UL 2079 for air leakage. The L-rating shall not exceed 5 cfm per linear foot (0.00775 m³/s m) of joint at 0.30 inch of water (7.47 Pa) for ambient temperature and elevated temperature tests.
 4. Where safing and smoke seal are interrupted at a stairwell, shear wall, or any other condition that prevents continuity, provide vertical safing, and smoke seal on the protected side, to close gaps between horizontal lines of safing at successive floors. Where needed to maintain continuity, provide safing and smoke seal between exterior wall and beams, columns and other structure surfaces where floor slabs are interrupted or do not occur.
 5. Place safing insulation, and if needed additional strips of safing insulation, horizontally and vertically as needed to protect anchors from exposure to fire at the floor below the anchor. Provide at least two inch insulation cover for anchor components.
- P. Primers
1. Coat aluminum surfaces in contact with masonry, concrete or steel with prime paint or bituminous paint.

2. Prime paint carbon steel parts of anchors, embedded anchors, reinforcement and supports. After field welding, remove weld slag and touch up primed surface.
 3. Provide minimum dry film thickness of one mil (0.0254 mm) for paint and 30 mils (0.762 mm) for bituminous paint. Prime paint shall conform to GSA specification TT-P-645B 1990.
- Q. Flashing
1. Acceptable materials are stainless steel sheet and aluminum sheet. Aluminum is required to have a shop-applied bituminous coating where it contacts dissimilar materials.
 2. Provide sealed lap joints, end dams and transitions to gutters.
- R. Delivery Time for Replacement Glass: After completion of construction, delivery time for replacement glass shall not exceed 16 weeks.

2.2 FABRICATION

- A. Perform fabrication and assembly as much as possible in the shop.
- B. Exposed work shall have continuous lines. Joints in exposed work shall be accurately fitted and rigidly secured.
- C. Welding shall be in accordance with recommendations of the American Welding Society and shall be done with electrodes and by methods recommended by suppliers of alloys being welded. Welds behind finished surfaces shall be done so as to minimize distortion. Discoloration of a finished surface due to welding or any other process is unacceptable. Weld spatter and welding oxides on finished surfaces shall be removed by descaling and/or grinding.
- D. Weld beads on exposed surfaces shall be ground and finished to match and blend with finish on adjacent metal. Grinding and polishing of nonferrous metal shall be done only with clean wheels and compounds free from iron and iron compounds. Soldering and/or brazing are not acceptable.
- E. Provide exposed fasteners only where shown on approved shop drawings. Exposed fastener heads shall be finished to match fastened material.
- F. Provide specified finishes on exposed surfaces. Provide specified galvanized finish or shop-applied prime paint on concealed steel.
- G. Systems with glass supported at all edges by structural silicone shall be unitized and shall be fully assembled, including silicone and glass, in the shop.

2.3 TOLERANCES

- A. Tolerances in the Aluminum Association Aluminum Standards and Data are applicable to finished, fabricated and assembled materials, except that flatness tolerance for aluminum sheet panels shall be half of standard sheet tolerance. Maintain stricter tolerances where required for proper fit of components.
- B. Fabrication tolerances for frames of shop-assembled and shop-glazed window and skylight frames are:
 1. Overall length and width: 0.062 inch (1.6 mm).

2. Deviation from square: 0.125 inch (3.2 mm).
3. Open gap at nominal hairline joint: 0.062 inch (1.6 mm) maximum.
4. Offset (in/out) between adjacent nominally flush surfaces: 0.031 inch (0.8 mm).

2.4 PAINTED ALUMINUM FINISH

A. General Requirements

1. Paint shall be supplied by a licensed formulator.
2. Application of shop-applied finish shall be performed under specifications issued by licensed formulator, by an applicator approved by formulator.
3. Color shall match approved samples. Samples shall show extremes of color range.
4. Pretreatment of metal surfaces shall be done in accordance with procedures recommended by formulator.
5. VOC's shall be captured and converted to water vapor by an oxidizer.
6. Touch-up of painted aluminum is permitted only with written permission from the Architect. Unless touch-up is authorized, replace damaged material with new material. Touch-up shall be done with PPG Corafon ADS air dry two-coat system.
7. Provide colors as selected by Architect.

B. Outdoor Surfaces

1. Painted aluminum finish shall be factory oven cured four coat finish based on Kynar 500 or Hylar 5000 Fluoropolymer resin.
2. Formulation shall have at least 70% Kynar 500 or Hylar 5000 resin in residual solids.
3. Pigmented organic coatings for extrusions, structural shapes, sheet or plate, spray applied in the factory, shall meet requirements of AAMA 2605.
4. Warranty
 - a. Color changes shall not exceed 5 Delta E units as defined by ASTM D2244 for specified special warranty period.
 - b. Chalking shall not exceed a number 8 rating as defined by ASTM D4214 for specified special warranty period.
 - c. Paint film shall not crack or peel during specified special warranty period.

C. Indoor Surfaces

1. Specified finish for outdoor surfaces is acceptable for indoor surfaces.
2. Where outdoor and indoor parts can be finished separately, factory oven cured acrylic or polyester paint is acceptable for indoor surfaces.
3. Acrylic and polyester pigmented organic coatings for extrusions, structural shapes, sheet or plate, spray applied in the factory, shall meet requirements of AAMA 2603.

2.5 ALUMINUM FINISH AT STRUCTURAL SILICONE

- A. Mill finish is not acceptable at structural silicone bonding surfaces.
- B. Aluminum surface to which structural silicone will be adhered shall have a finish that demonstrates by test the ability to satisfy specified requirements. Subject to testing, acceptable finishes are:
 - 1. Paint conforming to AAMA 2605 or AAMA 2603.
 - 2. Alodine conversion coating conforming to ASTM B449 Class 1.

2.6 STEEL FINISHES

- A. Cold formed carbon steel with thickness 0.168 inch (4.27 mm) or less shall be hot dip galvanized to meet or exceed requirements of classification G90 of ASTM A653/A653M.
- B. Cold formed carbon steel with thickness exceeding 0.168 inch (4.27 mm) and hot rolled steel shall be prime painted in conformance with GSA Specification TT-P-645B, or hot dip galvanized in conformance with ASTM A123/A123M.
- C. Corrosion of galvanized steel surfaces is not acceptable in any amount, including "storage stain" and "white rust." Store galvanized steel in a dry indoor environment. Protect galvanized steel during shipping, storage, handling and fabrication from conditions that promote corrosion.
- D. Stainless steel exposed surfaces shall have number 8 polished finish.

2.7 SOURCE QUALITY CONTROL

- A. Glass
 - 1. Heat Soak Test: Perform heat soak test on all tempered glass. Hold glass at 550 ± 18 degrees F (290 ± 10 degrees C) for minimum 2 hours. Record quantity and sizes tested, dwell time and quantity of breaks (if any). Submit records in electronic pdf format for information only.
 - 2. Color Measurement
 - a. Measure color of coated glass with spectrophotometers. Measure color from the uncoated side.
 - b. Perform continuous on-line color measurement across the entire glass surface on the coating line. Perform off-line quality control checks on a minimum of one unit every four hours and at each product change on the heat treating line.
 - c. The color target shall be established by the coater.
 - d. Color variation shall not exceed 4.5 Delta E*ab units as defined by ASTM C1376, except the target shall be as defined in this Section, not units installed on a building. Remove from production any non-conforming glass.
 - e. Record all off-line quality control check data and submit it in electronic pdf format for information only.
 - 3. Distortion Measurement of Heat-Treated Glass
 - a. Measurement device shall be Osprey LiteSentry.

- b. Measure all coated and uncoated heat-treated glass at the end of the heat treatment line, in a horizontal position with glass supported on rollers.
 - c. Roll wave peak to valley distortion for leading edge, central area, and trailing edge shall not exceed the highest values for units used on an approved visual mock-up, or 0.003 inch for central area, and 0.008 inch for leading and trailing edges, whichever is less.
 - d. For measurements taken over at least 90 percent of the area of each unit, distortion shall not exceed the highest value for units used on an approved visual mock-up, or ± 120 millidiopters, whichever is less.
 - e. Remove from production non-conforming glass.
 - f. Record all roll wave and millidiopter data, and submit it in electronic pdf format for information only.
- 4. Bow and Warp Tolerance for Heat-Treated Glass
 - a. Bow and warp shall not exceed one half of the values listed in ASTM C1048.
 - b. Measure at least one unit per hour.
 - c. Record bow and warp data, and submit it in electronic pdf format for information only.
- B. Test shop applied structural silicone by applying outward design pressure for at least 30 seconds. Test minimum 10 percent of units, using random selection throughout production. Record date of test, results and identification marking of unit tested. Mark each unit so that structural silicone batch numbers and date of application can be traced. Submit test data for information only.
- C. Perform specified water leakage test with static pressure on minimum 2 percent of shop assembled curtain wall units, using random selection throughout production. Record date of test, results and identification marking of unit tested. Submit test data for information only.
- D. Inspect materials and workmanship to assure compliance with Contract Documents. Provide access to storage and manufacturing facilities for observation by Owner and Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that structure and site conditions are ready to receive work of this Section.
- B. Perform layout based on established benchmarks.

3.2 INSTALLATION

- A. Install materials in accordance with approved shop drawings and Florida Product Approval reports. Provide labor, material, equipment and supervision necessary for complete installation.
- B. Field Tolerances

1. Provide anchor adjustment capability for full range of specified tolerances for building structure, but not less than one inch (25 mm) in all directions, except 0.5 inch (12 mm) in all directions at connections to wind girts.
 2. Work of this Section shall be within the following tolerances.
 3. Deviation from plumb, level or dimensioned angle shall not exceed 0.125 inch per 12 feet (3.2 mm per 3658 mm) of length of any member, 0.25 inch (6.4 mm) in any total run in any line.
 4. Deviation from theoretical position in plan or elevation, including deviation from plumb, level or dimensioned angle, shall not exceed 0.375 inch (9.5 mm) total at any location. Change in deviation shall not exceed 0.125 inch for any 12 foot (3.2 mm per 3658 mm) run in any direction.
 5. Maximum offset from true alignment between two metal components placed end to end shall not exceed 0.062 inch (1.6 mm).
 6. Open gap at nominal hairline joint between metal components shall not exceed 0.062 inch (1.6 mm).
 7. Variation of width of reveal formed by overlapping metal components shall not exceed plus or minus one half of nominal reveal width, or 0.125 inch, whichever is less.
 8. Maximum offset between glass framing members at corners of glazing pocket shall not exceed 0.031 inch (0.8 mm).
- C. Anchorage
1. Anchor component parts by bolting and welding. Install captured slip pads between moving parts.
 2. Provide noncorrosive separators between dissimilar materials.
 3. Remove weld slag and apply prime paint over welds. Prime paint exposed portions of embedded anchors. Touch up shop applied primer that is damaged by welding or other causes.
 4. Where slots or oversize holes are provided for adjustment only, secure connection after final adjustment. Interlocking serrations in extruded aluminum brackets and washers are acceptable. Steel weld washers with 0.25 inch (6 mm) minimum thickness are acceptable with steel brackets. Special washers or nuts that rely on friction and/or surface indentation of fastened part are not acceptable.
 5. Remove temporary shims and fasteners. Leave expansion joints free to move as designed.
- D. Clean surfaces to be sealed. Cleaning solvent shall be isopropyl alcohol. Install backers, primers and sealant in accordance with shop drawings, test results and manufacturer recommendations. Dry tool sealants as separate operation after application. Immediately remove masking.
- E. Install thermal insulation, vapor barrier, and safing insulation with specified supports. Install smoke seal. Surfaces to which smoke seal is applied shall be clean, dry and free from frost and dust. Maintain temperature required for application and drying of smoke seal.

3.3 GLAZING

- A. Inspect frame for proper dimensions and squareness. Adjust frame and/or glass size as required to meet specified requirements.
- B. Clean glazing pocket before setting glass. Cleaning solvent shall be isopropyl alcohol. Setting blocks shall be equidistant from glass centerline, with block centerlines between glass eighth points and quarter points. Distance from vertical glass edge to nearest edge of setting block shall not be less than 6 inches (152 mm) where glass width is at least 32 inches (813 mm). Side blocks shall be located between midheight and top corner of glass. Side blocks, setting blocks and chairs shall be positively retained in position.
- C. Install gaskets with injection molded corners where indicated on shop drawings. Where gasket joints occur, tightly butt ends and seal with compatible sealant. Gasket joints shall not occur at locations other than corners.
- D. Inspect glass before installation. Do not install glass that does not conform to this Section. Replace glass that is broken or damaged.
- E. Except as otherwise specified, comply with GANA Glazing Manual. Provide minimum nominal glass bite of 0.5 inch (12.7 mm), but not less than glass bite required for structural silicone. Where joint movement will result in variable glass bite, increase nominal bite to provide 0.375 inch (9.5 mm) minimum bite and 0.25 inch (6.4 mm) minimum edge clearance after worst combination of movements. Design for full values of all movements occurring simultaneously. Provide minimum nominal glass face clearance of 0.187 inch (4.8 mm).
- F. Remove and replace stops and apply sealants as required for complete glass installation.
- G. Defer glazing of openings that are obstructed during construction. Glaze such openings when obstructions are removed.
- H. Clean, prime and mask at structural silicone joints during same day on which silicone is applied.
- I. Temporarily clamp glass during cure of structural silicone. After sufficient cure, remove clamps and fill gaps in silicone.
- J. Mask glass and aluminum during application of structural silicone. Remove masking immediately after tooling sealant.
- K. Structural silicone shall not be applied to edges of insulating glass units, or to edges of laminated glass units. Sealants used as weather seals shall not be placed against edge of laminated glass interlayer.

3.4 FIELD QUALITY CONTROL

- A. Provide site supervision and Field Quality Control requirements for the Installer. Provide Field Quality Control staff having adequate prior experience with all specific products and materials to complete the specified systems and to integrate specified systems with adjacent construction. BECx shall provide an initial BECx checklist. Installers for work of this Section shall provide completed BECx checklist with weekly updates verifying all specific locations of the work, specific locations of repairs and descriptions of repairs. BECx checklist shall be completed in its entirety by installers

of work of this Section and shall be submitted to the Contractor, Architect, Owner and BECxA on a consistent weekly basis.

B. Hose Tests

1. Perform field hose tests for resistance to water leakage prior to installation of interior finishes and interior sealant joints. Test areas shall be selected by Architect. Area of each test area shall be at least 400 ft² (37 m²). There shall be no unacceptable water leakage as defined in this Section. Provide powered scaffold, hose, water supply and manpower to perform at least 23 successful tests, plus any unsuccessful tests. Water testing shall be conducted early in construction schedule. Construction sequence shall include provisions for timely completion of test areas. Remedial measures shall maintain standards of quality and durability and are subject to approval.
2. Test Areas
 - a. Airside vertical curtain walls, five locations, three at hold rooms or retail, one at a boarding pier, one at the Hub clerestory.
 - b. Airside Boulevard skylight, two locations, one at the ridge, one at a roof edge. Interior scaffolding is required for observers.
 - c. Landside vertical curtain walls, six locations, one at the east elevation, one at the north elevation between grids L11 and L12, one at the south elevation between grids L16 and L17, one at the west elevation between grids N1 and S1, one at north Boulevard clerestory, one at south Boulevard clerestory. Interior scaffolding is required for observers.
 - d. Landside punched windows, two locations, one at the north elevation consisting of two windows each at Departures Level and Domestic Arrivals Bridge Level, and one at the south elevation consisting of two windows each at Domestic Arrivals Bridge Level and Arrivals Level.
 - e. Landside Boulevard skylight, four locations, one at the ridge and three at roof edges. Interior scaffolding is required for observers.
 - f. Landside single pitch skylight, four locations including high edge and low edge, one each at north and south skylights between grids L16 and L17, one each at north and south skylights between grids L11 and L12. Interior scaffolding is required for observers.
 - g. GTF vertical curtain wall, one location, pedestrian bridge north elevation, pedestrian bridge level to skylight gutter.
 - h. GTF skylight, two locations, one at the ridge, one extending upward along the slope from the gutter.
 - i. Do not use the same areas for hose tests and chamber tests.
 - j. Test areas include boundaries with work of other sections. Coordinate test requirements with other sections.
3. Conduct test with Monarch Type B-25 #6.030 brass nozzle and 3/4 inch diameter hose. Water pressure to nozzle shall be in the range 30 to 35 psi. Working upward from bottom of test area, direct water at 5 foot long segments of glazing seals, frame joints and perimeter joints, moving slowly back and forth

on each segment for minimum of 5 minutes. Where a framing member is between two glass units and its width does not exceed 4 inches, both lines of glazing seal may be tested as one segment by centering the spray on one glazing seal while moving in one direction, and centering the spray on the other glazing seal while moving in the opposite direction. Sustained spraying at one point while the nozzle remains stationary is acceptable. Tip of nozzle shall be 12 inches from specimen exterior surface. Nozzle shall generally be perpendicular to specimen surface, but shall be tilted to any angle that maximizes exposure of a given joint to water flow rate and kinetic energy. Continuously check for leakage on indoor side. If necessary to pinpoint leak sources, perform additional testing. Repeated testing of joints is acceptable. The use of masking to pinpoint leaks is acceptable.

4. Provide scaffolding, ladders or lifts to allow close observation of all portions of test specimens.
5. Check completed areas below test area, and report any leaks that occur. A test that results in leakage at a completed area below a designated test area is a failure.
6. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines (including any lower areas where leaks occur), and location of each leak.

C. Chamber Tests

1. Perform field chamber tests for resistance to water leakage prior to installation of interior finishes and interior sealant joints. Test areas shall be selected by Architect. Area of each test area shall be at least 400 ft² (37 m²). Where the area of a single test is limited by the size of the water spray rack, it is acceptable to test in several steps by moving the spray rack to successive positions on a grid pattern, moving from low edge to high edge. There shall be no unacceptable water leakage as defined in this Section. Provide powered scaffold, hose, water supply, water spray rack, pressurized chamber on indoor side with access hatch, manometer, air blower and manpower to perform at least six successful tests, plus any unsuccessful tests. Water testing shall be conducted early in construction schedule. Construction sequence shall include provisions for timely completion of test areas. Remedial measures shall maintain standards of quality and durability and are subject to approval.
2. Test Areas
 - a. Airside vertical curtain walls, four locations, three at hold rooms or retail, one at a boarding pier.
 - b. Landside vertical walls, two locations, one at the east elevation, one at the north elevation between grids L16 and L17.
 - c. GTF vertical curtain wall, one location at pedestrian bridge, extending two glass openings upward from pedestrian bridge level.
 - d. Do not use the same areas for hose tests and chamber tests.
 - e. Test areas include boundaries with work of other sections. Coordinate test requirements with other sections.

3. Chambers shall be free-standing and shall be at least 3 feet deep to allow observers to stand inside during tests. Provide ladders or lifts inside chambers to allow close inspection of full height of specimens. Chambers that require observers to view specimens through clear or translucent windows or membranes are not acceptable.
 4. Conduct tests to ASTM E1105 except as modified by this Section, using Procedure "A" uniform pressure difference. Test pressure and pass/fail criteria shall be as required by this Section, without any adjustment or reduction.
 5. Check completed areas below test area, and report any leaks that occur. A test that results in leakage at a completed area below a designated test area is a failure.
 6. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines (including any lower areas where leaks occur), and location of each leak.
- D. Perform adhesion testing of weatherproofing sealants. Use Destructive Procedure Tail Method "A" and frequency of testing as defined by ASTM C1521. Adhesive failure is not acceptable as the sealant is stretched a predetermined amount. The standard requires stretching of sealant to two times its rated movement capacity. If sealant manufacturer recommends more than two times, use manufacturer recommendation. Submit reports for information only, using the form in ASTM C1521.
- E. Perform field adhesion tests on each floor on at least 10 percent of glass openings with field applied structural silicone. Use Destructive Hand Pull Tab Method "A" as defined in ASTM C1401, Appendix X2. Adhesive failure is not acceptable, regardless of percent elongation. Sealant shall be pulled until cohesive tearing occurs. For any opening that fails test, replace structural silicone at entire glass perimeter, and perform test on all openings within 20 feet of failed opening. For any floor with two or more failures, perform test on 100 percent of openings. Submit, for information only, reports that contain locations of tests and information required by ASTM C1401.
- F. Test internal gutters on each floor by temporarily plugging weep holes and filling with water. After minimum of fifteen minutes, inspect for water leakage. Correct deficiencies and retest until successful tests are achieved. Remove weep hole plugs. Test each type of internal gutter at minimum of 2 widely separated locations on each floor. For any gutter that fails test, perform test on all similar gutters within 50 feet of failed gutter. For any floor with 4 or more failures of a given gutter type, perform test on 100 percent of gutters of that type. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines, and results.
- 3.5 PROTECTION, CLEANING AND WASTE DISPOSAL
- A. Protect materials against damage and contamination. Clean surfaces during and at conclusion of construction to Section 01 7423 Final Cleaning.
- B. Periodically remove from the site debris, excess materials and unused tools and equipment. At conclusion of construction, leave premises in clean condition. Manage and dispose of wastes to Section 01 7419 LEED V4 Construction Waste Management and Disposal.

ORLANDO INTERNATIONAL AIRPORT
BP-S195
Terminal C
Airside Concourse

GLAZED CURTAIN WALLS

SECTION 08 44 13

END OF SECTION 08 44 13

SECTION 08 56 67 - BULLET-RESISTANT TRANSACTION WINDOWS

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bullet-resistant fixed steel transaction window assemblies.

1.3 REFERENCES

- A. American Welding Society (AWS) D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- B. ASTM International (ASTM) A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- C. Underwriters Laboratories (UL) 752 - Bullet Resisting Equipment.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide window frames of "non-ricochet type" intended to permit capture and retention of attacking projectile, lessening potential of random injury or lateral penetration.
 - 2. Two way "natural voice" communication permitted by design of vertical side frames and glazing technique.

1.5 SUBMITTALS

- A. Shop Drawings: Include window profiles and sizes, type and spacing of frame anchors, reinforcement size and locations, details of joints and connections, and welding details.
- B. Product Data: Include product description for window assemblies including bullet-resistant ratings.
- C. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content

- D. Samples: 2-inch x 2-inch coating samples showing available colors.
- E. Closeout Submittals:
 - 1. Maintenance Data: Include instructions for cleaning of glazed panels.

1.6 QUALITY ASSURANCE

- A. Transaction Window Assemblies: Ballistic Level 3 tested to UL 752.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store window assemblies upright in protected, dry area, off ground or floor, with at least 1/4-inch space between individual units.
- B. Do not cover with non-vented coverings that create excessive humidity.
- C. Remove wet coverings immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by ARMORTEX Inc. or comparable product by one of the following:
 - 1. Creative Industries, Inc.
 - 2. C.R. Laurence Co., Inc.
 - 3. Diebold, Inc.
 - 4. Total Security Solutions

2.2 MATERIALS

- A. Steel Sheet:
 - 1. ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
 - 2. Recycled content: Minimum 25 percent.
- B. Bullet-Resistant Composite: UL Listed Bullet Resistant Composite of UL Ballistic Level equal to specified frame ballistic protection level.
- C. Glazing:
 - 1. UL Listed laminated glass as specified in Section 08 80 00 "Glazing".
 - 2. Bottom edge of glazing panel provided with 18 gage stainless steel cap.
- D. Track and Hangers:
 - 1. Stainless steel 12 gage track guard and guide.
 - 2. Aluminum 1500 series sliding roller track and wheeled hangers.

2.3 FABRICATION

- A. Frames:
 - 1. Fabricate from 16 gage steel lined with bullet-resistant composite.

2. Bullet-resistant rating equivalent to or greater than glazing.
 3. Weld frame corners; knock-down and mechanical joints not acceptable.
 4. Frame modules capable of being joined with other frame modules to form continuous line.
 5. Replacement of glazing from secure side of window, not requiring removal of frame from opening.
- B. Shelf: Minimum 2 inches thick with recessed dip tray, full width of window x minimum 12 inches deep, centered under glazing, covered with 18 gage stainless steel.
- C. Dip Tray: Model RMDT1016, 16 gage stainless steel, 10 x 16 inches to outside edge of flanges, clear 1-5/8 inch open depth under glazing.
- D. Welding: In accordance with AWS D1.3/D1.3M. Grind exposed welds flush and smooth.
- E. Finish work neat and free from defects.
- F. Allowable Tolerances: Plus or minus 1/16 inch for frame opening width, height, diagonal dimensions, and overall width and height (outside to outside).

2.4 FINISHES

- A. Steel:
1. Dress tool marks and surface imperfections to smooth surfaces.
 2. Clean and chemically treat steel surfaces.
 3. Apply manufacturer's standard polyester powder coat, sprayed and baked, custom color to match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install window assemblies in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set plumb and level.
- C. Secure to adjacent construction using fastener type best suited to application.
- D. Field alterations to window assemblies not permitted unless approved in advance by manufacturer and Architect.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions in finish coat to match factory finish.

END OF SECTION 08 56 67

SECTION 08 65 30 - SOUND CONTROL WINDOWS

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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section Includes: Steel Acoustical Noise Control View Windows.
- B. Related Sections
 - 1. Section 08 80 00 "Glazing".
 - 2. Section 09 96 00 "High-Performance Coatings".

1.3 REFERENCES

- A. ASTM A 1008 - Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- B. ASTM A 569 - Standard Specification for Steel, Carbon, (0.15 Maximum Percent), Hot- Rolled Sheet and Strip, Commercial Quality.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- D. ASTM B 117 - Standard Method of Salt Spray (Fog) Testing.
- E. ASTM D 1735 - Standard Practice for Testing Water Resistance of Coating Using Water Fog Apparatus.
- F. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- G. ASTM E 336 - Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.
- H. ASTM E 413 - Classification for Determination of Sound Transmission Class.
- I. HMMA 840 – Installation and storage of Hollow Metal Doors and Frames; Hollow Metal Manufacturers Association.

1.4 SYSTEM DESCRIPTION

- A. Design requirements: Acoustical window assemblies to include frames, glass and gasketing system required to achieve specified performance requirements.

- B. Performance requirements: Sound Transmission Coefficient rating (STC) for installed assembly, when tested in accordance with ASTM E 90 and ASTM E 413.

1.5 SUBMITTALS

- A. Product data: Indicate window materials and construction.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C" for Leadership Extraction Practices for the following:
 - a. Extended Producer Responsibility
 - b. Recycled content
- C. Shop drawings: Indicate window opening criteria, elevations, sizes, type; identify and detail cutouts.
- D. Quality assurance submittals:
 - 1. Test Reports:
 - a. Certified laboratory reports, performed in accordance with ASTM E 90 and ASTM E 413, from independent testing laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) supporting compliance of assemblies to specified requirements.
 - b. Minimum five (5) field tests, performed in accordance with ASTM E 336 and ASTM E 413 by five separate independent testing agencies, substantiating acoustical performance when installed at no less than five (5) FSTC ratings below the specified STC rating.
 - 2. Certificates:
 - a. Contractor's certification that:
 - b. Products of this section, as provided, meet or exceed specified requirements.
 - c. Manufacturer of products of this section meets specified qualifications.
 - d. Manufacturer's instructions: Printed installation instructions for each component.
- E. Closeout submittals:
 - 1. Warranty documents, executed by manufacturer in Owner's name.
 - 2. Operation and maintenance data for assembly components.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Minimum five (5) years-documented experience producing systems specified in this section.
 - 2. Installer: Minimum five (5) years documented experience producing systems specified in this section, and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store frames in accordance with requirements of HMMA 840.

- B. Remove wraps or covers from frames upon delivery at the building site; clean and touch-up scratches or disfigurement caused by shipping or handling promptly with rust inhibitive primer.
- C. Store windows on planks or dunnage in a dry location; store in a vertical position spaced by blocking.
- D. Store units covered to protect them from damage, but permitting air circulation.

PART 2 - PRODUCTS

2.1 SOUND CONTROL WINDOWS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Krieger Steel Products. Model NCV-3825L-47 for 45+ STC requirements or comparable approved product by one of the following.
 - 1. Acoustical Surfaces, Inc.
 - 2. Soundproof Windows, Inc.
 - 3. Viracon.

2.2 MATERIALS

- A. Steel sheet: One of the following:
 - 1. Cold-rolled steel sheet conforming to ASTM A 1008, commercial quality.
 - 2. Hot-rolled steel sheet conforming to ASTM A 569, pickled and oiled, commercial quality.
- B. Galvanized steel sheet: ASTM A 653/A 653M, commercial quality, minimum G60 zinc coating.
- C. Acoustical material: Manufacturer's standard for required STC rating.
- D. Primer: Meeting ASTM B 117 salt spray for 150 hours, and ASTM D 1735 water fog test for organic coatings for 200 hours.
- E. Glazing: Clear tempered acoustical glass.

2.3 COMPONENTS

- A. Frames: Fabricate in accordance with Architect-approved shop drawings, and as follows:
 - 1. Frames for interior use: Fabricate from steel sheet, minimum 14 gage thickness.
 - 2. Frames for exterior use: Fabricate from galvanized steel sheet, minimum 14 gage thickness.
 - 3. Form frame members straight, and of uniform profile through lengths, as welded units with integral trim, of sizes and profiles indicated.
 - a. Weld contact edges of joints closed tight.
 - b. Miter perimeter trim faces and weld continuously.

4. When shipping limitations so dictate, fabricate frames for large openings in sections designed for assembly in the field; install alignment plates or angles, of same material and gage as frame, at each joint.
 5. Jamb anchors:
 - a. Fabricate of same material as frame material; weld anchors inside each jamb for wall anchorage.
 - b. Provide anchor types for indicated adjacent wall construction:
 - 1) Frames for installation in masonry walls: Adjustable jamb anchors, 16 gage, T-shape type.
 - 2) Frames for installation in stud partitions: Horizontal 16 gage steel "zee" sections to attach metal studs, welded inside each jamb.
 6. Plaster guards: Fabricate from minimum 22 gage steel; weld in place at hardware mortises on frames to be set in plaster, masonry, or concrete openings.
 7. Stops:
 - a. Where integral stops are indicated, form minimum 5/8 inch in depth.
 - b. Butt stop joints.
- B. Glass and Glazing
1. Tempered Acoustical glass shall be furnished in the thickness required to meet the STC ratings but not less than 1/4". The manufacturer will supply all glazing materials.
- C. Fire-Resistant Glazing:
1. Fire and Safety-Rated Laminated Glass: Fire rated, wireless, optically clear glazing material with intumescent interlayers for use in impact safety rated locations such as doors, transoms, borrowed lites and wall applications.
 - a. Basis of Design: Provide Vetrotech - Fire-Rated Glass & Systems; Contraflam 45.
 2. Fire Rating: 45 minute rated 3/4 inch thick fire resistant glazing material.
 3. Individual lites shall be permanently identified with a listing mark.
 4. Glazing material installed in "Hazardous Locations" (subject to human impact) shall be certified to meet the applicable requirements for fire rated assemblies referenced in ANSI Z97.1 Standard for Safety Glazing Materials Used in Buildings and/or CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
 5. Minimum Visible Daylight Transmission: 82 percent.

2.4 FINISHES

- A. Finish: All tool marks and surface imperfections shall be removed and exposed faces of all welded joints shall be dressed smooth. Assemblies shall be treated and shall be coated on all accessible surfaces with a rust-inhibitive primer which meets ASTM B117 salt spray for 150 hours, and ASTM D1735 water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions:
 - 1. Prior to installation, check and correct frames for size, squareness, alignment, twist and plumb.
 - 2. Verify openings are in accordance with approved shop drawings.
- B. Installer's examination:
 - 1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
 - 2. Transmit two copies of installer's report to Architect within 24 hours of receipt.
 - 3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
 - 4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.2 INSTALLATION

- A. Install units in accordance with approved shop drawings and manufacturer's printed installation instructions; in addition, install steel components in accordance with HMMA 840.
- B. Oversize assemblies:
 - 1. Weld field joints in accordance with AWS D1.1 and approved shop drawings.
 - 2. Finish exposed field welds smooth; touch-up with rust inhibitive primer.
- C. Fill voids between concealed side of frame and adjacent wall construction with dense fiberglass or lightweight gypsum plaster in accordance with approved shop drawings or manufacturer's printed installation instructions.
- D. Finish surfaces having abrasion damage smooth; touch-up with rust inhibitive primer.
- E. Install glass & gasketing systems in accordance with manufacturer's printed instructions.
- F. Field painting is specified in Section 09 96 00 "High-Performance Coatings".

3.3 FIELD QUALITY CONTROL

- A. Engage and pay for the field services of manufacturer's authorized representative to:
 - 1. Inspect completed installation of the frame assemblies.
 - 2. Issue certified statement of compliance of installed frame assemblies to Architect- approved shop drawings.
- B. Engage and pay for the services of independent testing agency to:
 - 1. Test frame assemblies selected by Owner or Architect in accordance with ASTM E 336.
 - 2. Issue certified report-documenting compliance of installed frame assemblies to specified acoustical performance requirements.

- C. Notify Architect a minimum of seven (7) calendar days prior to scheduled testing dates.

3.4 MAINTENANCE

- A. Instruct the Owner's Maintenance Personnel regarding the proper operation and maintenance of these Noise Control Windows.

END OF SECTION 08 65 30

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Intent: The intent of this Section is to provide finish hardware for the proper operation and control of all wood, hollow metal, and aluminum doors in the Project. Prior to bidding, notify the Architect of any doors that do not have hardware meeting this intention.
- B. This Section includes, but is not necessarily limited to furnishing and installing complete, the following:
 - 1. Finish hardware for proper operation, function, control and protection of all doors, as required.
- C. Related Sections:
 - 1. Section 08 11 13 "Hollow Metal Doors and Frames"
 - 2. Section 08 11 19 "Stainless Steel Doors and Frames"
 - 3. Section 08 33 23 "Overhead Coiling Doors"
 - 4. Section 08 33 26 "Overhead Coiling Grilles"
 - 5. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts"
 - 6. Division 28 Physical Access Control System Section

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Extended Producer Responsibility
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) List of related door devices specified in other Sections for each door and frame.
2. Wiring Diagrams: For electrified hardware items specified for this Project, Provide complete wiring diagrams along with riser drawings and elevations, showing locations where such material is to be installed. Wiring Diagrams shall be submitted with Hardware Schedule. Verify and coordinate with the electrical systems installer.
 - a. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Architectural Hardware Consultant.
- B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Warranty: Special warranty specified in this Section.

- D. Florida Building Code: Provide Miami-Dade Notice of Authorization (NOA) if required by authority having jurisdiction. Engineering Reports that opening meet requirement for wind load, water infiltration and impact as required in FBC.

1.5 CLOSEOUT SUBMITTALS

- A. Operations and Maintenance Data: Provide two copies in accordance with Division 01 and include:
1. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 2. Catalog pages for each product.
 3. Name, address, and phone number of local representative for each manufacturer.
 4. Parts list for each product. Final approved hardware schedule, edited to reflect conditions as-installed.
 5. Final keying schedule
 6. Copies of floor plans with keying nomenclature
 7. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 8. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 9. Any specialized tools needed to maintain the hardware.

1.6 QUALITY ASSURANCE

- A. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
1. For door hardware, an Architectural Hardware Consultant (AHC).
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- G. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Requirements for keyways provided in permanent cores.
 - 2. Requirements for access control.
 - 3. Address and schedule for delivery of permanent cores.
- H. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Review sequence of operation for each type of electrified door hardware.
 - 4. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Exit Devices: Three years from date of Substantial Completion.
 - b. Locksets: Five years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware.
 - b. Hager.
 - c. Bommer Industries, Inc.
 2. Requirements:
 - a. Exterior out-swinging door butts shall be stainless steel and shall have stainless steel hinge pins. All doors to have non-rising pins.
 - b. Hinges shall be sized in accordance with the following:
 - 1) Height:
 - a) Doors up to 41" wide: 4-1/2" inches.
 - b) Doors 42" to 48" wide: 5 inches.
 - c. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - d. Number of Hinges: Furnish 3 hinges per leaf to 7'-6" in height. Add one hinge for each additional 30 inches of height.

2.3 CONTINUOUS HINGES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. IVES Hardware.
 2. Markar.
 3. Pemko.
- B. Requirements:
 1. Aluminum Geared

- a. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
- b. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.

2.4 ELECTRIC POWER TRANSFERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Von Duprin EPT.
 2. Securitron CEPT
- B. Requirements:
 1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
 2. Power transfer hinges are not allowed.

2.5 PIVOTS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. IVES Hardware.
 2. Rixson.
 3. Dorma.
- B. Requirements:
 1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
 2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
 3. Provide appropriate model where pivot sets are scheduled at fire rated openings.

2.6 FLUSH BOLTS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Ives Hardware.
 2. Burns.
 3. Rockwood.

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. For doors over 90 inches in height increase top rods by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

2.7 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
- C. Lock Backset: 2-3/4 inches, unless otherwise indicated.
- D. Lock Trim:
 1. Operating Device: Lever with 2 1/8" diameter roses.
 2. All inside thumb pieces are to have ADA thumbturns.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- F. Electronic Options: Provide electronic locks where specified. Electronic locks are to incorporate a request to exit switch (REX) in the lever.
- G. Mortise Locks: BHMA A156.13; Grade 1; stamped steel case with steel or brass parts; Series 1000.
 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Corbin Russwin ML2000 Series; an ASSA Abloy company.
 - b. Marks Series 5; a Marks USA company.

2.8 COMBINATION LOCKS

- A. Lock Functions: As indicated in door hardware schedule.
- B. Rim Device: FF-L-2890 compliant.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. LOCKMASTERS, INC.

2. No Substitutions – Owner Standard.

2.9 ELECTRONIC STRIKES

- A. Provide electric strikes designed for use with type of locks shown at each opening.
- B. Where required, provide electric strikes UL Listed for fire doors and frames.
- C. Provide fail-secure type electric strikes, unless specified otherwise.
- D. Coordinate voltage and provide transformers and rectifiers for each strike as required.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HES 8500 Series; an ASSA Abloy Company.

2.10 MAGNETIC LOCKS

- A. Surface Magnetic Locks: ANSI/BHMA A156.23.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Schlage Electronics; an Allegion company.
 - b. Securitron; an ASSA Abloy Company.
- B. Magnetic locks to include minimum holding force of 1200 LBF. Provide magnetic locks equipped with SPDT Magnetic Bond Sensing device, where specified, to monitor whether sufficient magnetic holding force exists to ensure adequate locking and SPDT Door Status Monitor device, where specified, to monitor whether door is open or closed. Provide bond sensors fully concealed within electromagnet to resist tampering or damage.
- C. Provide fasteners, mounting brackets, and spacer bars required for mounting and details.
- D. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of magnetic locks for each individual leaf. Switches control both doors simultaneously at pairs. Locate controls as directed by Architect.

2.11 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Von Duprin 35A/98 Series; an Allegion company.
 - b. No Substitutions – Owner Standard.
 2. Additional Requirements:

- a. Strikes: Rim and surface vertical rods are to be provided with roller strikes. Devices without roller strikes will not be acceptable. Provide manufacturers standard strike for concealed vertical rod devices.
- b. Touchpad is to extend minimum of one half of door width, but not the full length of exit device rail.
- c. Provide flush, tapered end-cap with two-point attachment to door.
- d. All non-rated exit devices on exterior doors shall incorporate cylinder dogging. Exit devices with access control are to be supplied less dogging.
- e. Thru-bolting is not recommended provided the door is specified with proper reinforcement to accept surface mounted exit device.
- f. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
- g. Where lever trim is provided it is to be break-away type.
- h. Provide electrical options as scheduled.

2.12 LOCK CYLINDERS

- A. Lock Cylinders: BHMA A156.5; Grade 1. Tumbler type, constructed from brass or bronze.
 - 1. Cylinders and cores are to be furnished and supplied into the Owner's existing Corbin Russwin large format 6 pin removable core key system with L4 keyway.
 - 2. O-bitted cores are to be provided to the Owner for keying.
 - 3. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a. 12 construction change (day) keys.

2.13 KEYING

- A. Keying System:
 - 1. Owner will perform keying of lock and cylinders.
 - 2. Stamping: Permanently inscribe each key with a visual key control number and include the following notation: "DO NOT DUPLICATE."
- B. Quantity: In addition to one extra key blank for each lock, provide the following:
 - 1. Cylinder Change Keys: Three.
 - 2. Permanent Control Keys: Three.
 - 3. Interchagable Core Construction Keys: Twelve.

2.14 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; brass or stainless steel, unless otherwise indicated.
 - 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. IVES Hardware; an Allegion company.

- b. Rockwood Manufacturing Company.
- c. Trimco.

2.15 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Provide bar type coordinating devices surface applied to the underside of the stop at the frame head.
 - 1. Coordinators to be prime coat to receive same finish paint as the door frame.
 - 2. Provide filler bar of the correct length to span the entire width of the opening. Provide appropriate brackets for parallel arm closers and surface vertical rod panics.
- B. Astragals: BHMA A156.22.

2.16 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Parallel arm closers to have forged steel forearms. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LCN 4040XP Series; an Allegion company.
 - b. No Substitutions – Owner Standard.
 - 2. Additional requirements:
 - a. All Closers UL Certified to be in compliance with UBC 7.2 and UL 10C.
 - b. Door closer cylinders shall be of high strength cast construction to provide low wear operating capabilities of internal parts throughout the life of the installation.
 - c. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce possible clogging from particles within the closer. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck. Backcheck shall be properly located so as to effectively slow the swing of the door at a minimum of 10 degrees in advance of the dead stop location to protect the door frame and hardware from damage.
 - d. Closers with pressure relief valves will not be acceptable.
 - e. Closer cylinders, arms, adapter plates, and metal covers shall have a powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117.
 - f. Coordinate closer installation with overhead stop where required, provide special templates if required by manufacturer.
 - g. Provide brackets or plates required for proper Installation of door closers.

2.17 Automatic operators

- A. Low energy automatic operators: BHMA A156.19.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LCN Senior Swing
 - b. Horton 4000LE Series.
 - 2. Requirements:
 - a. Provide low energy automatic operator electro mechanical units complying with ANSI A156.19.
 - b. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
 - c. Provide drop plates, brackets, or adapters for arms as required for details.
 - d. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
 - e. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, presence detector input, which prevents closed door from opening or door that is fully opened from closing, hold open toggle input, which allows remote activation for indefinite hold open and close second time input is activated, vestibule inputs, which allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.18 DOOR STOPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. IVES Hardware; an Allegion company.
 - 2. Rockwood Manufacturing Company.
 - 3. Trimco.
- B. Provide wall stops wherever possible. Provide convex type.
- C. Provide floor stops only where specified.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:

1. Glynn-Johnson
2. Rixson

B. Requirements:

1. Provide heavy duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop.
2. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.20 Door Gasketing

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products.
 - b. Zero Manufacturing.
 - c. Reese Weatherstripping

2.21 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products.
 - b. Zero Manufacturing.
 - c. Reese Weatherstripping

2.22 SILENCERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. IVES Hardware; an Allegion company.
 2. Rockwood Manufacturing Company.
 3. Trimco.
- B. Requirements:
1. Provide "push-in" type silencers for hollow metal or wood frames.
 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
 3. Omit where gasketing is specified

2.23 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. IVES Hardware; an Allegion company.
 - b. Rockwood Manufacturing Company.
 - c. Trimco.
 - 2. Additional Requirements:
 - a. All protective plates are to be beveled on all four edges and have countersunk screw holes.

2.24 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
 - 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. IVES Hardware; an Ingersoll-Rand company.
 - b. Rockwood Manufacturing; an ASSA Abloy company.
 - c. Trimco.

2.25 DOOR POSITION SWITCHES

- 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. Sentrol 2700 Series High Security Concealed Magnetic Contacts.
- B. Requirements:
 - 1. Provide surface mount switches on secure side of door.

2.26 POCKET DOOR HARDWARE

- 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. Brio; an Allegion company.

2.27 FABRICATION

- A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with

commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.28 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Owner will replace construction cores with permanent cores after acceptance.
- E. Thresholds: Set thresholds for doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Contractor to instruct owner's personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SCHEDULE

- A. The hardware sets listed below represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process.

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DOOR HARDWARE

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HARDWARE SET: EAC-01
NOT USED:

HARDWARE SET: EAC-02
NOT USED:

HARDWARE SET: EAC-03
NOT USED:

HARDWARE SET: EAC-03A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET	626	IVE
2	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-HH-98-L-E996-06-FSE-CON	630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
	EA	SURFACE CLOSER	4040 EDA SRI	689	LCN
1	EA	CUSH SHOE SUPPORT	SRI 4040-30	689	LCN
1	EA	BLADE STOP SPACER	SRI 4040-61	689	LCN
1	EA	FIRE/LIFE HOLDER	SEM 7820	689	LCN
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER
WEATHERSTRIP/ASTRAGAL BY DOOR
SUPPLIER

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ENTRY VIA VALID CARD READ. PANICS
MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA KEYSWITCH. ALWAYS FREE
FOR EGRESS.

HARDWARE SET: EAC-04

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE

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4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
1	EA	DELAYED PANIC HARDWARE	HH-98-EO-SNB-CON	630	VON
1	EA	ELEC DELAYED PANIC HARDWARE	HH-98-L-E996-03 SS-FSE-630-CON	630/630	VON
3	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	CUSH SHOE SUPPORT	4040-30	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
1	EA	MULLION SEAL	8780N	N	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER
WEATHERSTRIP/ASTRAGAL BY DOOR
SUPPLIER

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CARD READ
ALLOWS ENTRY FROM PULL SIDE. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN
PUSH PAD IS DEPRESSED.

HARDWARE SET: EAC-04A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	DELAYED PANIC HARDWARE	CX-HH-3547A-EO	626	VON
2	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	CUSH SHOE SUPPORT	4040-30	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER

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4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)	SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630 SEN
1	EA		POWER SUPPLY BY ACCESS CONTROL PROVIDER	
	EA	NOTE	WEATHERSTRIP/ASTRAGAL BY DOOR SUPPLIER	

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED, EXIT ONLY. ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM. ALARM MUST RESET AT THE OPENING.

DPS WHEN REQUIRED BY DIVISION 28.

HARDWARE SET: EAC-04B
NOT USED:

HARDWARE SET: EAC-05
NOT USED:

HARDWARE SET: EAC-07
NOT USED:

HARDWARE SET: EAC-08
NOT USED:

HARDWARE SET: EAC-09

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET	626	IVE
2	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040-30	689	LCN
1	EA	BLADE STOP SPACER	4040-61	689	LCN
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
	EA	NOTE	WEATHERSTRIP/ASTRAGAL BY DOOR SUPPLIER		

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OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ALWAYS FREE FOR EGRESS FROM ROOF.

HARDWARE SET: EAM-01
NOT USED:

HARDWARE SET: EAM-02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
2	EA	PANIC HARDWARE	HH-LD-9847-L-SNB	630	VON
2	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	90 DEG OFFSET PULL	8190HD 12" O	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	CUSH SHOE SUPPORT	4040-30	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
	EA	NOTE	WEATHERSTRIP/ASTRAGAL BY DOOR SUPPLIER		

HARDWARE SET: EAM-03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	ELEC PANIC HARDWARE	HH-LD-9847-L-SNB-CON	630	VON
2	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	CUSH SHOE SUPPORT	4040-30	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

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DOOR HARDWARE

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EA NOTE

WEATHERSTRIP/ASTRAGAL BY DOOR
SUPPLIER
CARD READER BY ACCESS CONTROL
PROVIDER.
POWER SUPPLY BY ACCESS
CONTROL PROVIDER.

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. VALID CARD READER ALLOWS ENTRY
FROM PULL SIDE. ALWAYS FREE EGRESS.

HARDWARE SET: EAM-04
NOT USED:

HARDWARE SET: EAM-05
NOT USED:

HARDWARE SET: EAM-06
NOT USED:

HARDWARE SET: EHC-01

EACH TO HAVE:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-HH-98-EO-F-SNB-CON	630	VON
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-QEL-HH-98-L-NL-F-03 SS-630- CON	630/630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

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CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ENTRY VIA VALID CARD READ. ALWAYS
FREE FOR EGRESS.

HARDWARE SET: EHC-01A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-HH-98-EO-SNB-CON	630	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-HH-98-L-NL-03 SS-630-CON	630/630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
2	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ENTRY VIA VALID CARD READ. ALWAYS
FREE FOR EGRESS.

HARDWARE SET: EHC-01B
NOT USED:

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HARDWARE SET: EHC-02
NOT USED:

HARDWARE SET: EHC-03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-QEL-HH-98-L-NL-F-03 SS-630-CON	630/630	VON
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: EHC-03A
NOT USED:

HARDWARE SET: EHC-04
NOT USED:

HARDWARE SET: EHC-05

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON

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1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
1	EA	DELAYED PANIC HARDWARE	CX-HH-98-EO-SNB-CON	630	VON
1	EA	ELEC DELAYED PANIC HARDWARE	CX-HH-98-L-E996-03 SS-FSE-630-CON	630/630	VON
3	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-05A

EACH TO HAVE:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	DELAYED PANIC HARDWARE	CX-HH-9847-EO-SNB-CON	630	VON
1	EA	ELEC DELAYED PANIC HARDWARE	CX-HH-9847-L-E996-03 SS-FSE-630-CON	630/630	VON
2	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
2	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER

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1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
1	EA	POWER SUPPLY	PS904 900-4R-FA CARD READER BY ACCESS CONTROL PROVIDER POWER SUPPLY BY ACCESS CONTROL PROVIDER	LGR	VON

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-05B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
2	EA	DELAYED PANIC HARDWARE	CX-HH-98-EO-SNB-CON	630	VON
3	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
			CARD READER BY ACCESS CONTROL PROVIDER WHERE SHOWN ON TS DRAWINGS POWER SUPPLY BY ACCESS CONTROL PROVIDER		

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DOOR HARDWARE

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OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, NO ENTRY. PUSH SIDE - ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-05C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954	689	VON
1	EA	ELEC DELAYED FIRE EXIT HARDWARE	CX-HH-9847-L-F-E996-03 SS-FSE-630-CON	630/630	VON
1	EA	DELAYED FIRE EXIT HARDWARE	CX-HH-98-EO-F-SNB-CON	630	VON
3	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-06

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR

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HNTB Corporation

17 June 2022

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3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC DELAYED PANIC HARDWARE	CX-HH-98-L-E996-03 SS-FSE-630-CON	630/630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
CARD READER BY ACCESS CONTROL PROVIDER POWER SUPPLY BY ACCESS CONTROL PROVIDER					

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-06A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	DELAYED PANIC HARDWARE	CX-HH-98-EO-SNB-CON	630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

1 EA POWER SUPPLY BY ACCESS
CONTROL PROVIDER

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, NO ENTRY. PUSH SIDE - ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: EHC-07

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL	(APPLY TO ASTRAGAL) BY DOOR MANUFACTURER	630	
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER

HARDWARE SET: EHC-07A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R

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1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	485A	A	ZER
1	EA	ASTRAGAL	BY DOOR MANUFACTURER	630	
2	EA	DOOR BOTTOM	361AA6-Z49	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: EHC-08

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: EHC-08A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON

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1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	485A	A	ZER
1	EA	DOOR BOTTOM	360AA6-Z49	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: EHC-09
NOT USED:

HARDWARE SET: EHC-10
NOT USED:

HARDWARE SET: EHC-10A
NOT USED:

HARDWARE SET: EHC-10B
NOT USED:

HARDWARE SET: EHC-11

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

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PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER

HARDWARE SET: EHC-11A
NOT USED:

HARDWARE SET: EHC-12

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	ASTRAGAL SET	555AA X 55AA	AA	ZER
2	EA	DOOR BOTTOM	361AA6	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN SHIELD	141AA	AA	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL
PROVIDER
POWER SUPPLY BY ACCESS
CONTROL PROVIDER

HARDWARE SET: EHM-01

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	PANIC HARDWARE	CD-9849-L-DT-03 SS-630-249-LBL	630/630	VON
1	EA	PANIC HARDWARE	CD-9849-L-NL-03 SS-630-249-LBL	630/630	VON
2	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R

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1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SHCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER

HARDWARE SET: EHM-02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
2	EA	PANIC HARDWARE	HH-LD-98-L-03 SS-630	630/630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

WHERE REQUIRED ON TS DRAWINGS

HARDWARE SET: EHM-02A
NOT USED:

HARDWARE SET: EHM-02B
NOT USED:

HARDWARE SET: EHM-02C
NOT USED:

HARDWARE SET: EHM-03
NOT USED:

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HARDWARE SET: EHM-04
NOT USED:

HARDWARE SET: EHM-04A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
2	EA	PANIC HARDWARE	HH-98-EO-SNB	630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	485A	A	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR BOTTOM	360AA6-Z49	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

HARDWARE SET: EHM-05
NOT USED:

HARDWARE SET: EHM-06
NOT USED:

HARDWARE SET: EHM-06A
NOT USED:

HARDWARE SET: EHM-07
NOT USED:

HARDWARE SET: EHM-07A
NOT USED:

HARDWARE SET: EHM-08
NOT USED:

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HARDWARE SET: EHM-08A
NOT USED:

HARDWARE SET: EHM-08B
NOT USED:

HARDWARE SET: EHM-08C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP ST-1630	689	LCN
1	EA	GASKETING	429A	A	ZER
1	EA	GASKETING	488S-BK (APPLY TO ASTRAGAL)	S-BK	ZER
1	EA	ASTRAGAL	BY DOOR MANUFACTURER	630	
2	EA	DOOR BOTTOM	361AA6	AA	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN SHIELD	141AA	AA	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH (WHEN REQUIRED ON TS DRAWINGS)	630	SEN

HARDWARE SET: EHM-08D
EACH TO HAVE:

HARDWARE SET: EHM-09

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

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1	EA	GASKETING	429A
1	EA	DOOR SWEEP	39A
1	EA	THRESHOLD	656A-MSLA-10
1	EA	RAIN DRIP	142A

A	ZER
A	ZER
A	ZER
A	ZER

HARDWARE SET: EHM-09A
NOT USED:

HARDWARE SET: EHM-10
NOT USED:

HARDWARE SET: EHM-11
NOT USED:

HARDWARE SET: EHM-11A
NOT USED:

HARDWARE SET: EHM-12
NOT USED:

HARDWARE SET: EHM-13
NOT USED:

HARDWARE SET: EHM-14
NOT USED:

HARDWARE SET: EHM-15
NOT USED:

HARDWARE SET: EHM-16

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	ENTRANCE LOCK	ML2053 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	656A-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER

HARDWARE SET: IHC-01

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-EO-F-CON	630	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-98-L-NL-F-03 SS-630-CON	630/630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	MULLION SEAL	8780N	N	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
			CARD READER BY ACCESS CONTROL PROVIDER		
			POWER SUPPLY BY ACCESS CONTROL PROVIDER		

HARDWARE SET: IHC-02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954	689	VON
2	EA	FIRE/LIFE WALL MAG	PRACTICAL? SEM7850	689	LCN
1	EA	ELEC PANIC HARDWARE	98-EO-CON	630	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-L-SS-630-CON	630/630	VON

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1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: IHC-03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-98-L-NL-F-03 SS-630-CON	630/630	VON
1	EA	OH STOP	90S (WHERE WALL STOP IS NOT PRACTICAL)	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: IHC-04
NOT USED:

HARDWARE SET: IHC-05
NOT USED:

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HARDWARE SET: IHC-06

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	CX-9875-L-F-E996-03 SS-FSE-630-SS7500-CON	630/630	VON
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
		CARD READER BY ACCESS CONTROL PROVIDER (WHEN REQUIRED BY TS DRAWINGS)			
		POWER SUPPLY BY ACCESS CONTROL PROVIDER (WHEN REQUIRED BY TS DRAWINGS)			

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: IHC-06A
NOT USED:

HARDWARE SET: IHC-06B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	CX-98-L-F-03 SS-630-CON	630/630	VON
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

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1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
		CARD READER BY ACCESS CONTROL PROVIDER (WHEN REQUIRED BY TS DRAWINGS)			
		POWER SUPPLY BY ACCESS CONTROL PROVIDER (WHEN REQUIRED BY TS DRAWINGS)			

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, KEY ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: IHC-07
NOT USED:

HARDWARE SET: IHC-07A
NOT USED:

HARDWARE SET: IHC-07B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	TWO PT EU MORT LOCK	LM9295EUL 03A LBL	630	SCH
2	EA	SURFACE CLOSER	4040XP CUSH MC	MTLPC	LCN
2	EA	FIRE/LIFE HOLDER	4040SEH	689	LCN
2	EA	SILENCER	SR64	GRY	IVE
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
		CARD READER BY ACCESS CONTROL PROVIDER			
		POWER SUPPLY BY ACCESS CONTROL PROVIDER			

OPERATION: DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY/EXIT. NOT AN EGRESS DOOR.

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HARDWARE SET: IHC-07C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	DELAYED FIRE EXIT HARDWARE	CX-9847-EO-F-LBR-CON	630	VON
1	EA	ELEC DELAYED FIRE EXIT HARDWARE	CX-9847-L-F-LBR-E996-03 SS-FSE-630-CON	630/630	VON
2	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FIRE/LIFE HOLDER	4040SEH	689	LCN
1	EA	GASKETING	488S-BK	S-BK	ZER
2	EA	ASTRAGAL SET	8193AA	AA	ZER
4	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
2			CARD READER BY ACCESS CONTROL PROVIDER		
1	EA		POWER SUPPLY BY ACCESS CONTROL PROVIDER		

OPERATION: PULL SIDE - DOOR NORMALLY CLOSED AND LOCKED, VALID CARD READ ALLOWS ENTRY. PUSH SIDE - VALID CARD READ TEMPORARILY DISABLES CX DEVICE ALLOWING EGRESS. WITHOUT VALID CARD READ ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM. HOLD OPEN TO INTERFACE WITH SECURITY AND FIRE SYSTEM.

HARDWARE SET: IHC-08
NOT USED:

HARDWARE SET: IHC-08A
NOT USED:

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HARDWARE SET: IHC-08B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	CX-98-EO-F-CON	630	VON
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
2	EA	WIRE HARNESS	CON (VERIFY LENGTH AND QUANTITY REQUIRED)		SCH
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
1	EA		POWER SUPPLY BY ACCESS CONTROL PROVIDER		

OPERATION: DOOR NORMALLY CLOSED AND LOCKED, EXIT ONLY. ALARM WILL SOUND WHEN PUSH PAD IS DEPRESSED, THE DEVICE WILL PREVENT EGRESS FOR 15 SECONDS OR LESS. DEVICE WILL DISARM IMMEDIATELY UPON FIRE ALARM.

HARDWARE SET: IHC-09
NOT USED:

HARDWARE SET: IHC-10
NOT USED:

HARDWARE SET: IHC-11
NOT USED:

HARDWARE SET: IHC-12
NOT USED:

HARDWARE SET: IHC-13
NOT USED:

HARDWARE SET: IHC-14
NOT USED:

HARDWARE SET: IHC-15
NOT USED:

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HARDWARE SET: IHC-16
NOT USED:

HARDWARE SET: IHC-17
NOT USED:

HARDWARE SET: IHC-17A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438	626	IVE
			(WHERE WALL STOP IS NOT FEASIBLE)		
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	485A	A	ZER
1	EA	DOOR BOTTOM	360AA6-Z49	AA	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: IHC-18
NOT USED:

HARDWARE SET: IHC-19

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R

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1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
CARD READER BY ACCESS CONTROL PROVIDER					
POWER SUPPLY BY ACCESS CONTROL PROVIDER					

HARDWARE SET: IHC-19A
NOT USED:

HARDWARE SET: IHC-19AB

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438	626	IVE
(WHERE WALL STOP IS NOT COMPATIBLE)					
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	485A	A	ZER
1	EA	DOOR BOTTOM	360AA6-Z49	AA	ZER
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN
CARD READER BY ACCESS CONTROL PROVIDER					
POWER SUPPLY BY ACCESS CONTROL PROVIDER					

HARDWARE SET: IHC-19B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	BY SOUND DOOR SUPPLIER		

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1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SOUND SEALS	BY DOOR/FRAME SUPPLIER		
1	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

NOTE: STC RATED DOOR ASSEMBLY. COORDINATE HARDWARE REQUIREMENTS WITH DOOR MANUFACTURER.

HARDWARE SET: IHC-20
NOT USED:

HARDWARE SET: IHC-21
NOT USED:

HARDWARE SET: IHC-22
NOT USED:

HARDWARE SET: IHC-23
NOT USED:

HARDWARE SET: IHC-23A
NOT USED:

HARDWARE SET: IHC-23B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R

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1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
2	EA	ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS438	626	IVE
(WHERE WALL STOP IS NOT PRACTICAL)					
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: IHC-23C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	FAIL SECURE EL LOCK	ML20906 LWM SEC M92 CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
2	EA	ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS438	626	IVE
(WHERE WALL STOP IS NOT PRACTICAL)					
1	EA	GASKETING	488S-BK	S-BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

CARD READER BY ACCESS CONTROL PROVIDER
POWER SUPPLY BY ACCESS CONTROL PROVIDER

HARDWARE SET: IHM-01 NOT USED:

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HARDWARE SET: IHM-02
NOT USED:

HARDWARE SET: IHM-03
NOT USED:

HARDWARE SET: IHM-04
NOT USED:

HARDWARE SET: IHM-04A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	PANIC HARDWARE	9849-EO-249-LBL	630	VON
1	EA	PANIC HARDWARE	9849-L-NL-03 SS-630-249-LBL	630/630	VON
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
2	EA	ASTRAGAL SET	8193AA	AA	ZER
2	EA	DOOR POSITION SWITCH	2757 SWITCH	630	SEN

HARDWARE SET: IHM-05
NOT USED:

HARDWARE SET: IHM-06
NOT USED:

HARDWARE SET: IHM-07
NOT USED:

HARDWARE SET: IHM-08
NOT USED:

HARDWARE SET: IHM-09
NOT USED:

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HARDWARE SET: IHM-09A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
2	EA	FIRE EXIT HARDWARE	9849-EO-F-249-LBL	630	VON
1	EA	IC RIM CYLINDER	3080 CT6R	630	C-R
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER

HARDWARE SET: IHM-10
NOT USED:

HARDWARE SET: IHM-11
NOT USED:

HARDWARE SET: IHM-12
NOT USED:

HARDWARE SET: IHM-13
NOT USED:

HARDWARE SET: IHM-15
NOT USED:

HARDWARE SET: IHM-16
NOT USED:

HARDWARE SET: IHM-17

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN

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1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK (AT RATED OPENINGS)	S-BK	ZER
3	EA	SILENCER	SR64 (AT NON-RATED OPENINGS)	GRY	IVE
1	EA	DOOR POSITION SWITCH	2757 SWITCH (WHEN REQUIRED ON TS DRAWINGS)	630	SEN

HARDWARE SET: IHM-18

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK (AT RATED OPENINGS)	S-BK	ZER
3	EA	SILENCER	SR64 (AT NON-RATED OPENINGS)	GRY	IVE
1	EA	DOOR POSITION SWITCH	2757 SWITCH (WHEN REQUIRED ON TS DRAWINGS)	630	SEN

HARDWARE SET: IHM-19

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438 (WHERE REQUIRED)	626	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK (AT RATED OPENINGS)	S-BK	ZER
3	EA	SILENCER	SR64 (AT NON-RATED OPENINGS)	GRY	IVE

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HARDWARE SET: IHM-20
NOT USED:

HARDWARE SET: IHM-20A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW NRP (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	OH STOP	90S (WHERE WALL STOP IS NOT COMPATIBLE)	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: IHM-21
NOT USED:

HARDWARE SET: IHM-22
NOT USED:

HARDWARE SET: IHM-23
NOT USED:

HARDWARE SET: IHM-24

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	STOREROOM LOCK	ML2057 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
2	EA	OH STOP & HOLDER	90H	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
2	EA	ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

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HARDWARE SET: IHM-25
NOT USED:

HARDWARE SET: IHM-26
NOT USED:

HARDWARE SET: IHM-27
NOT USED:

HARDWARE SET: IHM-28
NOT USED:

HARDWARE SET: IHM-29
NOT USED:

HARDWARE SET: IHM-30
NOT USED:

HARDWARE SET: IHM-31
NOT USED:

HARDWARE SET: IHM-32
NOT USED:

HARDWARE SET: IHM-33
NOT USED:

HARDWARE SET: IHM-34

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	CLASSROOM LOCK	ML2055 LWM CT6R	630	C-R
1	EA	PERMANENT CORE	8000	626	C-R
1	EA	COORDINATOR	COR X FL	628	IVE

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1	EA	OH STOP & HOLDER	90H (WHERE DOOR DOES NOT RETURN TO WALL)	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP/HOLDER	FS495	626	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL SET	8193AA	AA	ZER

HARDWARE SET: IHM-35
 NOT USED:

HARDWARE SET: IHM-36
 NOT USED:

HARDWARE SET: IHM-37
 NOT USED:

HARDWARE SET: IHM-38
 NOT USED:

HARDWARE SET: IHM-39
 NOT USED:

HARDWARE SET: IHM-39A
 NOT USED:

HARDWARE SET: IHM-40
 NOT USED:

HARDWARE SET: IHM-41
 NOT USED:

HARDWARE SET: IHM-42
 NOT USED:

HARDWARE SET: IHM-43
 NOT USED:

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HARDWARE SET: IHM-44
NOT USED:

HARDWARE SET: IHM-45
NOT USED:

HARDWARE SET: IHM-46
NOT USED:

HARDWARE SET: IHM-47
NOT USED:

HARDWARE SET: IHM-48
NOT USED:

HARDWARE SET: IHM-49
NOT USED:

HARDWARE SET: IHM-50
NOT USED:

HARDWARE SET: IHM-51
NOT USED:

HARDWARE SET: IHM-52
NOT USED:

HARDWARE SET: IHM-53
NOT USED:

HARDWARE SET: IHM-54

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	PRIVACY LOCK	ML2030 LWA X LWM M19V	630	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

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DOOR HARDWARE

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1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
			(AT RATED DOORS)		
3	EA	SILENCER	SR64	GRY	IVE
			(AT NON-RATED OPENINGS)		

HARDWARE SET: IHM-55
 NOT USED:

HARDWARE SET: IHM-56
 NOT USED:

HARDWARE SET: IHM-57

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW (VERIFY TYPE AND QUANTITY REQUIRED)	652	IVE
1	EA	PASSAGE SET	ML2010 LWM	630	C-R
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
			(AT RATED OPENINGS)		
3	EA	SILENCER	SR64	GRY	IVE
			(AT NON-RATED OPENINGS)		

HARDWARE SET: IHM-58
 NOT USED:

HARDWARE SET: IHM-59
 NOT USED:

HARDWARE SET: IHM-60
 NOT USED:

HARDWARE SET: IHM-61
 NOT USED:

HARDWARE SET: IHM-62
 NOT USED:

ORLANDO INTERNATIONAL AIRPORT
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Terminal C, Phase 1X
Airside Concourse

DOOR HARDWARE

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HARDWARE SET: IHM-63
NOT USED:

HARDWARE SET: IHM-64
NOT USED:

HARDWARE SET: IHM-65
NOT USED:

HARDWARE SET: IHM-66
NOT USED:

HARDWARE SET: IHM-67
NOT USED:

HARDWARE SET: IHM-68

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	IC MORT. CYLINDER	1080 CT6R	630	C-R
2	EA	OH DOOR POSITION SWI	EDWARDS SIGNALIN 2207AU-L (WHERE REQUIRED BY TS DRAWINGS)	628	
1	EA	NOTE	REMAINDER OF HARDWARE BY DOOR SUPPLIER		

HARDWARE SET: IHM-69
NOT USED:

HARDWARE SET: IHM-70

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	REMAINDER OF HARDWARE BY DOOR SUPPLIER		
1	EA	NOTE	REFER TO DIVISION 28 FOR CONTROLS		

END OF SECTION 08 71 00

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HNTB Corporation

17 June 2022

SECTION 08 71 13 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Power door operators for swinging doors.
 - 2. Guide rails.
- B. Related Requirements:
 - 1. Section 08 11 13 "Hollow Metal Doors and Frames" for entrances furnished separately.
 - 2. Section 08 71 00 "Door Hardware" for hardware to the extent not specified in this Section.
 - 3. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for aluminum-framed entrances furnished separately.
 - 4. Division 26 Sections for electrical connections including conduit and wiring for automatic door operators.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- D. For automatic door terminology, see BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.3 COORDINATION

- A. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.
- B. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

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, dimensions of individual components and profiles, and finishes for automatic door operators.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. Shop Drawings: For automatic door operators.
 - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 - 2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Indicate locations of activation and safety devices.
 - 4. Include diagrams for power, signal, and control wiring.
 - 5. Include plans, elevations, sections, and attachment details for guide rails.
- D. Samples: For each exposed product and for each color and texture specified, manufacturer's standard size.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of automatic door operator.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Besam Entrance Solutions; ASSA ABLOY.
 - 2. DORMA USA, Inc.
 - 3. LCN; an Allegion brand.
 - 4. Stanley Access Technologies.
- B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
- C. Hinges: See Section 08 71 00 "Door Hardware" for hinge type for each door that door operator shall accommodate.
- D. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch-thick, extruded or formed aluminum; manufacturer's standard width; continuous over full width of operator-controlled door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

- E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER DOOR OPERATORS

- A. Standard: BHMA A156.10.
- B. Performance Requirements:
 - 1. Opening Force:
 - a. Power-Operated Swinging Doors: Not more than 30 lbf required to manually open door if power fails.
 - 2. Entrapment-Prevention Force: Not more than 40 lbf required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf required to prevent stopped door from moving in direction of closing.
- C. Configuration: Operator to control single swinging door.
 - 1. Traffic Pattern: Two way.
 - 2. Operator Mounting: Surface.
- D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.
- E. Operating System: Electromechanical.
- F. Microprocessor Control Unit: Solid-state controller.
- G. Features:
 - 1. Adjustable opening and closing speed.
 - 2. Adjustable opening and closing force.
 - 3. Adjustable backcheck.
 - 4. Adjustable hold-open time from zero to 30 seconds.
 - 5. Adjustable time delay.
 - 6. Adjustable acceleration.
 - 7. Adjustable limit switch.
 - 8. Obstruction recycle.
 - 9. Automatic door re-open if stopped while closing.
 - 10. On-off/hold-open switch to control electric power to operator; key operated.
- H. Controls: Activation and safety devices according to BHMA standards.
 - 1. Activation Device: Push-plate switch on each side of door to activate door operator.
 - 2. Safety Device: Presence sensor mounted on door header to detect pedestrians in presence zone and to prevent door from closing.

- I. Exposed Finish: Baked-enamel or powder-coat finish matching door and frame.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221.
 - 2. Sheet: ASTM B 209.
- B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

- A. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed in plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- C. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- D. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- E. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.
 - 1. Configuration: Square push plate with 4-by-4-inch junction box.
 - a. Mounting: As indicated on Drawings.
 - 2. Configuration: Rectangular push plate with 2-by-4-inch junction box.
 - a. Mounting: As indicated on Drawings.
 - 3. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
 - 4. Message: International symbol of accessibility and "Push to Open."
- F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Form aluminum shapes before finishing.
- C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.
- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
- E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.7 ACCESSORIES

- A. Signage: As required by cited BHMA standard for type of door and its operation.
 - 1. Application Process: Operator manufacturer's standard process.
 - 2. Provide sign materials with instructions for field application when operators are installed.

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- 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 range of approved Samples and are assembled or installed to minimize contrast.

2.9 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before automatic door operator installation.
- D. Verify that full-height finger guards are installed at each door with pivot hinges where door has a clearance at hinge side greater than 1/4 inch and less than 3/4 inch with door in any position.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel.
- C. Access-Control System: Connect operators to access-control system as specified in Division 28.
- D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Owner will engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Automatic door operators will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 1. Adjust operators on exterior doors for weathertight closure.
- B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 08 71 13

SECTION 08 71 63 - DETENTION DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes detention door hardware for the following:
 - 1. Swinging detention doors.
 - 2. Sliding detention doors.
- B. Related Requirements:
 - 1. Section 08 34 63 "Detention Doors and Frames".

1.3 COORDINATION

- A. Templates: Obtain and distribute, to the parties involved, templates for detention doors, frames, and other work specified to be factory prepared for installing detention door hardware.

1.4 PREINSTALLATION MEETINGS

- A. Detention Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer. Incorporate detention keying conference decisions into Project's final Detention Keying Schedule after reviewing detention door hardware keying system including, but not limited to, the following:
 - 1. Preliminary key system schematic diagram.
 - 2. Requirements for key-control system.
 - 3. Requirements for access control.
 - 4. Address for delivery of keys.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Inspect and discuss power and control system roughing-in and other preparatory work performed by other trades.
 - 2. Review sequence of operation for each type of detention door hardware.
 - 3. Review and finalize a construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Certifying procedures.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of detention door hardware.
- B. Shop Drawings: For each type of detention door hardware.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Detention Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware as well as installation procedures and wiring diagrams. Coordinate the Detention Door Hardware Schedule with detention doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of detention door hardware.
 - 1. Integrate detention door hardware indicated in "Detention Door Hardware Schedule" Article into Project's final Detention Door Hardware Schedule and indicate complete designations of every item required for each detention door and opening.
 - 2. Keying Schedule: Coordinate detention keying with other door hardware in Project's final Keying Schedule.
 - 3. Indicate each detention lock and type of key cylinder using the following prefixes: "P" for paracentric, "M" for mogul, "HS" for high security, and "C" for commercial.
 - 4. Indicate security level of each item.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified supplier.
- B. Product Certificates: For each type of detention door hardware.
 - 1. Certify that detention door hardware complies with listed fire door assemblies.
- C. Product Test Reports: For each type of detention lock and latch, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Examination reports documenting inspections of substrates, areas, and conditions.
- E. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
- F. Field quality-control reports documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.
- G. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For detention door hardware to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Normal local security operation.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of detention door hardware.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and an authorized representative of detention door hardware manufacturer for installation and maintenance of units required for this Project.
- B. Supplier Qualifications: Detention door hardware supplier with warehousing facilities in Project's vicinity who is, or employs, a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about detention door hardware and keying.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inventory detention door hardware on receipt and provide secure lockup for detention door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the Detention Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver detention door keys to Owner by registered mail or overnight package service.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of detention door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and detention door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.

2. Warranty Period: Three years from date of Substantial Completion.
3. Warranty Period for Continuous-Pin Detention Hinges: 10 years from date of Substantial Completion.
4. Warranty Period for Security Door Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Swinging Detention Door Assemblies: Provide detention door hardware as part of a detention door assembly that complies with security grade indicated, when tested according to ASTM F 1450, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

2.2 DETENTION DOOR HARDWARE, GENERAL

- A. Provide detention door hardware for each door as scheduled in "Detention Door Hardware Schedule" Article to comply with requirements in this Section.
 1. Detention Door Hardware Sets: Provide quantity, item, size, finish, or color indicated.
- B. Source Limitations: Obtain mechanical detention door hardware from same manufacturer as that of electrically powered or pneumatic detention door hardware.
- C. Regulatory Requirements:
 1. Fire-Rated Detention Door Assemblies: Provide detention door hardware for 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.
 2. Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

2.3 DETENTION HINGES

- A. Full Mortise Detention Hinges: Cast steel or stainless steel, ball bearing, with pins made non-removable by a concealed hardened roll pin.
 1. Leaves: Drilled for countersunk security fasteners.
 2. Size: Minimum 4-1/2 by 4-1/2 by 0.188 inch.
 3. Security Grade: 4 according to ASTM F 1758.
 4. Finish: BHMA 600.
- B. Basis of Design Manufacturer: Provide Products by Southern Folger or approved manufacturer meeting all requirements.

2.4 MECHANICAL DETENTION LOCKS AND LATCHES

- A. Lock Mountings:

1. Hollow-Metal Detention Doors: Mount detention lock to back of 0.179-inch nominal-thickness steel cover plate for installation in lock pocket fabricated into detention door. Attach cover plate to hollow-metal detention door with security fasteners.
- B. Mechanical Deadlocks, Paracentric Cylinder:
 1. Function: Deadlocked in both locked and unlocked position; latchbolt retracted and extended by five-tumbler paracentric cylinder; keyed one side.
 2. Latchbolt: 2-inch-high by 3/4-inch-thick steel, with two case-hardened-steel insert pins; 3/4-inch throw; 1/2-inch bolt projection when retracted.
 3. Security Grade: 4 according to ASTM F 1577.
- C. Basis of Design Manufacturer: Provide Products by Southern Folger or approved manufacturer meeting all requirements.

2.5 DETENTION LOCK TRIM

- A. Levers: Solid stainless steel.
- B. Knobs: Stainless steel.
- C. Escutcheons for Paracentric Locks: 0.125-inch-thick, 3-inch-diameter stainless steel with BHMA 630 finish. Attach with security fasteners.
 1. Style: Single or double wing as required by lock function.
- D. Basis of Design Manufacturer: Provide Products by Southern Folger or approved manufacturer meeting all requirements.
 1. Style: Single or double wing as required by lock function.

2.6 DETENTION CYLINDERS AND KEYING

- A. Source Limitations: Subject to compliance with requirements, provide cylinders and keying for paracentric and mogul cylinders by same manufacturer as for detention locks and latches.
- B. Paracentric Cylinders: Manufacturer's standard lever-tumbler type, constructed from one-piece spring-tempered brass; with tumblers activated by phosphor bronze springs; five tumblers per lock.
- C. Keying System: Provide a factory-registered keying system complying with the following requirements:
 1. Paracentric cylinders operated by change keys only.
- D. Keys: Provide cast silicon-bronze copper alloy keys complying with the following:
 1. Stamping: Permanently inscribe each key with a visual key-control number and include the following notation:

- a. "DO NOT DUPLICATE."
- 2. Quantity: In addition to one extra blank key for each lock, provide the following:
 - a. Cylinder Change Keys: Three.

2.7 SECURITY DOOR CLOSERS

- A. Standard: BHMA A156.4, Grade 1.
 - 1. Certified Products: Provide security door closers listed in BHMA's "Directory of Certified Door Products."
- B. Surface-Mounted Security Door Closers:
 - 1. Arms: Minimum 3/8-inch- (9.5-mm-) thick by 1-1/8-inch- (29-mm-) wide, rectangular steel main arm; 5/16-inch- (8-mm-) thick by 1-inch- (25-mm-) wide, rectangular steel secondary arm; full rack-and-pinion type; fabricated with orbital-riveted, pinned, or welded elbow and arm shoe/soffit plate joints designed to prevent disassembly with ordinary hand tools.
 - 2. Cover: Heavy-duty metal, attached with four security fasteners.
 - 3. Mounting: Attach security door closer with security fasteners.
- C. Unit Size: Comply with manufacturer's written recommendations for size of security door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to comply with field conditions and requirements for opening force.
- D. Basis of Design Manufacturer: Provide Products by LCN or approved manufacturer meeting all requirements.

2.8 DETENTION DOOR STOPS

- A. Silencers for Detention Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 1/2-inch diameter; fabricated for drilled-in application to detention door frame. Attach with security fasteners.

2.9 MAGNETIC HOLD-OPENS

- A. Standard: BHMA 156.15
- B. Basis of Design Manufacturer: Provide Products by LCN or approved manufacturer meeting all requirements.

2.10 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

- B. Base Metals: Produce detention door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified detention door hardware units and BHMA A156.18 finishes.
- C. Fasteners: Provide flat-head security fasteners with finished heads to match surface of detention door hardware.
 - 1. Security Fasteners: Fabricate detention door hardware using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials.
 - 2. Concealed Fasteners: For detention door hardware units that are exposed when detention door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching detention door hardware. Where using through bolts on hollow-metal detention door and frame construction, provide sleeves for each through bolt.
 - 3. Steel Machine Screws: For the following fire-rated applications:
 - a. Mortise detention hinges to detention doors.
 - b. Strike plates to detention frames.
 - c. Security door closers to detention doors and frames.
 - 4. Spacers Bolts: For through bolting of hollow-metal detention doors.
- D. Detention Lock Construction: Fabricate detention lock case and cover plate from steel plate. Fabricate bolts from solid sections; laminated construction is unacceptable.

2.11 HARDWARE FINISHES

- A. Standard: Comply with BHMA A156.18.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.12 SECURITY FASTENERS

- A. Operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific fastener type. Provide drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
 - 1. Drive-System Type: Pinned Torx.
 - 2. Fastener Strength: 120,000 psi.
 - 3. Socket Button Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835.
 - b. Stainless steel, ASTM F 879, Group 1 CW.

4. Socket Flat Countersunk Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835.
 - b. Stainless steel, ASTM F 879, Group 1 CW.
5. Socket Head Cap Fasteners:
 - a. Heat-treated alloy steel, ASTM A 574.
 - b. Stainless steel, ASTM F 837, Group 1 CW.
6. Protective Coatings for Heat-Treated Alloy Steel:
 - a. Zinc and clear trivalent chromium where indicated.
 - b. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine detention doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention door hardware connections before detention door hardware installation.
- C. Inspect built-in and cast-in anchor installations, before installing detention door hardware, to verify that anchor installations comply with requirements. Prepare inspection reports.
 1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
 2. Perform additional inspections to determine compliance of replaced or additional work.
- D. Verify locations of detention door hardware with those indicated on Shop Drawings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Detention Doors and Frames: Comply with BHMA A156.115 Series.
 1. Surface-Applied Detention Door Hardware: Drill and tap detention doors and frames according to SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount detention door hardware units at heights indicated in DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
- B. Install each detention door hardware item to comply with Shop Drawings and manufacturer's written instructions. Where cutting and fitting are required to install detention door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinge Installation:
 - 1. Welding: Where indicated, weld hinges to detention doors and frames with continuous fillet weld around three sides of hinge perimeter.
 - 2. Security Fasteners: Provide socket flat countersunk head machine screws; finish screw heads to match surface of detention hinges. Install into drilled and tapped holes.
- D. Security Fasteners: Install detention door hardware using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials.

3.4 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Perform the following tests and inspections:
 - 1. Verify that lock bolts engage strikes with required bolt projection.
 - 2. Verify that detention door hardware is installed, connected, and adjusted according to the Contract Documents.
- C. Detention work will be considered defective if it does not pass tests and inspections.
- D. Perform additional inspections to determine compliance of replaced or additional work.
- E. Prepare field quality-control certification that states installed products comply with requirements in the Contract Documents.
- F. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust and check each operating item of detention door hardware and each detention door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust detention door-control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by detention door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that detention door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain detention door hardware and detention door hardware finishes.

3.8 DETENTION DOOR HARDWARE SCHEDULE

- A. General: Provide detention door hardware for each detention door to comply with requirements in this Section and with detention door hardware sets indicated below.

HARDWARE SET: DT-01

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	204FMSS	US32D	SOUTHERN FOLGER
1 EA	LOCK	1070AK.a-1	US32D	SOUTHERN FOLGER
1 EA	CYLINDER	PARACENTRIC	---	SOUTHERN FOLGER
1 EA	CLOSER	4510T	AL	LCN
3 EA	SILENCERS	SR64	---	IVES
1 EA	MAGNET	SEM7850	AL	LCN

END OF SECTION 08 71 63

SECTION 08 80 00 - 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Glass for doors, interior borrowed lites, storefront framing, bullet resistant assemblies.
 - 2. Glazing sealants and accessories.
- B. Section does not include:
 - 1. Glass specified in Section 05 73 13 "Glazed Decorative Metal Railings"
 - 2. Glass specified in Section 08 41 20 "Structural Glass Fin Wall"
 - 3. Glass specified in Section 08 41 26 "All-Glass Interior Storefronts"
 - 4. Glass specified in Section 08 44 13 "Glazed Curtain Walls and Skylights"
- C. Related Requirements:
 - 1. Section 08 42 29.23 "Sliding Automatic Entrances" for glass sliding entrances.
 - 2. Section 08 56 67 "Bullet-Resistant Transaction Windows" for glazing as part of bullet resistant assemblies.
 - 3. Section 08 81 13 "Decorative Glass 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.
- C. FBC: Florida Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

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

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 2. Product Data: Documentation for Low Emitting Materials
 - a. Low Emitting Materials for Adhesives and Sealants
 3. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
 - c. Health Product Declarations (HPD's)
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- D. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass.
- C. Product Test Reports: For coated glass, insulating glass, and glazing sealants, for tests performed by a qualified testing agency.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Guardian Glass; SunGuard.
 - 2. Oldcastle Building Envelope™.
 - 3. Pilkington North America.
 - 4. Viracon, Inc.

- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 45 00 "Quality Control," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the FBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 3. 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.
 - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. 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 of thickness indicated.
 - 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.
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
 - 1. Health Product Declaration: Provide Health Product Declaration (HPD) with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- D. Ceramic-Coated Vision Glass: Refer to Section 08 44 13 "Glazed Curtain Walls and Skylights" for frit pattern requirements.
- E. Ceramic-Coated Spandrel Glass: Refer to Section 08 44 13 "Glazed Curtain Walls and Skylights" for spandrel glass requirements.
- F. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Starphire 6mm (minimum) or comparable approved product meeting all requirements including sustainability requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.
- G. Bullet Resistant Glazing: UL Standard 752, Level 3 all glass unit consisting of multiple layers of glass and polyvinyl butyral (PVB).
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Global Security Glazing, Armor-Gard or comparable approved product meeting all requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.

2.5 LAMINATED GLASS

- 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 to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
- B. Laminated One-Way Vision Glass: Transparent (One Way) Mirror Glass.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Pilkington, Mirropane or comparable approved product meeting all requirements.
 - a. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with polyisobutylene and polysulfide primary and secondary sealants.
 - 2. Perimeter Spacer: Polypropylene-covered stainless steel in color selected by Architect.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 BACKLIT GLASS

- A. Ultraclear float glass with polyester, translucent, acrylic pressure sensitive film attached to back face.
 1. Film Manufacturer: provide 3M FASARA Glass Finishes – Milky Milky (San Marino) 60 in. x 98.4 ft. film.

2.8 GLAZING SEALANTS

- A. General:
 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Low Emitting Adhesives and Sealants
 - a. Provide manufacture statements that confirm that the product used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario.
 - b. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements.
- B. Sealants: Listed products are acceptable subject to tests. Provide colors as selected by Architect.
 1. Sealants required for non-structural exposed outdoor seals at perimeters of metal panels and stone panels, and acceptable for other non-structural seals.
 - a. Dow Corning 756 SMS.
 2. Sealants acceptable for non-structural seals at locations other than perimeters of metal panels and stone panels.
 - a. Dow Corning 790, 791, 795.
 - b. Tremco Spectrem 1 and Spectrem 2.
 3. Sealants acceptable for shop-applied structural seals.
 - a. Tremco Proglaze II.
 4. Sealants acceptable for shop-applied and field-applied structural seals.
 - a. Dow Corning 795, 995.
 5. Data sheets for and samples of other sealants may be submitted for approval. Oil base sealants are not acceptable.
 6. Sealant back-up materials shall be polyethylene foam, urethane foam or extruded silicone as recommended by sealant manufacturer. Back-up shall not absorb water, and shall not emit gas, even if punctured.
 7. Coordinate with other sections to assure compatibility of intersecting sealants.

2.9 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces;

with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.11 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.

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.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant where indicated.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 GLASS SCHEDULE

A. MONOLITHIC GLASS

1. Float Glass Type: Clear annealed float glass.
 - a. Minimum Thickness: 6 mm.
2. Safety Glass Type: Clear fully tempered float glass.
 - a. Minimum Thickness: 6 mm.
 - b. Safety glazing required.

- B. Refer to Glass Schedule paragraph in Section 08 44 13 "Glazed Curtain Walls and Skylights" for all other glass types.

END OF SECTION 08 80 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Patterned glass.
2. Coated glass.
3. Acid-etched glass.
4. Sandblasted glass.
5. Laminated glass.
6. Glass with decorative film overlay.
7. Glass with finished edges.

B. Related Requirements:

1. Section 08 84 00 "Plastic Glazing" for acrylic and polycarbonate glazing.

1.2 DEFINITION

- A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

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

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:

1. Size and location of penetrations.
2. Glazing method.
3. Mounting method.
4. Attachments to other work.
5. Full-size details of edge-finished profiles.

- C. Glass Samples: For the following products, 12 inches square:

1. Each type of decorative glass.

- D. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative of the glazed system.
- E. Decorative Glazing Schedule: List decorative glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of decorative glass.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of decorative glass to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under NGA's Certified Glass Installer Program.
- 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 in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Refer to Section 01 43 39 "Visual Mock-up Requirements" for additional requirements.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect decorative glass and 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. Retain packaging and sequencing numbers for decorative-glass units.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

- A. 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products specified in Section 09 00 01 "Finish Key".
- B. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: 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 "GANA's "Glazing Manual" unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Class I, Quality-Q3, and with visible light transmission not less than 91 percent.
- C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- D. Fully Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Heat-Strengthened Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- F. Patterned Glass: ASTM C 1036, Type II, Class 1 (clear) or Class 2 (tinted) as indicated, Form 3; finish, pattern, and quality as indicated.
- G. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear) or Class 2 (tinted) as indicated, Form 3; finish, pattern, and quality as indicated.
- H. Patterned Ultraclear Glass: ASTM C 1036, Type II, Class 1 (clear), Form 3, with visible light transmission not less than 91 percent; finish, pattern, and quality as indicated.
- I. Tempered Patterned Ultraclear Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3, with visible light transmission not less than 91 percent; finish, pattern, and quality as indicated.
- J. Ceramic-Coated Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."
- K. 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.
- L. Decorative Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

2.5 GLAZING MATERIALS

- A. Glazing Sealants, Tapes, and Miscellaneous Glazing Materials: As specified in Section 08 80 00 "Glazing."
 1. Colors: As selected by Architect from manufacturer's full range.

2.6 HARDWARE FOR GLASS INSTALLATION

- A. Hardware: As indicated.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Gaskets: Manufacturer's standard, compatible with decorative glass type indicated.

- D. Anchors and Inserts: Provide devices as required for hardware installation. Provide metal expansion-bolt devices for drilled-in-place anchors. Provide anchors and inserts for applications on inside face of exterior walls and where indicated.

2.7 DECORATIVE-GLASS FABRICATION

- A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.
- B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.
 - 1. Finished Edge: Flat polished.
- C. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, with graphic image as indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine decorative-glass framing members, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Effective sealing between joints of decorative-glass framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate orientation of outer surfaces. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 INSTALLATION

- A. Set decorative-glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.
- B. Set glass lites with proper orientation so that each outer surface faces the direction indicated on Drawings.

- C. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.

3.4 GLAZING, GENERAL

- A. Decorative Glass: Install glazing as specified in Section 08 80 00 "Glazing."
- B. Comply with combined written instructions of manufacturers of glass, gaskets, sealants, tapes, 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 more 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.

3.5 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. 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.

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Terminal C
Airside Concourse

DECORATIVE GLASS GLAZING

SECTION 08 81 13

- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.
- E. Refer to Section 01 74 23 "Final Cleaning" for additional cleaning requirements.

END OF SECTION 08 81 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Monolithic acrylic glazing and support system.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide plastic glazing sheets and glazing materials capable of withstanding normal temperature changes without failure, including loss or breakage of plastic sheets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
 - 2. Product Certificates: Provide the following:
 - a. Environmental Product Declarations (EPD's)
 - b. Corporate Sustainability Reporting (CSR's)
- C. Plastic Glazing Samples: For each color and finish of plastic glazing indicated, 12 inches square and of same thickness indicated for final Work.
- D. Plastic Glazing Schedule: List plastic glazing types and thicknesses for each location. Use same designations indicated on Drawings. Indicate coordinated dimensions of plastic glazing and construction that receives plastic glazing, including clearances and glazing channel dimensions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plastic glazing to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Refer to Section 01 43 39 "Visual Mock-Up Requirements" for additional requirements.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect plastic glazing materials according to manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

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 COORDINATION

- A. Coordinate dimensions of plastic glazing with dimensions of construction that receives plastic glazing to ensure that glazing channels provide adequate face and edge clearance, bite, and allowance for expansion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content of plastic glazing: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- B. Environmental Product Disclosure: Provide an Environmental Product Declarations (EPD) that conforms with one of the following:
 - 1. Product specific declarations in accordance with ISO 1404
 - 2. Environmental Product Declarations conforming to ISO 14025, 14040, 14044 and EN 15804 or ISO 21930
 - 3. Industry Wide Product Specific Type III EPD Third Party Certification

2.2 PLASTIC GLAZING, GENERAL

- A. Sizes: Fabricate plastic glazing to sizes indicated.
- B. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
 - 1. Self-ignition temperature of 700 deg F or higher when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
 - 2. Smoke-developed index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.

3. Burning extent of 1 inch or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch or thickness indicated for the Work, where Class CC1 is indicated.
4. Flame-spread index not less than that indicated when tested according to ASTM E 84.

2.3 RESIN COMPOSITE PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Resin Composite Panels as indicated in Section 09 00 01 "Finish Key" or comparable approved product meeting all requirements including sustainability requirements.
 1. Refer to Sections 01 2500 "Substitution Procedures" and 01 6000 "Product Requirements" for comparable product requirements

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean framing members immediately before glazing. Remove coatings not firmly bonded to substrates.

3.2 PROTECTING AND CLEANING

- A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.
- B. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.
- C. Wash plastic glazing on both faces before date scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Wash plastic glazing according to plastic glazing manufacturer's written instructions.
 1. Refer to Section 01 35 46 "Indoor Air Quality" and Section 01 74 23 "Final Cleaning" for additional requirements.

END OF SECTION 08 84 00

SECTION 08 88 00 - SPECIAL FUNCTION 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 (including all sustainability requirements), apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Electrochromic insulating glass units for dynamic light and heat control.
- B. Related Requirements:
 - 1. Section 08 80 00 "Glazing"
 - 2. Division 26 Sections for control for electrical systems.

1.3 DEFINITIONS

- A. Fenestration: Openings in building's envelope including windows, doors, and skylights.
- B. Framing System: Basic rigid supporting structure of window.
- C. Glazing System: Soft material used in framing system.
- D. Bite: Dimension by which edge of glass product is engaged into glazing channel.
- E. IGU: Insulating Glass Unit.
- F. IGU Pigtail: Wire that extends from individual insulated glass units.
- G. Frame Cable: Wire that runs through framing system and connects IGU pigtail to low-voltage wiring on interior of building.
- H. 2-ply Laminated Glass: 2-sheets of monolithic glass bonded together with plastic interlayer by heat and pressure.
- I. Inboard Lite: Pane of IGU that faces interior of building.
- J. Outboard Lite: Pane of IGU that faces exterior of building.
- K. Performance Characteristics:
 - 1. Center-of-Glass Characteristics: Performance values that take only center portion of IGU into account and not framing members.
 - 2. Fenestration Performance: Performance based on total fenestration (glass and framing members). Values that can be validated and certified by National Fenestration Rating Council (NFRC).
- L. Sealing Insulating Glass Unit Surfaces and Coating Orientation:

1. Surface 1: Exterior surface of outer laminated glass ply.
 2. Surface 2: Interior surface of outer laminated glass ply (surface facing the laminating material).
 3. Surface 3: Exterior surface of inner laminated glass ply (surface facing the laminating material).
 4. Surface 4: Interior surface of inner laminated glass ply which is coated with the electrochromic layers.
 5. Surface 5: Exterior surface of inner pane.
 6. Surface 6: Room side surface of inner pane.
- M. Tinted: On state, with lowest visible light transmission.
- N. Clear: Off state, with highest visible light transmission.
- O. Variable Tint: Intermediate tint levels between fully tinted and clear.
- P. Gradient Tint: Seamless transition from clear to fully tinted across a single unit

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.
- B. Conduct pre-installation meeting with the following parties in attendance:
1. Architect, contractor, glazing contractor, framing manufacturer, electrochromic IGU and controls manufacturer, electrical contractor, and other parties related to work of this section, to review procedures, schedules, safety, and coordination with other elements of Project.

1.5 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Electrochromic glass units shall be operated by a control system approved by the electrochromic glass manufacturer and as specified in Section 26 09 00.
- B. System must be capable of providing up to 3 independently tintable zones in each pane to provide adequate light quality in the space. Refer to project drawings for zoning specifics.
1. Framing and Glazing Systems:
 - a. Designed to accommodate IGU components below:
 - b. Edge clearance: 1/4 inch (6 mm)
 - c. Bite clearance: 5/8 inch (16 mm)
 - d. Face clearance: 3/16 inch (5 mm)
 - e. Accommodate controls wiring.
 - f. Has glazing materials that are compatible with materials of electrochromic IGU.
 - g. Provide glazing and framing systems capable of withstanding normal thermal movements, wind loads, and impact loads, without failure,

including loss due to defective manufacture, fabrication, and installation, deterioration of glazing materials, and other defects in construction.

- 1) Normal Thermal Movement: Resulting from ambient temperature range of 120 degrees F (67 degrees C) and from consequent temperature range within glass and glass framing members of 180 degrees F (100 degrees C).
2. Provide glass products in thicknesses and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on Project loads and in-service conditions per the methodology described in ASTM E1300.
 - a. Select minimum thickness of annealed or heat-treated glass products to ensure probability of failure does not exceed the following:
 - 1) 8 breaks per 1000 for glass installed vertically or not over 15 degrees or more from vertical plan and under wind action.
 - 2) 1 break per 1000 for glass installed 15 degrees or more from vertical plane and under action of wind, snow, or both.

1.6 SUBMITTALS

- A. Product Data: Manufacturer's Product Data sheets including installation instructions.
- B. Documentation indicating compliance with ASTM E2141-14 and 2953-14, Standard Specification for Evaluating Accelerated Aging Performance of Electrochromic Devices in Sealed Insulating Glass Units as verified by third party test laboratory such as National Renewable Energy Laboratory (NREL).
- C. Test Report: ASTM E2190 Specification for IGU Seal Durability. Provide certificate or test report stating that IGUs that passed the testing requirement contained the electrochromic system (EC coatings, bus bars, wires etc.) as in the product specified herein. If triple glazing is specified herein, a test report for triple glazing is required.
- D. IG Certification: IGCC/IGMA certification for insulating glass units containing electrochromic system. Provide certificate stating that IGUs that passed the testing requirement contained the electrochromic system (EC coatings, bus bars, wires etc.) as in the product specified herein. If triple glazing is specified, certification covering triple glazing is required. If capillary tubes are required for altitude applications, certification covering units with capillary tubes is also required.
- E. Shop Drawings: Indicate framing system and accommodations for wiring paths, connectors, routing, and exit from framing system.

1.7 QUALITY ASSURANCE

- A. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.
 1. GANA Publications.
 2. AAMA Publications.
 3. IGMA Publications.

- B. Safety glass products in the US are to comply with CPSC 16 CFR Part 1201 for Category II materials and ANZI Z97.1 2009.
- C. Glass thermal and optical performance properties shall be based on calculations from the current LBNL WINDOW 6.3 computer program.
- D. Provide glass that is heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the base dimension, unless otherwise specified.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's instruction for receiving, handling, storing, and protecting materials.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store materials in original packaging, protected from exposure to harmful environmental conditions, including static electricity, and at temperature and humidity conditions recommended by manufacturer.
- D. Exercise care to prevent edge damage to glass, wire, and coatings on glass.
- E. Where insulating glass units will be exposed to substantial altitude changes, avoid seal ruptures by complying with manufacturer's recommendations for venting and sealing.

1.9 PROJECT / SITE CONDITIONS

- A. Verify frame channel dimensions are adequate for wire runs as designed.
- B. Environmental Requirements:
 - 1. Ensure that substrate surface and ambient air temperature are minimum of 40 degrees F (5 degrees C) and rising at application time and remain above 40 degrees F (5 degrees C) for at least 24 hours after application of sealants.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Electrochromic IGU Seals: Manufacturer agrees to replace electrochromic IGU's with defects in material or workmanship causing material obstruction of vision as a result of fogging or film formation of the internal glass as a result of failure of the seal.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Electrochromic IGU Tint: Manufacturer agrees to replace electrochromic IGU's with defects in material or workmanship, resulting in failure to tint.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Electrochromic IGU Lamination: Manufacturer agrees to replace electrochromic IGU's with lamination defects, such as edge separation or delamination, that materially obstruct vision through the glass.
 - 1. Warranty Period: Five years from date of Substantial Completion.

- D. Manufacturer's Special Warranty for Electrochromic Controls: Manufacturer agrees to replace electrochromic controls with defects in material or workmanship.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTROCHROMIC INSULATED GLASS UNITS, GENERAL

- A. Basis of Design: Subject to compliance with the requirements, provide SAGE Electrochromics, Inc.; SageGlass or a comparable product by another manufacturer meeting all requirements.

2.2 MATERIALS

- A. Electrochromic Laminated Sealed Insulating Glass Units (IGUs) on clear glass, Air Filled:

1. Laminated Outdoor Lite:
 - a. Outer Ply:
 - 1) Glass Type: Float glass.
 - 2) Glass Tint: Clear.
 - 3) Nominal Thickness: 0.16 inch (3.9 mm).
 - 4) Type FT.
 - b. Interlayer:
 - 1) Interlayer Type: Ionoplast interlayer.
 - 2) Interlayer Tint: Clear.
 - 3) Nominal Thickness: 0.90mm.
 - c. Inner Ply:
 - 1) Glass Type: Electrochromics coated clear float glass.
 - 2) Glass Tint: Electronically variable tintable.
 - 3) Nominal Thickness: 2.2 mm.
 - 4) Type: Annealed.
 - 5) Coating Orientation: Surface No. 4.
2. Cavity:
 - a. Spacer Material: Austenitic standard stainless steel, black finish.
 - b. Nominal Thickness: 11.5 mm +/- 0.5mm.
 - c. Cavity: 12mm.
 - d. Wall Thickness: >= 0.178 mm.
 - e. Gas Fill: Air.
 - f. Desiccant: Four legs filled with blend of 3A molecular sieve and silica gel desiccant.
3. Laminated Indoor Lite:
 - a. Inner Ply:
 - 1) Glass Type: Float glass.
 - 2) Glass Tint: Clear.
 - 3) Nominal Thickness: 3.9 mm.
 - 4) Type: FT.
 - b. Interlayer:
 - 1) Interlayer Type: Polyvinyl butyral.
 - 2) Interlayer Tint: Clear.
 - 3) Nominal Thickness: 1.52 mm.
 - c. Outer Ply:

- 1) Glass Type: Float glass.
 - 2) Glass Tint: Clear.
 - 3) Nominal Thickness: 3.9 mm.
 - 4) Type: FT.
 4. Pigtail:
 - a. Multi-conductor sheathed cable.
 - b. 2, 3 or 4 pin weather tight connector.
 5. Clear Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 63 percent.
 - b. Exterior Reflectance: No greater than 12 percent.
 - c. Interior Reflectance: No greater than 13 percent.
 - d. Summer U-factor (U-value): 0.32.
 - e. Winter U-factor (U-value): 0.32.
 - f. Solar Heat Gain Coefficient (SHGC): 0.44.
 - g. Shading Coefficient: 0.50.
 6. Tinted Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 1 percent.
 - b. Exterior Reflectance: No greater than 6 percent.
 - c. Interior Reflectance: No greater than 10.5 percent.
 - d. Summer U-factor (U-value): 0.32.
 - e. Winter U-factor (U-value): 0.32.
 - f. Solar Heat Gain Coefficient (SHGC): 0.10.
 - g. Shading Coefficient: 0.12.
 7. In-Pane Zoning
 - a. Gradual transition between tinted and clear areas within a single pane.
 - 1) The entire pane can be controlled to contain a gradual transition from one Visible Light Transmittance level to another Visible Light Transmittance level within the pane at a specific point in time.
- B. Frame Cable (one per IGU):
 1. Multi-conductor plenum rated sheathed cable type CMP/CL2P.
 2. 2, 3 or 4 pin weathertight connector.
 3. Connector shall be thin at <0.2" in height and installed in the glazing pocket or other easy to access space in the framing system for ease of maintenance.
- C. Off state: Clear.
- D. Operating Voltage: 5 volts DC or less applied to the EC insulating glass. Class 2 (low voltage, low current) electrical system.
- E. Control Functionality: Automated control for daylight and glare shall be provided. Manual over-ride must be provided in designated locations via wall mounted switch(es) or a software application. When a manual command is given via the wall switch or software application, it must over-ride the automated system immediately and initiate the requested change in state of the glass. Subsequent manual commands via the manual over-ride system must over-ride the previous command and be acted on by the control system immediately to initiate the requested change in state. This must occur no matter how soon the subsequent manual command(s) follow the previous manual command.

PART 3 - EXECUTION

A. Site Verification and Conditions

1. Verify that site conditions are acceptable for glass installation.
2. Verify openings for glazing are correctly sized and within tolerance.
3. Verify that functioning weep system is present.
4. Verify that minimum required face and edge clearances are being met.
5. Verify that glazing channels and recesses are clear and free of obstructions, weeps are clear, and channels and recesses are ready for glazing.
6. Verify that framing system is appropriately sized for IGU thickness and that precautions are taken to not over compress the edge seals of the IGU when the glass is installed.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation:

1. Clean and prepare glazing channels and other framing members to receive glass and wire.
2. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.
3. Install grommets at all locations where Frame Cable will penetrate metal framing or structure.

3.3 INSTALLATION

- A. Install products using recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in the "GANA Glazing Manual".
- B. Verify that IGU secondary seal is compatible with glazing sealants.
- C. Install glass in prepared glazing channels and other framing members.
- D. Install glass per framing manufacturer's wiring diagram showing IGU orientation and wire exit point into building. Comply with glass manufacturer's labels and instructions for glass orientation.
- E. Protect IGU pigtail and Frame Cable from any damage during installation. Use grommets during installation to protect wire when routing through frame. If Frame Cable or the connector is damaged during installation the Frame Cable must be replaced. If the IGU pigtail connector is damaged during installation electrochromic glass manufacturer must be notified and the connector must be repaired with the manufacturer's approved method.
- F. PVC jacketed plenum shall be conditioned for 24 hours at room temperature prior to installation and never installed below 0°C (32° F) ambient temperature. Once installed these wires must not be exposed to sunlight even through glass. If they are installed in an exposed location, they must be covered or painted (latex / water-based paint only).

- G. Verify glazing pocket where IGU Pigtail and Frame Cable connection is made is a dry location.
- H. Install silicone setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual and IGMA Glazing Guidelines and manufacturer's Glazing Guidelines.
- I. Use silicone edge blocks for all installed panes to prevent glass from walking post installation.
- J. Provide bite on glass, minimum edge and face clearances, and glazing material tolerances recommended by GANA Glazing Manual and as approved by glass manufacturer.
- K. Provide weep system as recommended by GANA Glazing Manual.
- L. Distribute weight of glass unit along edge rather than at corners.
- M. Comply with framing manufacturer's and referenced industry recommendations on expansion joints and anchors, accommodating thermal movement, glass openings, use of setting and edge blocks, use of glass spacers, edge blocks, and installation of weep systems. Setting and edge blocks must be made from silicone. Electrochromic glass manufacturer does not recommend the use of setting blocks made from other materials, as they been known to alter the chemical makeup of plastics and rubbers they come in contact with, resulting in seal failure.
- N. Protect glass from edge damage during handling and installation.
- O. Install per IGMA North American Glazing Guidelines for Sealed Insulated Glass Units, for Commercial and Residential Use TM-3000-90(04) states "For dry glazed systems, an adequate seal should consist of a minimum of 0.70 N/mm (4 lb/in) and not exceeding 1.75 N/mm (10 lb/in) applied to the edges of the insulated glass unit by gaskets or other fastening systems."
- P. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing, or plaster.
- Q. Remove labels within 30 days of exposure to sunlight or other UV light sources.

3.4 ADJUSTING

- A. Remove glass that is broken, chipped, cracked, or damaged in any way, and replace with new materials. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

3.5 CLEANING AND TESTING

- A. Clean glass inside and outside, immediately after installation and sealants have cured, per electrochromic glass manufacturer's written recommendations.
- B. Remove labels and markings from glass.

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SPECIAL FUNCTION GLAZING

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- C. Clean glass per:
 - 1. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
 - 2. GANA Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.
- D. Do not use scrapers or other metal tools to clean glass.
- E. Do not use 'high voltage spark' gas analyzers such as on electrochromic insulating glass units.

END OF SECTION 08 88 00

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. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. 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.
- E. 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. Sustainable Design Documentation Submittals: Refer to section 01 81 13.14 "Sustainable Design Requirements – LEED V4 BD+C".
 - 1. Product Data: Documentation for Leadership Extraction Practices in the following:
 - a. Leadership Extraction Practices for Recycled Content
- C. 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.
- D. Samples: For each type of metal finish required.

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.

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. 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 Drawings.
- B. 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.
- C. 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.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven-Rain-Resistant Louver:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck EHH-601PD or a comparable product by one of the following:
 - a. Air Flow Company, Inc.
 - b. Airolite Company, LLC (The).
 - c. Construction Specialties, Inc.
 - d. Nystrom, Inc.
 - e. Reliable Products, Inc.

- f. Ruskin Company
- 2. Louver Depth: 5 inches.
- 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
- 4. Louver Performance Ratings:
 - a. Free Area: Refer to Mechanical Drawings.
 - b. Air Performance: Refer to Mechanical Drawings.
 - 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 400 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: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 - 1. Insect Screening: Aluminum: 18-16 mesh, mill finish, .011 inch (0.3 mm) wire.

2.5 BLANK-OFF PANELS

- A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
 - 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.
 - 2. Panel Finish: Same finish type applied to louvers, but black color.
 - 3. Attach blank-off panels with clips.

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. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
 - 1. Refer to Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional information and requirements for recycled content.
- D. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant 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.
- E. 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.
- F. Shop Applied 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. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
- 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. 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 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: Match Architect's sample.

2.9 STAINLESS-STEEL SHEET FINISHES

- A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

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 07 92 00 "Joint Sealants" for sealants applied during louver installation.

- A. Installer shall provide field quality control by staff having adequate prior experience and shall provide the following reports and checklists.
 - 1. BECxA shall provide initial BECx checklists. Contractor shall provide weekly updates verifying all locations have been inspected and are free of installation defects and damage.
 - a. BECx Checklists shall include specific locations of the work and specific location and description of any repairs.
 - b. BECx checklist shall be completed in its entirety and shall be provided weekly to the Construction Manager, Architect, and Owner.
 - 2. Provide field inspection reports within 5 working days of inspection.

3.5 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