

SOLERA | RESERVE KENSINGTON

10540 METROPOLITAN AVENUE
KENSINGTON, MARYLAND

PROJECT MANUAL



SELECTIVE SPECIFICATION FOR HAWP

MARCH 18, 2019

Owner
McCaffery Interests, Inc.
Solera Senior Living



Associate Architect / Interior Designer
Lantz-Boggio

General Contractor

Civil Engineer
Dewberry

Structural Engineer
Structura, Inc.

MEP and FP Engineer
PE Services

Landscape Architect
Dewberry

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SECTION 013591 - HISTORIC TREATMENT PROCEDURES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes general protection and treatment procedures for designated historic spaces, areas, rooms, and surfaces in Project.

1.03 DEFINITIONS

- A. Consolidate: To strengthen loose or deteriorated materials in place.
- B. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- C. Dismantle: To disassemble or detach a historic item from a surface, or a nonhistoric item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- D. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance that are important to the successful preservation, rehabilitation, restoration, and reconstruction as determined by Architect. Designated historic spaces, areas, rooms, and surfaces are indicated on Drawings.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.
- H. Remove: To take down or detach a non-historic item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- I. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- J. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- K. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- L. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- M. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.
- N. Retain: To keep existing items that are not to be removed or dismantled.
- O. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.
- P. Salvage: To protect removed or dismantled items and deliver them to Owner [ready for reuse].
- Q. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.
- R. Strip: To remove existing finish down to base material unless otherwise indicated.

1.04 COORDINATION

- A. Historic Treatment Subschedule: A construction schedule coordinating the sequencing and scheduling of historic treatment work for entire Project, including each activity to be performed in historic spaces, areas, and rooms, and on historic surfaces; and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for historic treatment work.
1. Schedule construction operations in sequence required to obtain best historic treatment results.
 2. Coordinate sequence of historic treatment work activities to accommodate the following:
 - a. Owner's continuing occupancy of portions of existing building.
 - b. Owner's partial occupancy of completed Work.
 - c. Other known work in progress.
 - d. Tests and inspections.
 3. Detail sequence of historic treatment work, with start and end dates.
 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
 5. Use of elevator and stairs.
 6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.
- B. Public Circulation: Coordinate historic treatment work with public circulation patterns at Project site. Some work is near public circulation patterns. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

1.05 PROJECT MEETINGS FOR HISTORIC TREATMENT

- A. Preliminary Historic Treatment Conference: Before starting historic treatment work, conduct conference at Project site.
1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, historic treatment specialists, chemical-cleaner manufacturer, and installers whose work interfaces with or affects historic treatment shall be represented at the meeting.
 2. Agenda: Discuss items of significance that could affect progress of historic treatment work, including review of the following:
 - a. Historic Treatment Subschedule: Discuss and finalize; verify availability of materials, historic treatment specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Fire-prevention plan.
 - c. Governing regulations.
 - d. Areas where existing construction is to remain and the required protection.
 - e. Hauling routes.
 - f. Sequence of historic treatment work operations.
 - g. Storage, protection, and accounting for salvaged and specially fabricated items.
 - h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
 - i. Qualifications of personnel assigned to historic treatment work and assigned duties.
 - j. Requirements for extent and quality of work, tolerances, and required clearances.
 - k. Methods and procedures related to historic treatments, including product manufacturers' written instructions and precautions regarding historic treatment procedures and their effects on materials, components, and vegetation.
 - l. Embedded work such as flashings and lintels, special details, collection of wastes, protection of occupants and the public, and condition of other construction that affect the Work or will affect the work.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.
- B. Coordination Meetings: Conduct coordination meetings specifically for historic treatment work at bi-weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each historic treatment specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of historic treatment work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to historic treatment work.
 2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of historic treatment work. Include topics for discussion as appropriate to status of Project.
 - a. Historic Treatment Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
 - b. Schedule Updating: Revise Contractor's Historic Treatment Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each entity present, including review items listed in the "Preliminary Historic Treatment Conference" Paragraph above and the following:
 - 1) Interface requirements of historic treatment work with other Project Work.
 - 2) Status of submittals for historic treatment work.
 - 3) Access to historic treatment work.
 - 4) Effectiveness of fire-prevention plan.
 - 5) Quality and work standards of historic treatment work.
 - 6) Change Orders for historic treatment work.
 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.06 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
1. Carefully dismantle and salvage each item or object and protect it from damage, then promptly deliver it to Owner where directed.
 2. Coordinate with Owner's historical adviser, who will establish special procedures for dismantling and salvaging.

1.07 INFORMATIONAL SUBMITTALS

- A. Historic Treatment Subschedule:
1. Submit historic treatment subschedule within 30 days of date established for commencement of historic treatment work.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's historic treatment operations.
- C. Historic Treatment Program: Submit 30 days before work begins.
- D. Fire-Prevention Plan: Submit 30 days before work begins.

1.08 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: An experienced firm regularly engaged in historic treatments similar in nature, materials, design, and extent to this work as specified in each section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
 - 1. Field Supervisor Qualifications: Full-time supervisors experienced in historic treatment work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on Project site when historic treatment work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
 - a. Construct new mockups of required work whenever a supervisor is replaced.
- B. Historic Treatment Program: Prepare a written plan for historic treatment for whole Project, including each phase or process and protection of surrounding materials during operations. Describe in detail the materials, methods, and equipment to be used for each phase of work. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project historic treatment program with specific requirements of programs required in other historic treatment Sections.
 - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
 - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-prevention devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.09 STORAGE AND HANDLING OF HISTORIC MATERIALS

- A. Salvaged Historic Materials:
 - 1. Clean loose dirt and debris from salvaged historic items unless more extensive cleaning is indicated.
 - 2. Pack or crate items after cleaning; cushion against damage during handling. Label 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.
- B. Historic Materials for Reinstallation:
 - 1. Repair and clean historic items for reuse as indicated.
 - 2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make item functional for use indicated.
- C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after historic treatment and construction work in the vicinity is complete.
- D. Storage: Catalog and store historic items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
 2. Secure stored materials to protect from theft.
 3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.
- E. Storage Space:
1. Owner will arrange for limited on-site location(s) for free storage of historic material.
 2. Arrange for off-site locations for storage and protection of historic material that cannot be stored and protected on-site.

1.10 FIELD CONDITIONS

- A. Size Limitations in Historic Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.01 PROTECTION, GENERAL

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from historic treatment procedures.
1. Use only proven protection methods, appropriate to each area and surface being protected.
 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where historic treatment work is being performed.
 3. Erect temporary barriers to form and maintain fire-egress routes.
 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during historic treatment work.
 5. Contain dust and debris generated by historic treatment work and prevent it from reaching the public or adjacent surfaces.
 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
- B. Temporary Protection of Historic Materials:
1. Protect existing historic materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Architect.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by historic treatment work before commencing operations.
 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for historic treatment work.
 3. Maintain existing services unless otherwise indicated; keep in service and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
 - 1. Prevent solids such as stone or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from historic treatment work.
 - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Existing Roofing: Prior to the start of work in an area, install roofing protection for roofing indicated to remain.

3.02 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following:
 - 1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
 - 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
 - 3. Prohibit smoking by all persons within Project work and staging areas.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
 - 1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
 - 2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
 - 3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 - 4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
 - 5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 - 6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
 - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
 - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
 - d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work at each area of Project site to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
 - e. Maintain fire-watch personnel at each area of Project site until two hours after conclusion of daily work.

- C. Fire Extinguishers, Fire Blankets, and Rag Buckets: Maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
 - 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is completed.

3.03 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proved to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in historic treatment program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.04 GENERAL HISTORIC TREATMENT

- A. Have historic treatment work performed only by qualified historic treatment specialists.
- B. Execute work on historic materials using the gentlest means possible.
- C. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.
- D. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."
- E. Perform surveys of Project Site as the Work progresses to detect hazards resulting from historic treatment procedures.
- F. Follow the procedures in subparagraphs below and procedures approved in historic treatment program unless otherwise indicated:
 - 1. Retain as much existing material as possible; repair and consolidate rather than replace.
 - 2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
 - 3. Use reversible processes wherever possible.
 - 4. Use historically accurate repair and replacement materials and techniques unless otherwise indicated.
 - 5. Record existing work before each procedure (preconstruction) and progress during the work with digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."
- G. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Architect.

- H. Where missing features are indicated to be repaired or replaced, provide work with appearance based on accurate duplications rather than on conjecture, subject to approval of Architect.
- I. Where work requires existing features to be removed or dismantled and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.
- J. Identify new and replacement materials and features with permanent marks hidden in the completed Work to distinguish them from original materials. Record a legend of identification marks and the locations of the items on record Drawings.

END OF SECTION 013591

SECTION 024296 - HISTORIC REMOVAL AND DISMANTLING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes historic treatment procedures in the form of special types of selective demolition work for designated historic spaces, areas, rooms, and surfaces and the following specific work:
 - 1. Removal and dismantling of indicated portions of building or structure and debris hauling.
 - 2. Removal and dismantling of indicated site elements and debris hauling.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

1.03 DEFINITIONS

- A. Dismantle: To disassemble or detach a historic item from a surface, or a non-historic item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Existing items that are not to be removed or dismantled, except to the degree indicated for performing required Work.
- C. Remove: To take down or detach a non-historic item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- D. Retain: To keep existing items that are not to be removed or dismantled.
- E. Salvage: To protect removed or dismantled items and deliver them to Owner ready for reuse.

1.04 PRECONSTRUCTION MEETINGS

- A. Preconstruction Conference(s): Conduct conference(s) at Project site.
 - 1. Review minutes of Preliminary Historic Treatment Conference that pertain to removal and dismantling procedures and protection of historic areas and surfaces.
 - 2. Review list of items indicated to be salvaged.
 - 3. Verify qualifications of personnel assigned to perform removal and dismantling.
 - 4. Inspect and discuss condition of each construction type to be removed or dismantled.
 - 5. Review requirements of other work that depends on condition of substrates exposed by removal and dismantling work.
 - 6. Review methods and procedures related to removal and dismantling work, including, but not limited to, the following:
 - a. Historic removal and dismantling specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Fire prevention.
 - d. Coordination with building occupants.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For historic removal and dismantling specialist and historic removal and dismantling specialist's field supervisors.

- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's removal and dismantling operations.
- C. Removal and Dismantling Historic Treatment Program: Submit 30 days before work begins.
- D. List of Items Indicated to Be Salvaged: Prepare a list of items indicated on Drawings to be salvaged for Owner's use or for reinstallation. Submit 15 days before preconstruction conference.
- E. Inventory of Salvaged Items: After removal or dismantling work is complete, submit a list of items that have been salvaged.
 - 1. Include item description, item condition, number of items if more than one of a type, and tag number. Include photo of item in original location.
 - 2. As work proceeds, include on the inventory items that were indicated to be salvaged and items of historic importance discovered during the work. Document reasons, if any, why an item indicated to be salvaged was not salvaged.

1.06 QUALITY ASSURANCE

- A. Historic Removal and Dismantling Specialist Qualifications: A qualified historic treatment specialist. General selective demolition experience is insufficient experience for historic removal and dismantling work.
- B. Removal and Dismantling Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of removal and dismantling work, including protection of surrounding and substrate materials and Project site.
 - 1. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- C. Mockups: Prepare mockups of specific historic removal and dismantling procedures specified in this Section to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Typical Removal Work: Remove typical wall area and typical window, of location and extent as directed by Architect.
 - 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.
- D. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- D. Storage or sale of removed or dismantled items on-site is not permitted unless otherwise indicated.

PART 2 - PRODUCTS - (Not Used)**PART 3 - EXECUTION****3.01 HISTORIC REMOVAL AND DISMANTLING EQUIPMENT**

- A. Removal Equipment: Use only hand-held tools, except as follows or unless otherwise approved by Architect on a case-by-case basis:
 - 1. Light jackhammers are allowed subject to Architect's approval.
 - 2. Large air hammers are not permitted.
- B. Dismantling Equipment: Use manual, hand-held tools, except as follows or otherwise approved by Architect on a case-by-case basis:
 - 1. Hand-held power tools and cutting torches are permitted only as submitted in the historic treatment program. They must be adjustable so as to penetrate or cut only the thickness of material being removed.
 - 2. Pry bars more than 18 inches long and hammers weighing more than 2 lb are not permitted for dismantling work.

3.02 EXAMINATION

- A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures are necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.
 - 1. Verify that affected utilities are disconnected and capped.
 - 2. Inventory and record the condition of items to be removed and dismantled for reinstallation or salvage. Enter this information on the submittal of inventory of salvaged items.
 - 3. Before removal or dismantling 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.
 - 4. Engineering Survey: Engage a professional engineer to survey 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 as a result of removal and dismantling work.
- B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
- C. Perform surveys as the Work progresses to detect hazards resulting from historic removal and dismantling procedures.

3.03 HISTORIC REMOVAL AND DISMANTLING

- A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.
- B. Perform work according to the historic treatment program and approved mockup(s).
 - 1. Perform removal and dismantling to the limits indicated.
 - 2. Provide supports or reinforcement for existing construction that becomes temporarily weakened by removal and dismantling work, until the Project Work is completed unless otherwise indicated.
 - 3. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
 - 4. Do not operate air compressors inside building unless approved by Architect in each case.

5. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.
 6. Dispose of removed and dismantled items off-site unless indicated to be salvaged or reinstalled.
- C. Water-Mist Sprinkling: Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment according to the historic treatment program to ensure that such water does not create a hazard or adversely affect other building areas or materials.
- D. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.
- E. Removing and Dismantling Items on or Near Historic Surfaces:
1. Use only dismantling equipment and procedures within 12 inches of historic surface. Do not use pry bars. Protect historic surface from contact with or damage by tools.
 2. Unfasten items in the opposite order from which they were installed.
 3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
 4. Dismantle anchorages.
- F. Masonry Walls:
1. Remove masonry carefully, and erect temporary bracing and supports as needed to prevent collapse of materials being removed.
 2. Dismantle top edge and sides before removing wall. Stop removal work and immediately inform Architect if any structural elements above or adjacent to the work show signs of distress or dislocation during any phase of removal work.
 3. Remove wall in easily managed pieces.
 4. During removal, maintain the stability of the partially remaining wall. Notify Architect of the condition of temporary bracing for wall if work is temporarily stopped during the wall's removal.
- G. Steelwork:
1. Expose structural steel for examination by Architect and Contractor's professional engineer before proceeding with removal or dismantling.
 2. If distress in structure is apparent during performance of the work, stop removal or dismantling and take immediate precautionary measures to ensure safety of the structure. Inform Architect of the problem, steps taken, and proposed corrective actions.
 3. Brace and support structural steel being removed and remaining during removal and dismantling.
 4. Concrete-Encased Steel: Where steel is known to be encased by concrete that is being removed, saw cut with blades that can cut no deeper than the thickness of the concrete cover, with an adequate margin for error in the location of the steel. Isolate sections of concrete by saw cutting before beginning removal.
- H. Loose Plaster: Identify loose, non-historic plaster, and separate it from its substrate by tapping with a hammer and prying with a chisel or screwdriver. Do not use pry bars. Leave sound, firmly adhered plaster in place. Do not damage, remove, or dismantle historic plasterwork, except where indicated or where it is an immediate hazard to personnel and as approved by Architect.
- I. Concrete Floor Surface Removal: Remove floor surfaces, fill, and topping to the indicated lower elevations or cleavage planes as indicated on Drawings. Use dismantling methods when removing floor surfaces 12 inches or less away from historic walls. Take away material to a uniform surface at the indicated level.
- J. Anchorages:
1. Remove anchorages associated with removed items.
 2. Dismantle anchorages associated with dismantled items.
 3. In non-historic surfaces, patch holes created by anchorage removal or dismantling according to the requirements for new work.

4. In historic surfaces, patch or repair holes created by anchorage removal or dismantling according to Section that is specific to the historic surface being patched.

END OF SECTION 024296

SECTION 042000 - UNIT MASONRY**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Clay face brick.
 - 3. Mortar and grout.
 - 4. Steel reinforcing bars.
 - 5. Masonry-joint reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.
- B. Products Installed but not Furnished under This Section:
 - 1. Cast-stone trim in unit masonry.
 - 2. Steel lintels in unit masonry.
 - 3. Steel shelf angles for supporting unit masonry.
 - 4. Cavity wall insulation.
- C. Related Requirements:
 - 1. Division 05 "Metals," structural steel framing section for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - 2. Section 072100 "Thermal Insulation" for cavity wall insulation.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.03 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
- C. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- D. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- E. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Discussions shall include but not be limited to the following:
 - 1. Structural concepts and any special masonry details.
 - 2. Locations of expansion and control joints.
 - 3. Standard of workmanship and quality control requirements.
 - 4. Construction and substrate conditions.
 - 5. Environmental conditions.
 - 6. Special coordination items

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.

- a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - c. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - d. Ceilings, Walls, and Insulation: Laboratory test reports for ceilings, walls, and thermal insulation, indicating compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - 1) SCS Indoor Advantage Gold - Building Materials, NSF/ ANSI 332, and UL GreenGuard Gold meet the requirement.
- C. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Trim Units: Show sizes, profiles, and locations of each trim unit required.
 3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- D. Samples for Verification: For each type and color of the following:
 1. CMUs.
 2. Clay face brick, in the form of straps of five or more bricks.
 3. Special brick shapes.
 4. Pigmented colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 5. Weep holes/vents and cavity drainage materials.
 6. Accessories embedded in masonry.

1.06 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Integral water repellent used in CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.

5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.07 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for typical exterior wall in sizes approximately 96 inches long by 72 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long.
 - b. Include lower corner of window opening, with trim if applicable, at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include framing, sheathing, water-resistive barrier/air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated and apply any additional specified sealers or coatings, such as anti-graffiti coatings to cleaned faces.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. 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.
 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 COORDINATION

- A. Concrete Reinforcement Coordination: Coordinate reinforcement in concrete and any required mechanical anchorage prior to post-tensioned concrete slabs being performed. X-ray surveying of slabs after concrete work is completed for coordination of work of this Section will be at the expense of the installer.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 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.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS**2.01 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.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include [furniture, plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."
- J. Ceilings, Walls, and Thermal Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health (CDPH) Standard Method v1.1-2010.

2.03 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.

2.04 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.

2.05 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 square-edged units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent as follows:
 - 1. Locations:
 - a. Concrete masonry units in exterior walls and construction exposed to weather.
 - b. Concrete masonry units in blind side, property line applications.
 - c. Where indicated.
 - 2. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ACM Chemistries; RainBloc.
 - 2) BASF Construction Chemicals - Building Systems; Rheopel Plus.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: As indicated on Drawings.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 4. Faces To Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.06 CONCRETE MASONRY LINTELS

- A. General: Provide one of the following:
- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 cast-in-place concrete section, and with reinforcing bars indicated.
- D. 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.

2.07 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C 216.
1. Basis-of-Design Products: To be determined.
 2. Grade: SW.
 3. Type: FBX.
 4. Unit Compressive Strength: Minimum 3350 psi, measured in accordance with ASTM C67.
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 7. Size (Actual Dimensions): To be determined.
 8. Application: Use where brick is exposed unless otherwise indicated.
 9. Color and Texture: Match Architect's samples.

2.08 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.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cemex S.A.B. de C.V.
 - b. Essroc, Italcementi Group.
 - c. Holcim (US) Inc./Lafarge North America Inc./Lehigh Cement Company.
 - d. Lafarge North America Inc.
 - e. Lehigh Cement Company.
- E. Mortar Cement: ASTM C 1329/C 1329M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lafarge North America Inc.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
- G. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Essroc, Italcementi Group; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond Portland & Lime.
 - 4) Lehigh Cement Company.; Lehigh Custom Color Portland/Lime Cement.
 2. Colored Masonry Cement:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - 2) Essroc, Italcementi Group; Brixment-in-Color or Flamingo Color Masonry Cement.
 - 3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 4) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - 5) Lehigh Cement Company.; Lehigh Custom Color Masonry Cement.
 3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 4. Pigments shall not exceed 10 percent of portland cement by weight.
 5. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- H. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- I. Aggregate for Grout: ASTM C 404.
- J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Building Systems; Trimix-NCA.
 - b. Euclid Chemical Company (The); Accelguard 80.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
- K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ACM Chemistries; RainBloc for Mortar.
 - b. BASF Corporation, Construction Chemicals; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- L. Water: Potable.

2.09 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in 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.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: Minimum 0.148-inch diameter for single wythe joint reinforcement, and minimum 0.187-inch for multiwythe joint reinforcement.
 4. Wire Size for Cross Rods: Minimum 0.148-inch diameter.
 5. Wire Size for Veneer Ties: Minimum 0.148-inch for tab type and eye type adjustable units, and minimum 0.187-inch diameter for pintle type adjustable units.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:
1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.10 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 4. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie made from minimum 0.187-inch- diameter, hot-dip galvanized steel wire.
 3. Mill Galvanized Wire: Mill-galvanized wire ties may be used in interior walls, as acceptable to Architect. Use of mill-galvanized wire is not allowed in spaces where humidity is expected to exceed 75 percent.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from minimum 0.060-inch- thick steel sheet, galvanized after fabrication.
 - a. Minimum 0.064-inch-thick, galvanized-steel sheet may be used at interior walls, as acceptable to Architect. Use is not allowed in spaces where humidity is expected to exceed 75 percent.
 2. Tie Section: Triangular-shaped wire tie made from minimum 0.187-inch- diameter, hot-dip galvanized steel.

- a. Mill Galvanized Wire: Mill-galvanized wire ties may be used in interior walls, as acceptable to Architect. Use of mill-galvanized wire is not allowed in spaces where humidity is expected to exceed 75 percent.
- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M or epoxy coating 0.020 inch thick.
- G. Adjustable Masonry-Veneer Anchors:
 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
 2. Fabricate sheet metal anchor sections and other sheet metal parts from minimum 0.075-inch- thick steel sheet, galvanized after fabrication.
 3. Fabricate wire ties from minimum 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
 5. Screw-Attached, Masonry-Veneer Anchors - Typical: Wire tie and a sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and base for inserting wire tie.
 - a. Use: For anchoring masonry veneer to metal stud, masonry, concrete or wood supporting structure, where there is no insulation and little potential for sheathing board deterioration.
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Heckmann Building Products Inc.; 315-D with 316.
 - 2) Hohmann & Barnard, Inc.; DW-10HS.
 - 3) Wire-Bond; 1004, Type III.
 6. Screw-Attached, Masonry-Veneer Anchors - Pronged-Leg Anchor: Wire tie and a gasketed sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and base for inserting wire tie. Self-adhering, modified bituminous gasket fits behind anchor plate and extends beyond pronged legs.
 - a. Use: For anchoring masonry veneer to steel stud supporting structure where there is insulation, and potential for sheathing board deterioration.
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Hohmann & Barnard, Inc.; X-SEAL Anchor.
 - 2) Wire-Bond; 1004X, Type III X.
 7. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.
 - a. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
 - b. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
 - c. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors, torque-controlled expansion anchors or undercut anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or Type 316, for anchors.

8. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B 117.

2.11 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
 1. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 2. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
 3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 4. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
 5. Solder metal items at corners.
- B. Flexible Flashing: Where flexible flashing is indicated or specified, provide either stainless core flexible flashing with drainage fabric, or rubberized-asphalt flashing with separate cavity drainage material.
 1. Stainless Steel Core Flexible Flashing – With Drainage Fabric: Engineered stainless steel core flexible flashing with drainage fabric; ASTM A167 stainless steel sheet with polymer fabric laminated to back face and non-woven drainage fabric laminated to front face, with non-asphaltic adhesive.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) York Manufacturing, Inc.; York Flash-Vent SS.
 - 2) STS Coatings, Inc.; Wall Guardian TWF Stainless Steel.
 - 3) Building Materials West Company, Inc.; Evacu-Flash SS.
 - b. Mastic/Sealant: Standard of manufacturer.
 - c. Pre-Formed Corners: Provide pre-formed outside and inside corners standard of manufacturer using minimum 26 gage stainless steel.
 - d. End Dams: Provide pre-formed end dams standard of manufacturer using minimum 26 gage stainless steel.
 - e. Splice Material: Standard self-adhering metal material of manufacturer, matching and compatible with flashing material, and sealant.
 - f. Termination Bar: Manufacturer standard 1 inch, minimum 26 gage stainless steel termination bar with sealant lip.
 - g. Drip Edges: Stainless steel drip edges to be located beneath flexible flashing at exterior face of wall, meeting requirements of Paragraph "Metal Flashing" above.
 - h. Fasteners: Standard of manufacturer for intended use.
 - i. Weep Vent Protection Sheet: Geotextile drainage fabric standard of manufacturer, at least 12 inches in height.
 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Peel-N-Seal.
 - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 3) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
 - 4) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.

- 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 6) Hohmann & Barnard, Inc.; Sando-Seal.
 - 7) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - 8) Polyguard Products, Inc.; Polyguard 400.
 - 9) Williams Products, Inc.; Everlastic MF-40.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
 - c. Drip Edges: Stainless steel drip edges to be located beneath flexible flashing at exterior face of wall as specified in Article - Flashing, Weep Holes, and Cavity Vents.
- C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
 4. Where flashing is fully concealed, use metal flashing or flexible flashing.
- D. Single-Wythe CMU Flashing System: 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.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Mortar Net USA, Ltd.; Blok-Flash.
- E. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- G. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- 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 less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Break Weep Mesh.
 - 2) Archovations, Inc.; CavClear Weep Vents.
 - 3) Mortar Net USA, Ltd.; Mortar Net Weep Vents.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hohmann & Barnard, Inc.; Mortar Trap.
 - b. Mortar Net USA, Ltd.; Mortar Net.

2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
- F. Cavity Mortar Control: In lieu of using rubberized-asphalt flashing with a separate cavity drainage material specified above, provide stainless steel core flexible flashing with weep vent protection sheet (drainage fabric) as specified in Article "Embedded Flashing Materials."

2.13 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, masonry cement mortar, or unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 1. For masonry below grade or in contact with earth, use Type M.
 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.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 3. Mix to match Architect's sample.
 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Cast-stone trim units.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Cast-stone trim units.
- F. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 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**3.01 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION, GENERAL

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

3.03 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 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, unless otherwise indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated. Between top of full height walls and partitions, and structure above, provide void space to compensate for deflection of above structure
 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 078400 "Firestopping."

3.05 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Absorptive Stones (Limestone, Sandstone and Cast Stone): Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- F. Cut joints flush where indicated to receive cavity wall insulation, weather barriers, and air barriers unless otherwise indicated.

3.06 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.
 2. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally for standard modular brick and 12 inches clear horizontally for thicker break; and 16 inches clear vertically.
 3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.07 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Wind Loads Less Than 40 PSF: Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 5. Wind Loads of 40 to 55 PSF: Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide air space of width as indicated on Drawings, but not less than 1 inch between back of masonry veneer and face of sheathing or insulation, whichever is further outboard.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.08 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 returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.09 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Provide expansion joints in unit masonry and control joints in concrete unit masonry aligned with openings and joints in related work as applicable, meeting recommendations indicated in BIA - Technical Notes on Brick Construction 18A - Movement, Design and Detailing of Movement Joints, and NCMA - Technical Note TEK 10-2A - Control Joints for Concrete Masonry Walls, and as indicated by final reviewed shop drawings. In addition, before start of work review location of all joints with Architect.
- B. Install control- and expansion-joint materials in unit masonry as masonry progresses.
- C. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- D. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- E. Form expansion joints in brick using one of the following methods:
 1. Build flanges of factory-fabricated, expansion-joint units into masonry.
 2. Build in compressible joint fillers where indicated.
 3. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- F. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

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

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Ventilated Rainscreen: Install cavity vents at both base and top of wall compartments for ventilated rainscreen. Provide weep vents at wall base, shelf angles, ledges, and any other obstructions of air cavity, as well as ventilation openings at top of wall compartments to encourage upward flow of air in cavities.
- C. General: 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. Lap edges of flashing at seams minimum 6 inches and continuously seal watertight.
 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. For metal flashings, form 1/4-inch hook in edge of flashing embedded in inner wythe.
 4. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge overlapped by weather barrier/air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar with watertight edge.
 5. At single wythe masonry walls, carry flashing completely through wythe and turn up back side of masonry minimum 8 inches, terminating with termination with watertight edge.
 6. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end.
 7. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 8. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 9. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

10. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - a. Install joint sealer below drip edge to prevent moisture migration under flashing.
 11. Where flashing is attached to face of substrate, install mechanically fastened termination bar at required height and cap with continuous bead of sealant to provide continuous watertight edge
- D. Flexible Through-Wall Flashing With Drainage Fabric:
1. General: Install where indicated, specified, or required in accord with flashing manufacturer's written instructions. Do not tuck flashing into backer wall, or bond or splice to non-woven drainage fabric.
 - a. End Dams: Extend flashing 6 inches minimum, beyond opening, each side without stretching flashing material. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use preformed end dams from manufacturer.
 - b. Flashing Width: Width required starting 1-1/2 inches to the exterior of the outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2 inches.
 - c. Splicing: Splice end joints by butting ends together over 4 inches wide piece of self-adhering stainless steel flashing. Self-adhering stainless steel flashing shall be sealed metal face down on to the substrate with the mastic. Butt the two piece of flashing together and embed into splice sealant. Seal the butt seam with sealant.
 - d. Drip Edge: Install metal drip edges beneath flexible flashing meeting instructions and recommendations of Paragraph "General" above.
 2. Concrete Structure:
 - a. Surface mount flashing after air barrier installation in accordance with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.
 - c. Fasten to concrete back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
 3. Masonry Structure:
 - a. Surface mount flashing after air barrier installation in accordance with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.
 - c. Fasten to masonry back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
 4. Metal Stud Framing:
 - a. Surface mount flashing after air barrier installation in accordance with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.
 - c. Fasten to metal stud framing back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.
 5. Lay flashing in continuous bead of sealant on masonry supporting steel.
 6. Fold ends of flashing at end of opening to form dam; seal with sealant or utilize preformed end dams from manufacturer.
 7. Inside Corners: Follow manufacturer's instructions using corner and splice material or utilize preformed corners from manufacturer.
 8. Outside Corners: Follow manufacturer's instructions using corner and splice material or utilize preformed corners from manufacturer.
 9. Do not coat the entire drainage fabric with air barrier. Leave the drainage fabric exposed at least an inch over the top of the mortar droppings.

10. Protect weep vents using geotextile weep vent protection sheet, and install on the third row height of standard bricks so fabric reaches the base of the flashing and covers the weep vents.
- E. Single-Wythe CMU Flashing: 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.
- F. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- G. Weeps: Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
 1. Use specified weep/cavity vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- H. Cavity Mortar Control:
 1. Place cavity drainage material in cavities and airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
 2. In lieu of a separate cavity mortar control device, provide stainless steel core flexible flashing with drainage fabric.
- I. Cavity Vents: Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.
 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B for nonessential facilities, and Level C for essential facilities (IBC Occupancy Category IV) in TMS 402/ACI 530/ASCE 5.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction - Non-Essential Facilities: One set of tests.
- D. Testing Frequency - Essential Facilities: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test - Unit Strength Method: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test - Unit Strength Method: For each type of unit provided, according to ASTM C 140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 6. Clean stone trim to comply with stone supplier's written instructions.

END OF SECTION 042000

SECTION 047200 - CAST STONE MASONRY**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Cast-stone trim.
 - a. Window sills.
 - b. Lintels.
 - c. Coping.
 - d. Wall caps.
 - e. Belt courses.
 - f. Water tables.
 - g. Medallions.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.

- b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
- D. Samples for Initial Selection: For colored mortar.
- E. Samples for Verification:
 - 1. For each color and texture of cast stone required, 10 inches square in size.
 - 2. For each trim shape required, 10 inches in length.
 - 3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
 - 1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Architectural Precast Association.
- B. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
- B. Pack, handle, and ship cast-stone units in suitable packs or pallets.
 - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
 - 2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.08 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.

- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include [furniture,]plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.03 CAST-STONE MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Air-Entraining Admixture: ASTM C 260/C 260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - 4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.
 - 1. Epoxy Coating: ASTM A 775/A 775M.
 - 2. Galvanized Coating: ASTM A 767/A 767M.
- H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.04 CAST-STONE UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Any current producer member of the Architectural Precast Association.
 - 2. Any current producer member of the Cast Stone Institute.
- B. Cast-Stone Units: Comply with ASTM C 1364.
 - 1. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- D. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- E. Cure Units as Follows:
 - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
 - 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 deg F or above.
 - b. No fewer than six days at mean daily temperature of 60 deg F or above.
 - c. No fewer than seven days at mean daily temperature of 50 deg F or above.
 - d. No fewer than eight days at mean daily temperature of 45 deg F or above.
- F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- G. Colors and Textures: Match Architect's samples.

2.05 MORTAR MATERIALS

- A. General: Provide mortar materials that comply with Section 042000 "Unit Masonry."
- B. Water: Potable.

2.06 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.
- B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- C. General-Purpose Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.
- D. Sealant: As specified in Section 079200 "Joint Sealants."

2.07 MORTAR MIXES

- A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.
 - 1. Comply with ASTM C 270, Type N.

PART 3 - EXECUTION**3.01 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.
Commencement of installation indicates acceptance of conditions.

3.02 SETTING CAST STONE IN MORTAR

- A. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."
- B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Coordinate installation of cast stone with installation of flashing specified in other Sections.
- C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- D. Set units in full bed of mortar with full head joints unless otherwise indicated.
 - 1. Set units with joints 3/8 inch wide unless otherwise indicated.
 - 2. Build anchors and ties into mortar joints as units are set.
 - 3. Fill dowel holes and anchor slots with mortar.
 - 4. Fill collar joints solid as units are set.
 - 5. Build concealed flashing into mortar joints as units are set.
 - 6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
 - 7. Keep joints at shelf angles open to receive sealant.
- E. Pointing with Mortar:
 - 1. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
 - 2. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 - 3. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.
- F. Pointing with Sealant:
 - 1. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.
 - 2. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."
 - a. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Sealant Joints: Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
 - 1. Keep joints free of mortar and other rigid materials.
 - 2. Build in compressible foam-plastic joint fillers where indicated.
 - 3. Form joint of width indicated, but not less than 3/8 inch.
 - 4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.03 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- B. Keep cavities open where unfilled space is indicated between back of cast-stone units and backup wall; do not fill cavities with mortar or grout.
- C. Fill anchor holes with sealant.
 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.
- E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast-stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 1. Form open joint of width indicated, but not less than 3/8 inch.
- F. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.04 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.05 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
 1. Remove mortar fins and smears before tooling joints.
 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.

3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. General-Purpose Cleaner:
 - a. Wet surfaces with water before applying cleaner.
 - b. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - c. Remove cleaner promptly by rinsing thoroughly with clear water.
 - d. Do not use acidic cleaners.

END OF SECTION 047200

SECTION 055213 - PIPE AND TUBE RAILINGS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.
- B. Related Requirements:
 - 1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
 - 2. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 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.

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Sustainable Design Submittals:

1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.

- b. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.

1.06 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.
- C. Product Test Reports: If authorities having jurisdiction do not allow Contractor to provide engineering calculations for pipe and tube railings, submit the following:
 - 1. Tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.07 QUALITY ASSURANCE

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

1.08 DELIVERY, STORAGE, AND HANDLING

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

1.09 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

2.01 MANUFACTURERS

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

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.

- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include [furniture,]plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. 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.

2.04 METALS, GENERAL

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

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.05 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. 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.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.06 FASTENERS

- A. 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. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 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 for use with Type 304 stainless steel, and Group 2 stainless-steel bolts for use with Type 316 stainless steel, ASTM F 593, and nuts, ASTM F 594.

2.07 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings," as applicable.
- D. 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.
- E. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

- G. 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.

2.08 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. Form Changes in Direction as Follows:
1. By bending.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- 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.
1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

- 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.

2.09 STEEL AND IRON FINISHES

- A. Finish Type:
1. Indoor Finish: Shop- or factory-prime painted with water-based primer, to receive field applied finish coat.
 2. Outdoor Finish:
 - a. Zinc Rich Primer: Zinc rich primer shop or factory-prime painted, to receive field applied finish coat.
- B. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- D. 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.

PART 3 - EXECUTION

3.01 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.
- B. Only proceed with installation after unsatisfactory conditions have been resolved. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

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

3.04 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.

3.05 ANCHORING POSTS

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

3.06 ATTACHING RAILINGS

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

3.07 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.08 PROTECTION

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

END OF SECTION 055213

SECTION 057500 - DECORATIVE FORMED METAL**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior formed-metal-shaped panels.
 - 2. Closures and trim.
 - 3. Lighting coves.
 - 4. Pockets for window treatment.
- B. Related Requirements:
 - 1. Section 057000 "Decorative Metal" for decorative items made primarily from plate, bars, extrusions, tubes, castings, and other forms of metal, but which may include sheet metal components.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for items made of formed metal for flashings and trim.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 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.

1.05 PREINSTALLATION MEETINGS

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

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 8. Low-Emitting Materials:

- a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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 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.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer fabricator.
- B. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.

1.09 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.

1.10 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

2.01 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.

1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.02 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. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

2.03 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in decorative formed metal and remain weathertight; as recommended in writing by decorative formed metal manufacturer.
 1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
 2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: ASTM C 920; elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.
- C. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.
- D. 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.

- E. 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 otherwise indicated.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- F. Structural Anchors: For applications indicated to comply with certain design loads, provide 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.
- G. 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.
- H. 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.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts for Type 304 stainless steel, or Group 2 stainless-steel bolts for Type 316 stainless steel, ASTM F 593, and nuts, ASTM F 594.
- I. Sound-Deadening Materials:
 - 1. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
 - 2. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- J. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
- K. 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.
- L. Isolation Coating: Manufacturer's standard coating.

2.04 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.

2.05 METAL PANELS, CLOSURES AND TRIM

- A. Form metal panels, closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.
1. Aluminum Sheet: Minimum 0.063 inch thick.
 - a. Finish - Interior: Clear anodic finish, or baked enamel or powder coat, as indicated on Drawings.
 - b. Finish - Exterior: Clear anodic finish, or high-performance organic coating, as indicated on Drawings.
 2. Formed metal panels, closures and trim may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view and not exposed to weather.
- B. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support metal panels, closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
- C. Drill and tap holes needed for securing metal panels, closures and trim to other surfaces.
- D. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
- E. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.06 LIGHTING COVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fry Reglet Corporation.
 2. Gordon, Incorporated.
 3. Hi-Tech Metals, Inc.
 4. MM Systems Corporation.
 5. Pittcon Industries.
- B. Form lighting coves from metal of type and thickness indicated below. Coordinate size of coves, location of cutouts for electrical wiring, and method of attachment to adjoining construction.
1. Aluminum Sheet: Minimum 0.063 inch thick.
 - a. Finish: Baked enamel or powder coat.
 2. Fabricate light coves with tapered edges for taping and spackling.
 3. Provide mitered corners, factory welded with backplates or factory endcaps.
 4. Lighting coves may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

2.07 POCKETS FOR WINDOW TREATMENT

- A. Form pockets from metal of type and thickness indicated below, with end closures. Coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.
1. Aluminum Sheet: Minimum 0.063 inch thick.
 - a. Finish: Baked enamel or powder coat.
 2. Pockets for window treatment may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
- B. Reinforce pockets for attaching window treatment equipment and hardware, or increase metal thickness.

- C. Divide continuous pockets with built-in partitions located to separate adjoining drapery and blind units, to coincide with window mullions, and to receive filler panels at ends of partitions.

2.08 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. 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.

2.09 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: Match Architect's sample.
- C. High-Performance Organic Finish (PVDF): Premium two-coat (mica) 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.
 - 1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 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.

3.03 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.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. 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.

3.04 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 057500

SECTION 060312 - HISTORIC WOOD REPAIR**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes historic treatment of wood in the form of repairing wood features as follows:
 - 1. Repairing lap siding, shingle siding, porch railing and trim.
 - 2. Replacing lap siding, shingle siding, porch railing and trim.
- B. Related Requirements:
 - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.
 - 2. Section 024296 "Historic Removal and Dismantling" for historic removal and dismantling work.
 - 3. Section 061000 "Rough Carpentry" for wood framing, blocking, furring and backing.
 - 4. Section 080314 "Historic Treatment of Wood Doors" for historic wood door repairs, including related trim.
 - 5. Section 090391 "Historic Treatment of Plain Painting" for historic wood repairs, including related trim.

1.03 DEFINITIONS

- A. Very Low-Pressure Spray: Less than 100 psi standard City water pressure without augmentation.
- B. Low-Pressure Spray: 100 to 300 psi; 4 to 6 gpm.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic wood repair.
 - 2. Review methods and procedures related to historic wood repair, including, but not limited to, the following:
 - a. Historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Fire-protection plan.
 - d. Wood historic treatment program.

1.05 SEQUENCING AND SCHEDULING

- A. Perform historic wood repair in the following sequence, which includes work specified in this and other Sections:
 - 1. Before removing wood components for on-site or off-site repair, tag each component with location-identification numbers. Indicate on tags and building plans the locations of each component, such as "Baseboard on North Side of Room 101."
 - 2. Dismantle hardware and tag with location-identification numbers.
 - 3. In the shop, label each repaired component and whole or partial replacement with permanent location-identification number in inconspicuous location and remove site-applied tags.
 - 4. Sort units by condition, separating those that need extensive repair.
 - 5. Clean surfaces.
 - 6. General Wood-Repair Sequence:

- a. Remove paint to bare wood.
- b. Repair wood by consolidation, replacement, partial replacement, and patching.
- c. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
7. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
8. Reinstall components.
9. Apply finish coats.
10. Install remaining hardware.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing or attaching wood members to other surfaces, accessory items, and finishes.
 2. Include field-verified dimensions and the following:
 - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relationship of existing components to new components.
 - b. Templates and directions for installing hardware and anchorages.
 - c. Identification of each new unit and its corresponding location in the building on annotated plans and elevations.
 - d. Provisions for sealant joints and flashing as required for location.
- C. Samples for Initial Selection: For each type of exposed wood and finish.
 1. Identify wood species, cut, and other features.
 2. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
 1. Replacement Wood: 12-inch- long, full-size molding sections with applied finish.
 - a. Additional Samples of replacement members that show fabrication techniques, materials, and finishes as requested by Architect.
 2. Repaired Wood: Prepare Samples using existing wood removed from site, repaired, and prepared for refinishing.
 3. Refinished Wood: Prepare Samples using existing wood removed from site, repaired, and refinished.
 4. Hardware: Full-size units with each factory-applied or restored finish.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For historic treatment specialist, including workers, and wood-repair-material manufacturer.
- B. Wood Historic Treatment Program: Submit before work begins.
- C. Preconstruction Test Reports: For historic wood repair.

1.08 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic wood-repair specialist, experienced in repairing, refinishing, and replacing wood in whole and in part. Experience only in fabricating and installing new woodwork is insufficient experience for wood historic treatment work.
- B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation, Project-site inspection, and on-site assistance.

- C. Wood Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site.
 - 1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
- D. Mockups: Prepare mockups of historic treatment repair processes to demonstrate aesthetic effects and to set quality standards for materials and execution, and for fabrication and installation. Prepare mockups so they are as inconspicuous as practicable.
 - 1. Locate mockups on existing surfaces where directed by Architect.
 - 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.

1.09 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing on historic wood materials as follows:
 - 1. Provide test specimens representative of proposed materials and existing construction.
- B. Historic Treatment Products: Test historic treatment products and methods for effectiveness and compliance with specified requirements.
- C. Wood Species and Paint Color: Perform paint analysis and wood analysis to determine original paint color and original species of wood siding and trim.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.
- B. Until installed, store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with historic wood repair only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.01 HISTORIC WOOD REPAIR, GENERAL

- A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.
 - 1. Exception: Industry practices cited in Section 12, Article 1.5, "Industry Practices," of the Architectural Woodwork Standards do not apply to the work of this Section.

2.02 REPLICATED WOOD ITEMS

- A. Replicated Wood Siding, and Trim: Custom-fabricated replacement wood units and components.
 - 1. Joint Construction: Joints matching existing joints.
 - 2. Wood Species: Match species of original wood, as determined by wood species analysis.
 - 3. Wood Cut: Match cut of existing wood.

4. Wood Member and Trim Profiles: Match profiles and detail of existing.

2.03 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
 1. Species: Match species of original wood, as determined by wood species analysis.
- B. Exterior Siding: Match species of original wood, as determined by wood species analysis.
- C. Exterior Trim: Match species of original wood, as determined by wood species analysis.

2.04 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood.
 - b. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100.
 - c. Gougeon Brothers, Inc.; West System.
 - d. Protective Coating Company; PC-Petrifier or PC-Rot Terminator.
 - e. System Three Resins, Inc.; RotFix.
- C. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to featheredge.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood with WoodEpoxy.
 - b. Advanced Repair Technology, Inc.; Primatrate with Flex-Tec HV.
 - c. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
 - d. Gougeon Brothers, Inc.; West System thickened with filler.
 - e. Polymeric Systems, Inc.; QuickWood.
 - f. Protective Coating Company; PC-Woody.
 - g. System Three Resins, Inc.; Sculpwood.

2.05 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage caused by fungi and wood-boring insects; complying with AWPA P5; containing no boric acid.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. Nisus Corporation.
 - c. System Three Resins, Inc.
- B. Cleaning Materials:
 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
 2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

- C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 - 2. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
 - 3. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 - 4. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

2.06 WOOD FINISHES

- A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.
 - 1. Field finish priming and painting of historic wood is specified in Section 090391 "Historic Treatment of Plain Painting."

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect adjacent materials from damage by historic wood repair.
- B. Clean wood of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.02 HISTORIC WOOD REPAIR, GENERAL

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from 20 feet away for exterior work.
- B. General: In treating historic items, disturb them as minimally as possible and as follows:
 - 1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 - 2. Repair items in place where possible.
 - 3. Install temporary protective measures to protect wood-treatment work that is indicated to be completed later.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods, such as sanding, wire brushing, or power tools, except as indicated as part of the historic treatment program and as approved by Architect.
- D. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.
 - 1. Unless otherwise indicated, repair wood by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 - 2. Where indicated, repair wood by limited replacement matching existing material.
- E. Replace Wood: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
 - 1. Do not use substitute materials unless otherwise indicated.

- F. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location. Key items to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.03 WOOD PATCH-TYPE REPAIR

- A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.
 - 1. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
 - 2. Treat wood with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
 - 1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 - 2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
 - 3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
 - 4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
 - 5. Clean spilled compound from adjacent materials immediately.

3.04 WOOD-REPLACEMENT REPAIR

- A. General: Replace parts of or entire wood items at locations where damage is too extensive to patch.
 - 1. Remove surface-attached items from wood surface before performing wood-replacement repairs unless otherwise indicated.
 - 2. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
 - 3. Remove broken, rotted, and decayed wood down to sound wood.
 - 4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
 - 5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Reinstall items removed for repair into original locations.

3.05 FIELD QUALITY CONTROL

- A. Manufacturers Field Service: Engage wood-repair-material manufacturers' factory-authorized service representatives for consultation and Project-site inspection and provide on-site assistance when requested by Architect.

3.06 ADJUSTMENT

- A. Adjust existing and replacement operating items, hardware, and accessories for a tight fit at contact points and for smooth operation and tight closure. Lubricate hardware and moving parts.

3.07 CLEANING AND PROTECTION

- A. Protect wood surfaces from contact with contaminating substances resulting from construction operations. Monitor wood surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact wood surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after historic wood repair. Avoid damage to coatings and finishes. Remove excess sealants, patching materials, dirt, and other substances.

END OF SECTION 060312

SECTION 061000 - ROUGH CARPENTRY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Wood blocking and nailers.
 - 4. Wood furring.
 - 5. Wood sleepers.
 - 6. Plywood backing panels.
- B. Refer to structural Drawings for additional requirements. In case of conflict, the structural Drawings shall govern.
- C. Related Requirements:
 - 1. Section 06160 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 06176 "Metal-Plate-Connected Wood Trusses" for wood trusses made from dimension lumber.

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. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated materials.
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 products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. For adhesives used on the interior of the building, include a statement of VOC content in g/L.
5. For composite wood products used on the interior of the building, indicate that product contains no added urea formaldehyde resins.

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. Engineered wood products.
 3. Power-driven fasteners.
 4. Post-installed anchors.
 5. Metal framing anchors.
- C. Calculations for Framing Order Waste Factor: For wood framing, calculations supporting that the overall framing waste factor is less than 10 percent.

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.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: As indicated on structural Drawings.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- 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 items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
 1. Application: Interior partitions not indicated on Drawings as load bearing.
 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Spruce-pine-fir; NLGA.
- B. Load-Bearing Partitions: No. 1 or No. 2 grade.
 1. Application: Exterior walls and interior load-bearing partitions.
 2. Species: As indicated on structural Drawings.
- C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
 1. Species: As indicated on structural Drawings.

2.4 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products, General: Products shall contain no added urea formaldehyde resins.
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 1. Extreme Fiber Stress in Bending, Edgewise: As indicated on structural Drawings.
 2. Modulus of Elasticity, Edgewise: As indicated on structural Drawings.
- D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 1. Extreme Fiber Stress in Bending, Edgewise: As indicated on structural Drawings.
 2. Modulus of Elasticity, Edgewise: As indicated on structural Drawings.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated on Drawings and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
- 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; NLGA.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 - 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.7 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 with ACQ or another preservative treatment process other than inorganic boron (SBX – Sodium Borate), or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
 - 2. Where rough carpentry is pressure-preservative-treated with inorganic boron (SBX – Sodium Borate) and enclosed within the finished building, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
 - 1. Simpson Strong-Tie Co., Inc. or approved equivalent. See Structural Drawings.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated on Drawings.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated on Drawings.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior locations and where indicated on Drawings.

2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Use one of the following:
 - 1. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
 - 2. Polyethylene foam sheet, 3/8 inch thick in widths equivalent to framing.

- a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Styrofoam Sill Seal.
- B. Adhesives for Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Multipurpose construction adhesives used on the interior of the building (i.e., inside the weatherproofing system and applied on-site) must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date of July 1, 2005, and rule amendment date of January 7, 2005, and shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Wall, roof, and floor rough carpentry framing is to be pre-framed using panelized construction components to the greatest extent possible.

3.2 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Include no direct wood-to-concrete connections. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated on Drawings 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.
 - 2. At ceilings above bathtubs and showers that are noted to be 5/8 inch thick moisture-resistant gypsum board and where structural framing exceeds spacing of 16 inches on center, provide 2x4 wood blocking at 16 inches on center maximum spacing between structural framing for ceiling support.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated on Drawings 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.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- J. 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.
- K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without

splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.3 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated on Drawings 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.
 - 1. Build anchor bolts into masonry during installation of masonry work.
 - 2. Where possible, secure anchor bolts to formwork before concrete placement.

3.4 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.5 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates unless otherwise indicated using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. Refer to structural Drawings for more information.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers unless otherwise indicated. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. Refer to structural Drawings for more information.
- D. Provide diagonal bracing in walls, at locations indicated on Drawings, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal- size boards, let-in flush with faces of studs or metal wall bracing, let into studs in saw kerf.

3.6 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated on Drawings or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated on Drawings or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated on Drawings or, if not indicated, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated on Drawings for eaves, overhangs, dormers, and similar conditions if any.

3.7 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, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06100

SECTION 070150.19 - PREPARATION FOR REROOFING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Full tear-off of entire roof, unless otherwise indicated on Drawings.
 - 2. Removal of base flashings.
 - 3. Temporary roofing.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of the premises and phasing requirements.
 - 2. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.03 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.
- B. Full Roof Tear-Off: Removal of existing roofing system from deck.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, sections, and details.
- C. Temporary Roofing Submittal: Product data and description of temporary roofing system. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer, stating acceptance of the temporary roof and that its inclusion does not adversely affect the roofing system's resistance to fire and wind.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.06 QUALITY ASSURANCE

- A. Reroofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing system tear-off and replacement, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.

- d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
- e. Existing roof deck conditions requiring notification of Architect.
- f. Existing roof deck removal procedures and Owner notifications.
- g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
- h. Structural loading limitations of roof deck during reroofing.
- i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
- j. HVAC shutdown and sealing of air intakes.
- k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
- l. Discovery of asbestos-containing and other hazardous materials.
- m. Governing regulations and requirements for insurance and certificates if applicable.
- n. Existing conditions that may require notification of Architect before proceeding.

1.07 FIELD CONDITIONS

- A. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- C. Conditions existing at time of inspection for bidding are maintained by Owner as far as practical.
- D. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
 - 2. Existing roof will be left no less watertight than before removal.
- E. Hazardous Materials: It is not expected that hazardous materials, will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.01 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.

2.02 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of new roofing system.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Shut off rooftop utilities and service piping before beginning the Work.
- B. Test existing roof drains to verify that they are not blocked or restricted. Immediately notify Architect of any blockages or restrictions.
- C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

3.02 ROOF TEAR-OFF

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day.
- B. Full Roof Tear-Off: Remove existing roofing and other roofing system components down to the deck.
 1. Remove any substrate boards, vapor retarders, roof insulation and cover board.
 2. Remove wood blocking, curbs, and nailers.
 3. Remove fasteners from deck.

3.03 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.04 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.
- B. Remove temporary roofing before installing new roofing.

3.05 BASE FLASHING REMOVAL

- A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 "Sheet Metal Flashing and Trim."
- C. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing." If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- D. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with Section 061053 "Miscellaneous Rough Carpentry."

3.06 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board.
 - 2. Glass-fiber blanket.
 - 3. Mineral-wool blanket.
 - 4. Mineral-wool board.
 - 5. Mineral-wool board - rainscreen.
 - 6. Insulation for miscellaneous voids, and around openings in the exterior wall.
- B. Related Requirements:
 - 1. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction.
 - 2. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.

- a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Ceilings, Walls, and Insulation: Laboratory test reports for ceilings, walls, and thermal insulation, indicating compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - 1) SCS Indoor Advantage Gold - Building Materials, NSF/ ANSI 332, and UL GreenGuard Gold meet the requirement.
 - 2) Low-emitting product certification.

1.05 INFORMATIONAL SUBMITTALS

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

- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.06 COORDINATION

- A. Coordinate with installation of vapor retarder membrane and flashing in roof construction to ensure continuity of vapor retarder plane in exterior enclosure.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Fire-Resistance Ratings: For products required to be part of a fire-resistance rated assembly, products shall be in compliance with ASTM E119, As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Fire Propagation Characteristics (NFPA 285): Foam insulation materials shall have passed NFPA 285 testing as part of approved assembly required for the Work.
1. Substitution of materials that are only part of a tested assembly, and not part of *the* tested assembly used on the Project, is not acceptable. All materials used in the assembly must have been tested together and passed meeting requirements of NFPA 285.
 2. Additional testing and/or engineering judgments (including costs) required by the authority having jurisdiction for material substitutions not meeting this requirement, are the responsibility of the Contractor. Provide proof in the form of NFPA 285 assembly reports or 3rd party engineering judgments acceptable to authorities having jurisdiction.

2.02 SUSTAINABLE PERFORMANCE REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.

2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include [furniture, plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Ceilings, Walls, and Thermal Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health (CDPH) Standard Method v1.1-2010.

2.03 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. General: Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type IV - Foundation Applications: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Extruded Polystyrene Board, Type VII - Split Slab Applications: ASTM C 578, Type VII, 60-psi minimum compressive strength, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.

2.04 GLASS-FIBER BLANKET

- A. Recycled Content of Insulation: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.

- d. Knauf Insulation.
- e. Owens Corning.

2.05 MINERAL-WOOL BLANKETS

- A. Recycled Content of Insulation: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- B. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber Inc.; an Owens Corning company.

2.06 MINERAL-WOOL BOARD

- A. Recycled Content of Insulation: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- B. Mineral-Wool Board, Types IA and IB, Unfaced: ASTM C 612, Types IA and IB; 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 4 lb/cu. ft.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.
- C. Mineral-Wool Board, Curtain Wall: ASTM C612; Types IA and IB; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84. Nominal density of 4 lb/cu. ft. minimum.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermafiber, Inc; Curtain Wall Insulation Series or comparable product by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.
- D. Mineral-Wool Board, Rainscreen, Unfaced: ASTM C612; Types IA and IB, unfaced; specifically manufactured for use in rain screen and cavity wall construction; with maximum flame-spread and smoke-developed indexes of zero and zero, respectively, per ASTM E 84. Nominal density of 4 lb/cu. ft. minimum.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermafiber, Inc; RainBarrier 45 Insulation or comparable product by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.

2.07 INSULATION FASTENERS

- A. Foam Board Plastic Insulation Anchors: Non-thermally bridging, plastic anchors manufactured specifically for attachment of rigid continuous insulation to framed construction, and masonry and concrete construction. Length as required for thickness of insulation material and penetration into substrate.
 - 1. Product - Masonry and Concrete: Subject to compliance with requirements, provide the following:
 - a. Rodenhouse Inc.; Plasti-Grip PMF (Plastic Masonry Fastener).
 - 2. Product - Framed Construction: Subject to compliance with requirements, provide the following:
 - a. Rodenhouse Inc.; Thermal-Grip ci Prong Washer.
- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Gemco.
 2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- D. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
- E. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space between face of insulation and substrate to which anchor is attached, of depth as indicated on Drawings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Gemco.
- F. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.08 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 2.0 lb/cu. ft. minimum density.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Icynene Inc.; Icynene MD-C-200 or comparable product by one of the following:
 - 1) BASF Corporation
 - 2) Dow Chemical Company.
 - 3) CertainTeed Corporation.
 - 4) Icynene Inc.

- 5) Johns Manville Corporation.
- b. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Minimal Expanding Spray Polyurethane Foam Sealant: 1 or 2 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.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company; Great-Stuff PRO or comparable product by one of the following:
 - a. BASF Corporation
 - b. Dow Chemical Company.
 - c. CertainTeed Corporation.
 - d. Johns Manville Corporation.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. Only proceed with installation after unsatisfactory conditions have been resolved. Commencement of installation indicates acceptance of conditions.

3.02 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.

3.03 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.04 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 1. If not otherwise indicated, extend insulation to depth as indicated on Drawings, or a minimum of 36 inches below exterior grade line, whichever is more stringent.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 1. If not otherwise indicated, extend insulation distance as indicated on Drawings, or a minimum of 36 inches in from exterior walls, whichever is more stringent.

3.05 INSTALLATION OF FOUNDATION WALL INSULATION

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

3.06 FOAM-PLASTIC BOARD INSTALLATION IN SPLIT SLAB CONSTRUCTION

- A. Install insulation meeting instructions and recommendations of manufacturer.
- B. Install insulation in two or more layers to achieve required thickness over structural slab surface.
- C. Lay insulation with long ends continuous and aligned, but short ends staggered between rows, with board edges and ends abutted, with gaps no less than 1/4 inch. Fill any gaps with insulation.
- D. Lay multiple layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- F. Prevent insulation from being displaced or damaged while placing slab.

3.07 INSTALLATION OF RAINSCREEN INSULATION

- A. Mineral-Wool Board, Rainscreen: Install with closely fitting joints using attachment method recommended for substrate according to manufacturer's written instructions.

3.08 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. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.09 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.

3.10 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.

3.11 INSULATION SCHEDULE

- A. Insulation Under Concrete Slabs: Extruded polystyrene foam-plastic board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene foam-plastic board.
- C. Insulation Inside Masonry Cavity Walls, Continuous: Mineral-wool board, rainscreen, unfaced.
- D. Insulation Inside Open Joint Rainscreen Walls, Continuous: Mineral-wool board, rainscreen, unfaced.
- E. Insulation in Metal Framed Walls: Mineral-wool blanket or glass-fiber blanket insulation, unfaced.
- F. *Insulation in Wood Framed Walls: Mineral-wool blanket ~~or glass-fiber blanket insulation~~, unfaced.***
- G. Insulation at Spandrel In Curtain Wall Systems: Mineral-wool board, curtain wall.
- H. Around Windows, Door frames, Louvers, and Other Openings in the Exterior Wall; and in Shim Space: Minimal expanding spray polyurethane foam sealant.
- I. Other Miscellaneous Areas: Spray polyurethane foam insulation.

END OF SECTION 072100

SECTION 073113 - ASPHALT SHINGLES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Asphalt shingles.
 - 2. Underlayment.
 - 3. Ridge vents.
 - 4. Metal flashing and trim.
 - 5. Fascia and soffit vents.
 - 6. Gable louvers.

1.03 DEFINITION

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- D. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site prior to starting work at project site to review conditions associated with performing work. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, representative of Owner's insurance company, if applicable, installer of work under this section, and installers of related work including installers of roof accessories and roof mounted equipment. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Installation procedures and manufacturer's recommendations.
 - 2. Safety procedures.
 - 3. Coordination with installation of other work.
 - 4. Availability of roofing materials.
 - 5. Preparation and approval of substrate and penetrations through roof.
 - 6. Other items related to successful execution of work.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Samples for Initial Selection: For each type of asphalt shingle indicated.

1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For the following products, of sizes indicated:
 1. Asphalt Shingles: Full size.
 2. Ridge and Hip Cap Shingles: Full size.
 3. Ridge Vent: 12-inch- long Sample.
 4. Exposed Valley Lining: 12 inches square.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For , from ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes.
- D. Sample Warranty: For manufacturer's warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Source Limitations: Obtain all shingles required for this project from one manufacturer with to assure consistent quality and appearance for the project.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer, with at least 5 years of documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.
- B. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:
 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.
 2. Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Failure of asphalt shingles to self-seal after a reasonable time.
 2. Material Warranty Period: 40 years from date of Substantial Completion, prorated, with first 20 years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to code required design wind speed, for 10 years from date of Substantial Completion.

4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.
 5. Workmanship Warranty Period: 100 percent coverage for Two years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt-shingle roofing that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.03 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Asphalt Shingles: ASTM D 3462/D 3462M, premium, granule surfaced, self sealing asphalt shingle with a fiberglass reinforced core, and stain and algae protection; with architectural laminate styling for a wood shake appearance.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Materials Corporation; Timberline Ultra HD or comparable product by one of the following:
 - a. Atlas Roofing Corporation.
 - b. GAF Materials Corporation.
 - c. Owens Corning.
 - 2. Style: As selected by Architect from full range of manufacturer.
 - 3. Strip Size: Manufacturer's standard.
 - 4. Algae Resistance: Granules resist algae discoloration.
 - 5. Impact Resistance: UL 2218, Class 4.
 - 6. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles, high profile, self-sealing, matching color and blend of roof shingle.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Materials Corporation; Timbertex Premium Ridge Cap Shingles or comparable product of asphalt shingle manufacturer.
- C. Starter Strip Shingles: Self sealing starter shingle of asphalt shingle manufacturer, designed for premium roof shingles.

2.04 UNDERLAYMENT MATERIALS

- A. Eave Protection Underlayment Membrane: Self-adhering, self sealing, bituminous leak barrier surfaced with a smooth polyethylene film, 60 mils minimum thickness.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Materials Corporation; StormGuard Leak Barrier or comparable product of asphalt shingle manufacturer.
- B. Shingle Underlayment: Premium, water repellant, breather type non-asphaltic underlayment; UV stabilized polypropylene construction.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Materials Corporation; Deck-Armor Premium Breathable Roof Deck Protection or comparable product of asphalt shingle manufacturer.
- C. Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

2.05 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge shingles.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Corporation; Cobra Snow Country Advanced, or comparable product by asphalt shingle manufacturer.
 - 2. Minimum Net Free Area: Minimum 18 inches of net free ventilation area per lineal foot.

2.06 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, or hot-dip galvanized-steel wire shingle nails as recommended by manufacturer, minimum 10 to 12 gage, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
 - 1. Shank: Smooth, barbed or deformed shank as recommended by manufacturer.

2. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Synthetic-Underlayment Fasteners: As recommended in writing by synthetic-underlayment manufacturer for application indicated.
- D. Fascia and Soffit/Under Eave Vents: Continuous aluminum soffit vent.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Corporation, MasterFlor LSV8 Series Soffit Vent, or comparable product of asphalt shingle manufacturer.
- E. Gable Louvers: One piece integral construction, thermoformed plastic or aluminum gable louvers. Mounting, size and style as indicated on Drawings.

2.07 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Sheet Metal: Aluminum, 0.032 inch thick minimum.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 1. Apron Flashings: Fabricate with lower flange a minimum of 5 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 5 inches over the underlying asphalt shingle and up the vertical surface.
 3. Cricket or Backer Flashings: Fabricate with concealed flange extending a minimum of 24 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney and 6 inches above the roof plane.
 4. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch-high, inverted-V profile at center of valley and equal flange widths of 12 inches.
 5. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.
- D. Bituminous Paint: Acid and alkali resistant type; black color.

PART 3 - EXECUTION

3.01 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.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made for flashings and penetrations through asphalt shingles.
 3. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
 4. Verify roof openings are correctly framed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 UNDERLAYMENT INSTALLATION

- A. General: Install in accordance with manufacturer's instructions and recommendations, recommendations in ARMA - Residential Asphalt Roofing Manual, and asphalt shingle recommendations in NRCA - The NRCA Roofing and Waterproofing Manual, and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
- B. Eaves:
 - 1. Install eaves edge metal flashing tight with fascia boards; lap joints 2 inches and seal with plastic cement or high quality urethane sealant recommended by manufacturer; nail at the top of the flange.
 - 2. In the north, and on all roofs between 2/12 and 4/12 (low slopes) install eave protection underlayment membrane up the slope from eaves edge a full 36 inches or to at least 24 inches beyond the interior warm wall. Lap ends 6 inches and bond.
- C. Valleys:
 - 1. Install eave protection underlayment membrane at least 36 inches wide and centered on the valley. Lap ends 6 inches and seal.
 - 2. Where valleys are indicated to be open valleys, install metal flashing over membrane before shingle underlayment is installed; Do not nail through the flashing. Secure the flashing by nailing at 18 inches on center just beyond edge of flashing so that nail heads hold down the edge.
- D. Hips and Ridges: Install eave protection underlayment membrane along entire lengths. If ridge vents are to be installed, position the membrane so that the ridge slots will not be covered.
- E. Roof Deck: Install shingle underlayment over the entire area not protected by eave protection underlayment membrane at the eaves or valley. Install sheets horizontally so water sheds and nail in place.
 - 1. On roofs sloped between 2:12 and 4:12, provide 2 layers of shingle underlayment and lap horizontal edges at least 19 inches and at least 19 inches over eave protection underlayment membrane.
 - 2. Lap shingle underlayment over eave protection underlayment membrane in valley at least 6 inches.
- F. Penetrations:
 - 1. Vent Pipes: Install a 24 inch square piece of eaves protection underlayment membrane lapping over roof deck underlayment; seal tightly to pipe.
 - 2. Vertical Walls: Install eaves protection underlayment membrane extending at least 6 inches up the wall and 12 inches on to the roof surface. Lap the membrane over the roof deck underlayment.
 - 3. Roof Hatches: Install eaves protection underlayment membrane from under the built-in counterflashing and 12 inches on to the roof surface lapping over roof deck underlayment.
 - 4. Chimneys: Install eaves protection underlayment membrane around entire chimney extending at least 6 inches up the wall and 12 inches on to the roof surface. Lap the membrane over the roof deck underlayment.
 - 5. Rake Edges: Install metal edge flashing over eaves protection underlayment membrane and roof deck underlayment; set tight to rake boards; lap joints at least 2 inches and seal with plastic cement; secure with nails.

3.03 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
 - 2. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
 - 3. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Rake Drip Edges: Install rake drip-edge flashings over underlayment and fasten to roof deck.
- F. Eave Drip Edges: Install eave drip-edge flashings below underlayment and fasten to roof sheathing.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.04 ASPHALT-SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems," and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
- B. Starter Shingles:
 - 1. For maximum wind resistance along rakes and eaves, install any starter strip containing sealant or cement shingles to underlayment and each other in a 4 inch width of asphalt plastic roof cement.
 - 2. Place starter strip shingles 1/4 inch to 3/4 inch over eave and rake edges to provide drip edge.
 - 3. Nail approximately 1-1/2 inches to 3 inches above the butt edge of the shingle.
 - 4. Rake starter course should overlap eave edge starter strip at least 3 inches.
- C. Shingle Placement and Nailing:
 - 1. Secure with 4, 5, or 6 nails per shingle per manufacturer's application instructions or local codes.
 - 2. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.
 - 3. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.
 - 4. Offset shingles based on the type of shingle specified meeting instructions and recommendations of manufacturer.
- D. Closed-Cut Valleys: Extend asphalt-shingle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt-shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
 - 1. Do not nail asphalt shingles within 6 inches of valley center.
 - 2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
- E. Attic Ventilation:
 - 1. General: Ventilation shall meet or exceed current FHA., HUD. and codes of authorities having jurisdiction.
 - 2. Ridge and Soffit Ventilation:
 - a. Install ridge vent along the entire length of ridges.
 - b. Cut continuous vent slots through the sheathing, stopping 6 inches from each end of the ridge.
 - c. On roofs without ridge board, make a slot 1 inch wide, on either side of the peak (2 inch overall).
 - d. On roofs with ridge board, make two slots 1-3/4 inches wide, one on each side of the peak (3-1/2 inch overall).

- e. Install ridge vent material along the full length of the ridge, including uncut areas.
- f. Butt ends of ridge vent material and join using roofing cement.
- g. Install eaves vents in sufficient quantity to equal or exceed the ridge vent area.
- 3. Gable Louvers:
 - a. Cut vent hole through sheathing as recommended by the manufacturer for the type of vent to be installed.
 - b. Install a 24 inches square of leak barrier, centered around the hole for roof louvers.
 - c. Install according to manufacturers instructions for flashing vent penetrations.
- 4. Install eave vents in sufficient quantity to equal or exceed the exhaust vent area, calculated as specified by manufacturer.
- F. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.
- G. Penetrations: All penetrations shall be flashed according to manufacturer, ARMA and NRCA application instructions and construction details.
 - 1. Meet instructions and recommendations of roof hatch manufacturer.

3.05 PROTECTION

- A. Do not permit traffic over finished roof surface.
- B. Protect installed products from foot traffic until completion of the project.
- C. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.
- D. Remove and replace damaged or broken shingles before Date of Substantial Completion.

END OF SECTION 073113

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes standing-seam metal roof panels.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site prior to starting work at project site to review conditions associated with performing work. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, qualified technical representative of roofing manufacturer, Quality Control Service, representative of Owner's insurance company, if applicable, installer of work under this section, and installers of related work including installers of roof accessories and roof mounted equipment. Record discussions of meeting and furnish a copy of record to each participant.
 - 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.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Sustainable Design Submittals:
 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - c. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - d. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.

- a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
- 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Delegated-Design Submittal: For standing-seam metal roof panel systems:
 - 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only
- E. 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.
- F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- D. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- E. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- F. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- G. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, specializing in installation of metal roofing systems similar to those required for this project, with no less than 5 years of documented experience.

- B. **Manufacturer Qualifications:** A qualified manufacturer that is UL listed for roofing system identical to that used for this Project; with minimum 10 years of documented experience. Manufacturer shall physically produce their own product. Manufacturer shall also be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.
- C. **Factory-Authorized Representative:** Require site attendance of qualified technical representative of roofing manufacturer during installation of the work, at a minimum, during first 2 days of work and thereafter once each week, and during inspections and testing specified in Article - Field Quality Control. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.

1.09 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.
- B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered and weatherproofed the same day.

1.11 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.

1.12 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: 20 years from date of Substantial Completion.
- B. **Special Warranty on Panel Finishes:** Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - 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. Shop drawings must be provided to, reviewed, and approved by panel manufacturer prior to panel system installation.
 2. Inspections by panel system manufacturer technical representative are required. Perform first inspection when underlayment and flashing are in place and second inspection when the roof is complete.
 3. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain primary components including roof insulation, and fasteners for roofing system from same manufacturer as membrane roofing. Secondary materials for roofing system shall be as approved or recommended by roofing membrane manufacturer, and when required, furnished by roofing manufacturer.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include [furniture,]plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.03 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design standing-seam metal roof panel systems.
- C. 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.
- D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 15 lbf/sq. ft.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: Minimum UL 90.
- 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.

2.04 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, Snap-Joint, Standing-Seam Metal Roof Panels : Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together. Provide seam caps with integral weatherseal at ribs.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company, Berridge Tee-Panel, or comparable product by one of the following:
 - a. Architectural Building Components.
 - b. Berridge Manufacturing Company.
 - c. CENTRIA Architectural Systems.
 - d. MBCI; a division of NCI Group, Inc.
 - e. Morin - A Kingspan Group Company.
 - f. Petersen Aluminum Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch (24 gage).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: Custom to match Architect's samples.
3. Clips: Concealed fasteners system designed to accommodate thermal movement.
 - a. Material: 0.062-inch- thick, stainless-steel sheet.
4. Seam Cap: Same material, finish, and color as roof panels, with integral extruded vinyl weather seal gasket to prevent siphoning of moisture through standing seam.
5. Panel Height: 1 inch, unless otherwise indicated on Drawings.
6. Panel Width: 12-3/4 inches, unless otherwise indicated on Drawings.

2.05 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.06 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.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match [metal roof panels] [roof fascia and rake trim].
- 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. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
 - 1. Insulate roof curb with 1-inch- thick, rigid insulation.
- G. Panel Fasteners: Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, self-tapping screws standard of manufacturer designed to withstand design loads.
- H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. 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.

2.07 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 Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.08 FINISHES

- A. General: 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.
 - a. Color and Finish: Custom to match Architect's samples.

PART 3 - EXECUTION

3.01 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 primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. 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. Commencement of installation shall indicate acceptance of conditions.

3.02 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.

3.03 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. Roll laps with roller. Cover underlayment within time period required by underlayment manufacturer.
 1. Apply over the entire roof surface.

- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.04 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.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by installing batten seam cap and completely engage factory-applied vinyl weatherseal.
- 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.
- J. Roof Curbs: Install flashing around bases where they meet metal roof panels.
- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 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.

3.06 FIELD QUALITY CONTROL

- A. Testing and Inspections: Owner may engage qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- C. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.07 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 074113.16

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes metal composite material wall panels, with fire retardant core.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 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.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.

- b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- 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, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Delegated-Design Submittal: For metal composite material wall panel systems:
 - 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.
- E. Coordination Drawings: Submit exterior elevations, drawn to scale, that have the following items shown and coordinated with each other, using input from installers of these items as follows:
 - 1. Metal wall panels and attachments.
 - 2. Girts.
 - 3. Wall-mounted items including doors, windows, louvers and lighting fixtures.
 - 4. Penetrations of wall by pipes and utilities.
- F. 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.
- G. 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.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Manufacturer's Certificate: Certification that the products supplied meet or exceed the specified requirements, signed by manufacturer.
- C. Product Test Reports: For each product, tests performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Single Responsibility: Work shall be performed by single installer having sole responsibility for providing complete work, including components, performance, quality and appearance of the work.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with minimum 5 years of documented experience.
- C. Fabricator: Company specializing in fabrication of metal composite material wall panel systems, approved by manufacturer, certified as a MCA Premium MCM Fabricator, and with minimum 5 years documented experience.
- D. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and fabricator.

1.09 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.

1.10 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.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before panel fabrication and indicate measurements on Shop Drawings.

1.11 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.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 WALL PANEL SYSTEM FABRICATORS**

- A. Source Limitations: Obtain primary panel system components from a single manufacturer. Secondary materials for panel system shall be as approved or recommended by panel manufacturer, and when required, furnished by panel manufacturer.
- B. Fabricators: Subject to compliance with requirements, provide wall panel system fabricated by one of the following:
 - 1. East Coat Metal Systems.
 - 2. Metal Design Systems, Inc.
 - 3. Shaffner Heaney Associates, Inc.
 - 4. Sobotec, Ltd.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include [furniture, plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.03 PERFORMANCE REQUIREMENTS

- A. Design Basis: Information included on drawings and in specifications establishes a basis of aesthetics and performance for formed metal wall panel system, and is indicated by dimensions, arrangements, alignment, orientation, and profiles related to sightlines, components within the system itself and adjacent construction. Aesthetic effect or appearance shall not be changed without prior acceptance of Architect. If changes are desired, submit complete set of drawings, data and written explanation for proposed changes.
- B. General Standard: Metal composite material wall panel systems shall meet ICC AC208 - Acceptance Criteria for Metal Composite Material (MCM).
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal composite material wall panel systems.
- D. 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.

- 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: 6.24 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-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.
- I. Fire Propagation Characteristics (NFPA 285): Metal composite material wall panels shall have passed NFPA 285 testing as part of approved assembly required for the Work.
 - 1. Substitution of materials that are only part of a tested assembly, and not part of *the* tested assembly used on the Project, is not acceptable. All materials used in the assembly must have been tested together and passed meeting requirements of NFPA 285.
 - 2. Additional testing and/or engineering judgments (including costs) required by the authority having jurisdiction for material substitutions not meeting this requirement, are the responsibility of the Contractor. Provide proof in the form of NFPA 285 assembly reports or 3rd party engineering judgments acceptable to authorities having jurisdiction.

2.04 METAL COMPOSITE MATERIAL WALL PANELS - FIRE RETARDANT

- 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, fire retardant, 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 Alcoa Architectural Products (USA), Reynobond FR, or comparable product by one of the following meeting requirements of Paragraph "Fire Propagation Characteristics (NFPA 285)" in this Section:
 - a. Alcoa Architectural Products (USA).; Reynobond FR.
 - b. ALPOLIC Materials; ALPOLIC / fr (fire resistant core).
 - c. ALUCOBOND; 3A Composites USA, Inc.; Alucobond Plus.
- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, aluminum sheet facings.
 - 1. Panel Thickness: 0.157 inch.
 - 2. Core: Fire retardant.
 - 3. Exterior Finish: Mica fluoropolymer .
 - a. Color: Dark bronze, to match Architect's samples.
- C. Attachment Assembly Components: Formed from extruded aluminum.
- D. Attachment Assembly: Rainscreen principle system, dry joint. Wet sealed systems are not allowed.

2.05 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.06 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 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.

2.07 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. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION

3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.
- B. Deliver anchorage items to be cast into concrete or built into masonry to appropriate installer(s) together with setting templates.
- C. 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.
- D. Flashing and Trim: Install flashings and other sheet metal to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.03 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.

2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal composite material panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. 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.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.04 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.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.06 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. Remove site cuttings from finish surfaces.
- C. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- D. Provide protection of wall panels as necessary due to cleaning of adjacent materials with chemicals that may harm wall panel finish.
- E. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

SECTION 074213.53 - METAL SOFFIT PANELS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes metal soffit panels - wood grain finish.
- B. Related Sections:
 - 1. Section 074113.13 "Formed Metal Roof Panels" for lap-seam metal roof panels.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
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 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

- c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Delegated-Design Submittal: For metal composite material wall panel systems:
 - 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.
- E. Coordination Drawings: Submittals, drawn to scale, that have the following items shown and coordinated with each other, using input from installers of these items as follows:
 - 1. Metal soffit panels and attachments.
 - 2. Supports.
 - 3. Soffit-mounted items including vents and lighting fixtures.

4. Penetrations of wall by pipes and utilities.
- F. 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.
- G. 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.

1.06 INFORMATIONAL SUBMITTALS

- 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.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Single Responsibility: Work shall be performed by single installer having sole responsibility for providing complete work, including components, performance, quality and appearance of the work.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with minimum 5 years of documented experience.
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 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.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

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 walls, 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 - Wood Grains: 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: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.02 PERFORMANCE REQUIREMENTS

- A. Design Basis: Information included on drawings and in specifications establishes a basis of aesthetics and performance for formed metal wall panel system, and is indicated by dimensions, arrangements, alignment, orientation, and profiles related to sightlines, components within the system itself and adjacent construction. Aesthetic effect or appearance shall not be changed without prior acceptance of Architect. If changes are desired, submit complete set of drawings, data and written explanation for proposed changes.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal composite material wall panel systems.
- C. 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.
- D. 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..
- E. 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..
- 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.

2.03 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. V-Groove-Profile Metal Soffit Panels - Wood Grain: Solid panels formed with vertical panel edges and a flat pan between panel edges; with a V-groove joint between panels.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dizal.
 - b. Knotwood.
 - c. Luxyclad.
 - 2. Material: Same material, finish, and color as metal 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: Minimum 0.062 inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Manufacturer's premium wood grain high performance organic finish.
 - d. Color: Wood grain with color/species as selected by Architect from manufacturer's full range.
 - 4. Panel Width: As selected by Architect from manufacturer's full range (4", 6" or 8").

2.04 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. Trim: Pre-finished aluminum trim to match metal soffit panels, including but not limited to vent strips, inside and outside corners, starter tracks, base and flat caps, J-trim, and finishing strips.
- 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; 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.

2.05 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 soffit panel manufacturer for application but not less than thickness of metal being secured.

2.06 FINISHES

- A. General:

1. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 2. 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.
- B. Aluminum Panels and Accessories:
1. High-Performance Organic Finish (PVDF): 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.
 - a. Color and Gloss: Wood grain finish with color/species as selected by Architect from full range of manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.03 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. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- 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).

3.04 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.53

SECTION 074246 - FIBER-CEMENT CLADDING SYSTEM**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes fiber-cement cladding system, including fiber cement panels and all accessories as required to provide a complete drained and back-ventilated rainscreen system.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Section 072726 "Fluid-Applied Membrane Air Barriers" for high-build fluid applied air and water barriers.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, thicknesses, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.

- b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Shop Drawings: Submit detailed drawings showing project specific installation details.
 - 1. Provide scaled layout of fiber-cement cladding panels.
 - 2. Indicate expansion joints, both horizontal and vertical.
 - 3. Indicate ship-lap joints and cut edges
- D. Delegated-Design Submittal: For fiber-cement cladding systems:
 - 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.
- E. Samples for Initial Selection: For fiber-cement panels including related accessories.
- F. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of panels.

2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.06 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement panels.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement panels.
- C. Research/Evaluation Reports: For each type of fiber-cement panel required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing fiber cement panel systems of the type specified in this section with minimum 5 years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Proceed with panel installation only if substrate is completely dry and if existing and forecasted weather conditions permit panels to be installed according to manufacturer's written instructions

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 2. Warranty Period:
 - a. Panel: 50 years from date of Substantial Completion.
 - b. Finish: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fiber cement cladding systems.
- B. Drained and Back Ventilated Rainscreen: System must pass all component tests when tested in accordance with AAMA 509.
- C. Loading: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as indicated on Drawings, and in accordance with applicable codes. Provide systems tested in accordance with ASTM E 330 and certified to be without permanent deformation or failure of structural members.

1. Design Pressure: As indicated on Drawings, complying with requirements of codes and regulations of authorities having jurisdiction.
- D. Water Penetration: No water leakage observed into wall cavity when tested in accordance with ASTM E 331.

2.03 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

2.04 FIBER-CEMENT WALL PANELS

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nichiha Fiber Cement.
 2. Labeling: Provide fiber-cement wall panels that are tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Fiber Cement Wall Panels - Flat Panel:
1. Products: Subject to compliance with requirements provide the following:
 - a. Nichiha USA, Inc.; Illumination Series.

2. Style: Orientation as indicated on Drawings.
3. Length and Width: As indicated on Drawings.
4. Texture: Smooth.
5. Thickness: 5/8 inch, nominal.
6. Joint Treatment: Ship-lapped.
 - a. Panels shall be profiled along all four edges, with both horizontal and vertical joints between installed panels ship-lapped.
 - b. Provide factory-applied sealant gasket added to top and right panel edges; all joints contain factory sealant.
7. Finish: Factory applied topcoat.
 - a. Colors: As selected by Architect from full range of manufacturer, minimum 2 colors.

2.05 ACCESSORIES

- A. Panel Accessories, General: Provide starter strips, tracks, clips, spacers, closures, covers, flashings, joint sealants, gaskets, fillers, expansion joints, edge trim, outside and inside corner caps, and other items as recommended by panel manufacturer for building configuration.
 1. Provide accessories matching color and texture of adjacent panels unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 1. Moldings and trim, finished to match panels.
 - a. Trim: Include outside corners, vertical joints, and terminations.
- C. Steel Clip System: Standard support system of manufacturer consisting of galvanized steel starter tracks, and stainless steel panel clips, joint clips, corner clips, sealant backers, shims, and other like items necessary for support of wall panels; designed as required to accommodate specified wind loading and movement.
- D. Flashing: Manufacturer's standard proprietary flashing system, or provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 1. Finish for Aluminum Flashing: High-performance organic finish.
- E. Fasteners: Corrosion resistant fasteners recommended by panel manufacturer, such as hot-dipped galvanized screws. Do not use aluminum fasteners, staples or fasteners that are not rated or designed for intended use.
 1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch , or three screw-threads, into substrate.
- F. Joint Sealant: ASTM C920, elastomeric joint sealant as recommended by panel manufacturer, meeting requirements of Section 079200 "Joint Sealants".

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement panel system and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
Commencement of installation shall indicate acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Install sheet metal flashing meeting requirements of Section 076200 "Sheet Metal Flashing and Trim," at, but not limited to, the following locations:
 1. Above door and window trim and casings.
 2. Above horizontal trim in field of cladding system.

3. Wall bottoms, material transitions and penetrations.

3.03 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Do not install damaged components.
 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 3. Install fasteners no more than 24 inches o.c., but ultimately no more than required to accommodate specified loading requirements.
 4. Use trim details indicated on drawings.
 5. Touch up all field cut edges before installing, as acceptable to Architect.
 6. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Steel Studs: Use self-tapping screws, with the points of at least 3 screws penetrating each stud the panel crosses and at panel ends.
- C. Joints:
 1. Vertical Control/Expansion Joints: Provide within 2 to 10 feet of outside corners finished with metal trim and approximately every 30 feet thereafter.
 2. Horizontal/Compression Joints: Provide for multi-story installations meeting instructions and recommendations of manufacturer. Locate joints at floor lines. Joints are flashed minimum 1/2 inch breaks. Do not caulk.
 - a. Steel Framed and Concrete Buildings (More than three floors or 45 feet): Provide a compression joint every 25 feet at a floor line.
 3. Joints at Trim: Allow space between both ends of panels that butt against trim for thermal movement; seal joint between panel and trim with exterior grade sealant.
- D. Do not install wall panels less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
- E. Seal around all penetrations.
- F. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.04 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074246

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Adhered polyvinyl-chloride (PVC) roofing system or ketone ethylene ester (KEE) roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
 - 4. Cover boards.
 - 5. Substrate boards.
 - 6. Pavers.
 - 7. Green roof systems.
- B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 053100 "Steel Decking."
- C. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
 - 2. Section 070150.19 "Preparation for Re-Roofing" for re-cover board beneath new roofing at existing buildings.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 4. Section 077129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.
 - 5. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
 - 6. Division 22 "Plumbing" for roof drains.

1.03 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.
- B. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Heat Island Reduction:
 - a. For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement, and are DOE ENERGY STAR listed.
 - 2. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 3. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 4. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 5. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.

- b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 6. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 7. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 8. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 9. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 1. Membrane: Base flashings, membrane terminations, conditions of interface with other materials, mechanical fastener layout, and paver layout and densities, including corner, perimeter and field conditions.
 2. Insulation: Indicate layout for insulation showing each roof level, and each saddle, cricket and sloped condition. Drainage slopes and angles of tapers shall be indicated. Indicate total thickness at thinnest and thickest points of insulation, and density, placement and installation of insulation fasteners, including corner, perimeter and field locations.
 3. Roof Plan: Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
 4. Cover Board: Indicate locations, layout and details for cover board sheathing.
 5. Flashing: Show details at flashing, penetrations, and membrane terminations.
 6. Pavers: Type, layout and arrangement of pavers, and details of supports and terminations.
 7. Landscape and Green Roof Components: Location and details of protection sheets, vegetated roof components, and all other accessories required for green roof installation, and any additional requirements specified in Division 32 landscape and vegetated roof component sections.
- D. Samples for Verification: For the following products:
 1. Sheet roofing, of color required.
 2. Roof paver in each color and texture required.
 3. Walkway pads or rolls, of color required.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system
- D. Product Test Reports: For components of roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- F. Field quality-control reports.
- G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- H. Sample Warranties: For manufacturer's special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.08 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. Paver Units: Furnish 5 full size units for each type, pattern, and size indicated.

1.09 QUALITY ASSURANCE

- A. Single Responsibility: Work shall be performed by single installer having sole responsibility for providing complete work, including components, performance, quality and appearance of the work.
- B. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project; with minimum 10 years of documented experience. Manufacturer shall physically produce their own product. Products produced by other manufacturers and sold under separate manufacturer name are not acceptable. Manufacturer shall also be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.
- C. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty; with minimum 5 years documented experience. Installer shall also have documented experience of successful installations of specified roofing systems of similar type and extent as those required for the Work.
- D. Factory-Authorized Representative: Require site attendance of qualified technical representative of roofing manufacturer during installation of the work, at a minimum, during first 2 days of work and thereafter once each week, and during inspections and testing specified in Article - Field Quality Control. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered and weatherproofed the same day.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Coverage shall be non-prorated.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, vapor retarders, roof pavers, walkway products, roofing accessories, green roof system overburden and all other components of roofing system.
 - 2. Warranty Wind Speed: Not less than code required design wind speed.
 - 3. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's standard warranty, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, walkway products, roofing accessories, and green roof system overburden for the following warranty period:
 - 1. Warranty Period: 2 years from date of Substantial Completion.
- C. Additional Green Roof and Vegetation Special Warranties: As specified in Division 32 "Exterior Improvements" landscaping and vegetated roofing sections.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain primary components including roof insulation, and fasteners for roofing system from same manufacturer as membrane roofing. Secondary materials for roofing system shall be as approved or recommended by roofing membrane manufacturer, and when required, furnished by roofing manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

- C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency according to ANSI/FM 4474, to resist the design uplift pressures at corner, perimeter, and field-of-roof as determined by ASCE 7, ANSI/SPRI WD-1, and code requirements of authorities having jurisdiction; but with assembly uplift of not less than 60 psf.
- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.
- F. Slopes: Provide slopes as required to provide positive drainage of roof areas to roof drains.
 - 1. Provide saddles and crickets as required to provide unrestricted drainage around obstructions.
 - 2. Slope for general roof areas shall be 1/4 inch minimum per foot, unless otherwise indicated by Contract Documents.
 - 3. Slope for saddles and crickets shall be 1/2 inch minimum per foot, unless otherwise indicated by Contract Documents.

2.03 SUSTAINABLE DESIGN REQUIREMENTS

- A. Heat Island Reduction:
 - 1. Solar Reflectance Index (SRI): Roofing system shall have a solar reflectance index of not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
 - 2. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- B. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- C. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- D. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- E. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- F. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- G. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.

- H. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.04 PVC ROOFING

- A. General: Provide one of the following membranes, at Contractor's option.
- B. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric reinforced; manufactured by spread coat process.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corporation JM PVC MIN or comparable product by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Johns Manville.
 - c. Sarnafil Inc.
 - d. Versico Incorporated.
 - 2. Thickness - Typical: 60 mils, minimum
 - 3. Thickness - Under Green Roof: 80 mils , minimum.
 - 4. Exposed Face Color: White.
- C. PVC Sheet: ASTM D 4434/D 4434M, Type II, Grade I, glass-fiber reinforced; manufactured by spread coat process.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Sarnafil Inc; Sarnafil G410.
 - 2. Thickness - Typical: 60 mils (1.5 mm), minimum
 - 3. Thickness - Under Green Roof: 80 mils, minimum.
 - 4. Exposed Face Color: White.
- D. KEE Sheet: ASTM D 6754/ASTM D 6754M, fabric reinforced.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Seaman Corporation; FiberTite.
 - 2. Thickness - Typical: 45 mils, minimum (without cover board).
 - 3. Thickness - Green Roof: 50 mils, minimum (with cover board).
 - 4. Exposed Face Color: White.

2.05 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

- F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- G. Roof Protection Sheet: Same material as specified for roofing membrane.

2.06 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Corporation; Dens Deck Prime.
 - b. USG Corporation; Securock Glass Mat Roof Board.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.07 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
 - 1. Products: Subject to compliance with requirements, and as acceptable to roofing manufacturer, such as:
 - a. GCP Applied Technologies (Formerly Grace Construction Products/W.R. Grace & Co.); Ice and Water Shield Select.

2.08 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, as furnished by manufacturer, such products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Hunter Panels.
 - c. Johns Manville.
 - 2. Compressive Strength: 20 psi minimum.
 - 3. Thermal Resistance (LTTR): LTTR-value of 5.7 minimum for each 1 inch thickness when aged, conditioned and evaluated meeting requirements of most current edition of CAN/ULC-S770.
 - 4. Insulation Thickness: Thickness of each insulation board unit to be provided for work shall be based on thermal resistivity requirements required by codes and regulations of authorities having jurisdiction.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope as indicated on Drawings, but at minimum 1/4 inch per 12 inches.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.09 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

- B. Foam-In-Place Insulation: ASTM C1029, Type II, rigid, closed cell spray applied polyurethane (foam-in-place) insulation for thermal applications, including fill at cavities, penetrations, cracks, junctures between various building components and like conditions, with density of 1.75 pounds per cubic foot minimum.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- D. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Full-spread spray-applied, low-rise, two-component urethane adhesive.
- E. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick minimum, factory primed.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Corporation; Dens Deck Prime.
 - b. USG Corporation; Securock Glass Mat Roof Board.

2.10 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

2.11 TERRACE AND DECK PAVERS

- A. Wood Pavers: Natural Ipe wood, commercial grade structural pavers, complete with fasteners and anchors for permanent securement to support pedestals. Fasteners and anchorage shall be stainless steel and concealed in final installation.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eco Arbor Designs; Structural Ipe Deck Tile.
 - b. HandyDeck; Structural Ipe Decking Tiles.
 - c. United Construction Products; Bison Ipe Tiles.
 - 2. Fire Rating: Class A.
 - 3. Janka Hardness Rating: Minimum 3,000 lbs.
 - 4. Actual Size: 24 x 24 inches, by manufacturer standard thickness.
 - 5. Pattern: As selected by Architect from full range of manufacturer.
 - 6. Finish: As selected by Architect from full range of manufacturer.
 - 7. Stain: As selected by Architect from full range of manufacturer.
- B. Concrete Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, manufactured for use as terrace and deck pavers; minimum compressive strength of 7500 psi, ASTM C 140; with absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
 - 1. Basis-of-Design Product - High SRI Paver: Subject to compliance with requirements, provide Hanover Specialties, Inc., Glacier White Paver, or comparable product by one of the following:
 - a. Hanover Architectural Products.
 - b. Wausau Tile Inc.
 - c. Oldcastle Westile Roofing Products.
 - 2. Thickness: 2 inches.
 - 3. Face Size: 24 x 24 inches.
 - 4. Color - High SRI Pavers: White paver meeting requirements of ASTM C 1549 and ASTM C 1371 with solar reflectance of 0.65 minimum when tested meeting requirements of ASTM E 903 and emittance of 0.90 minimum when tested meeting requirements of ASTM E 408.

- C. Paver Supports: Injection molded weathering grade plastic, cruciform shape spacer tabs, telescoping to permit adjustment to height. Pedestals shall maintain a consistent space between paver units and allow water to drain between and under paver units.
- D. Paver Edging: Preformed edging, manufactured for the purpose of edging between pavers and landscaping, around drainage structures, vents and any other mechanical penetrations. Unless otherwise indicated provide prefinished aluminum with slots for optimal flow of water through system. Provide corners and connection accessories as required to permanently anchor system.
 - 1. Color: As selected by Architect from manufacturer's full range.
- E. Filter Sheet: Water permeable, non-rotting, non-woven polymeric geotextile fabric, 2 oz/yd² minimum.

2.12 GREEN ROOF SYSTEM

- A. Protection/Drainage Layer : As recommended by manufacturer and acceptable to vegetated roof system manufacturer for use as protection layer and to provide continuous free flow of water between roofing membrane and green roof components. Material shall be non-moisture holding, non-biodegradable, and resistant to soil conditions, chemicals, fertilizers, mildew and insects common to green roof assemblies.
- B. Drain Inspection Chambers: Square, stainless steel chambers for coverage of roof drains to allow for inspection and maintenance, with filtered perforations, detachable covering and load distributing contact area. Size shall be approximately 12 in square and of height as required for application.
- C. Vegetation and Edge Restraints: Vegetated trays, vegetated mats, growing media, drainage panels, edge restraints and other like landscaping components are as specified in Division 32 landscaping and vegetated roof assembly sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 "Metal" steel decking section.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed, or minimum 28 days, whichever is more stringent.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for moisture per one of the following methods, as acceptable to roofing manufacturer:
 - a. Plastic Sheet Method: Test for capillary moisture by plastic sheet method according to ASTM D 4263. Remediate as required for tests that do not pass.
 - b. Internal Relative Humidity Test: Using in situ probes per ASTM F 2170. Remediate as required in locations where concrete substrates exhibit relative humidity level greater than 75 percent, or exceeds limits of adhesive and roofing manufacturer, whichever is more stringent.
 - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.03 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions and NRCA Roofing and Waterproofing Manual.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.04 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.05 VAPOR-RETARDER INSTALLATION

- A. General:
 - 1. Continuity with Wall Vapor Retarders: Install flexible flashing from vapor retarder to vapor retarder material of wall construction, lap and seal to provide continuity of the vapor retarder barrier plane.
 - 2. Edges: Perimeter edges of vapor retarder at terminations of retarder, such as at walls, curbs, penetrations and like items shall be continuously sealed to adjacent vertical construction or roof deck as applicable to prevent any moisture reaching insulation. Seal of retarder to roof deck shall be 2 inches minimum. No wrinkles or fish mouths shall exist.
 - 3. Cavities and Penetrations: Apply foam-in-place insulation in any cavity, void or juncture, or penetration void between vapor retarder and adjacent construction, from top side or underside of roof deck, to prevent moisture flow and condensation forming on indoor surfaces of vapor retarder or adjacent construction.
- B. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.
- C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.06 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Install insulation in two or more layers over roof deck with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

- E. Slope and trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Adhered Insulation - Concrete Substrates: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- H. Mechanically Fastened and Adhered Insulation - Steel Roof Deck: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- I. Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Embed cover boards into required quantity and pattern of adhesive over insulation in accordance with insulation and roofing manufacturer's recommendations as required to resist uplift pressure at corners, perimeter and field of roof.

3.07 ADHERED ROOFING INSTALLATION

- A. Fully adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
 - 1. Install sheet according to ASTM D 5036.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- F. Extend membrane up a minimum of 8 inches onto vertical surfaces.
- G. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- H. Apply roofing with side laps shingled with slope of roof deck where possible.
- I. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation. Overlap edges and ends minimum 3 inches, but at minimum dimension required by manufacturer.
 - 1. Test lap edges with probe to verify seam weld continuity meeting requirements of Article "Field Quality Control" of this Section. Apply lap sealant to seal cut edges of sheet.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

- K. Where required by roofing membrane manufacturer, edge seal edges of membrane against moisture wicking into reinforcement with continuous bead of edge sealant. Complete edge sealing same day as membrane is installed.

3.08 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Roofing membrane shall be extended 8 inches onto vertical surfaces. Adhere flexible flashing over membrane.
- D. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- E. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- G. Penetrations: Around roof penetrations, seal flanges and flashings with flexible flashing, sealing top edge with continuous bead of sealant meeting instructions and recommendations of manufacturer, to provide watertight installation.

3.09 EXPANSION JOINTS

- A. Expansion Joints: Install roofing expansion joints where indicated. Make joints watertight.
- B. Install prefabricated joint components in accordance with manufacturer's instructions and Section 077129 "Manufactured Roof Expansion Joints."

3.10 WALKWAY INSTALLATION

- A. Flexible Walkways: Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions. Install walkway products in locations indicated, and the following:
 - 1. Four feet wide area around equipment roof curbs and supports, roof hatches and like items.
 - 2. Roof surfaces at sills of door, bottoms of steps of stairs, ladders and like conditions, 3 feet square minimum at each location.

3.11 ROOF PROTECTION SHEET

- A. Roof Protection Sheet: Provide roof protection sheet at six foot wide area around exterior perimeter of kitchen exhausts, vents, pipes and like items.

3.12 TERRACE AND DECK PAVERS

- A. General: Install pavers with non-skid finish face up, in pattern as indicated on Drawings, in accordance with written instructions and recommendations of manufacturer.
- B. Filter Sheet: For protection of roofing membrane, loose lay filter sheet over entire roof surface to receive pavers, lapping adjacent sheets 2 inches minimum and turning sheet up all vertical areas and flashed surfaces to completely protect roofing membrane and flashing.
- C. Pedestals: Accurately install adjustable height paver pedestals and accessories in locations and to elevations required. Adjust for final level and slope as required.
- D. Pavers:
 - 1. Install pavers on paver pedestals, securing to pedestals meeting instructions and recommendations of manufacturer. Provide space between underside of pavers and top of roof surface to allow for drainage, and provide space between pavers to permit surface water drainage.
 - 2. Install pavers to vary not more than 1/16 inch in elevation between adjacent pavers, or not more than 1/16 inch from surface plane elevation of individual paver.

3. Maintain tolerances of paving installation within 1/4 inch in 10 feet of surface plane in any direction.

3.13 GREEN ROOF SYSTEM INSTALLATION

- A. General: As specified in Division 32 "Exterior Improvements" landscaping and vegetated roof assembly sections.
- B. Protection/Drainage Layer: Provide protection/drainage layer over entire roof membrane area to receive vegetated roof trays.
 1. Install drainage composite directly over the waterproofing membrane.
 2. Neatly trim drainage composite to fit closely around penetrations and at the base of all drains to ensure that water will flow freely from composite into drain openings.
 3. All cut edges of the drainage composite shall be covered in order to protect the waterproofing membrane from damage.

3.14 DAILY SEAL

- A. At end of each days work, provide temporary water cut-off edge seal at loose ends of roofing membrane providing 100 percent water tight seal.
- B. Remove temporary seal upon resuming work. Remove contaminated membrane and insulation. Do not reuse contaminated materials in the work.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Fastener Pullout Tests: Perform mechanical fastener pullout resistance tests at project site to confirm fastener and roof deck holding resistance, and fastener density. Testing shall be in compliance with FM DS 1-29 and ANSI/SPRI FX-1.
- C. Welded Seam Evaluations:
 1. Destructive Evaluations: Perform destructive testing on one inch wide cross section of welded seams a minimum of two times a day including first seam of day, on first seam after welder has cooled and if extreme weather changes have occurred. Perform corrective action on welds of seams that fail from shearing of membrane prior to separation of weld. Patch each weld seam watertight. Keep records of testing indicated dates, times, weather conditions and results of testing. Provide upon request.
 2. Non-Destructive Evaluations: Probe full length of heat welded seams to ensure consistent seaming with rounded end probing tool. Installer shall evaluate on-site daily.
- D. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire roof area for potential leaks using electric field vector mapping (EFVM).
- E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- F. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.16 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Manufactured through-wall flashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed steep-slope roof sheet metal fabrications.
 - 5. Formed wall sheet metal fabrications.
 - 6. Formed equipment support flashing.
 - 7. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Roofing sections for materials and installation of sheet metal flashing and trim integral with roofing.
 - 3. Exterior metal panel wall system sections for sheet metal flashing and trim integral with metal wall panels.
 - 4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.03 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.

1.04 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 temporary conditions, and procedures for coping with inclement weather.
 - 3. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 4. Review warranty provisions and requirements of roofing work related to sheet metal flashing and trim.
 - 5. Review requirements for insurance and certificates if applicable.
 - 6. Review sheet metal flashing observation and repair procedures after flashing installation.

1.05 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. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.06 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.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.08 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.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes - Anodic Finish: 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. Finish Warranty Period: 5 years from date of Substantial Completion.

- B. Special Warranty on Finishes - High Performance Organic Finish: 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.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. 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.
- E. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.
- F. Metal Flatness: Flat metal components shall have exposed surfaces of such flatness that when measured, maximum slope of surface at any point, measured from nominal plane of surface, shall not exceed 1.25 percent.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. As-Milled Finish: Mill.
 - 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - 3. Exposed Coil-Coated Finish:
 - a. High-Performance Organic Finish - Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes 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.
 - b. Color: Match Architect's sample.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .

- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish - Exposed: 4 (polished directional satin).
 - 2. Finish - Concealed: 2D (dull, cold rolled).
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 ; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. High-Performance Organic Finish - Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes complying with AAMA 621 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.
 - 3. Color: Match Architect's sample.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .

2.03 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HTUltra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Metal High Temperature Underlayment.
 - g. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

- c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
- 1. For Stainless Steel: ASTM B 32, 80 percent tin and 20 percent lead where exposed and 60 percent tin and 40 percent lead where covered, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
- 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
- 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 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 - Soldered Metals: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams - Painted or Coated Metals: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Seams for Aluminum - Uncoated Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- J. Do not use graphite pencils to mark metal surfaces.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness, unless greater thickness is indicated on Drawings. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
 - 1. Gutter Profile: As indicated on Drawings.
 - 2. Expansion Joints: Butt type with cover plate.
 - 3. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 4. Gutters with Girth up to 15 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
 - 5. Gutters with Girth 16 to 20 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.
 - 6. Gutters with Girth 21 to 25 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
 - 7. Gutters with Girth 26 to 30 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.063 inch thick.
- B. Downspouts: Fabricate downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
 - 1. Hangar Style: As indicated on Drawings.
 - 2. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 3. Fabricate from the following materials:
 - a. Aluminum: 0.024 inch thick.
- C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 - 1. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows.
 - 1. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

- E. Splash Pans: Fabricate to dimensions and shape required.
 - 1. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.

2.07 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. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
 - 2. Fabricate with scuppers spaced maximum 10 feet apart, to dimensions required with 4-inch- wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 - 3. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 4. 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 drill elongated holes for fasteners on interior leg. Miter corners, lap seam, and seal watertight. Shop fabricate interior and exterior corners.
 - 1. Coping Profile: As indicated on Drawings.
 - 2. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
 - 3. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 4. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
- D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch thick.

2.08 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. General: As specified in Section 073113 "Asphalt Shingles."

2.09 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.
 - 1. Fabricate from the following materials:
 - a. Stainless Steel: 0.016 inch thick.

- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams.
 - 1. Finish: Clear anodic finish, and high performance organic (PVDF) finish, as indicated on Drawings.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

2.10 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

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches . Roll laps and edges with roller. Cover underlayment within 14 days.

3.03 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 and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws, but at minimum not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches ; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel and aluminum sheet.
 - 2. Do not use torches for soldering.
 - 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 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.

3.04 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. Fasten gutter spacers to front and back of gutter.
 - 2. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.

3. Anchor gutter with gutter brackets spaced not more than 36 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.
 5. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- 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.
 3. Connect downspouts to underground drainage system.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.
- E. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
 2. Loosely lock front edge of scupper with conductor head.
 3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.05 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches 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 snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant, as required for compatibility with roofing membrane, and clamp flashing to pipes that penetrate roof.

3.06 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in .
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend minimum 4 inches beyond wall openings. Up turn interior flashing leg and fully seal end dams.

3.07 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.

3.08 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.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.09 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Flanged bellows-type roof expansion joints.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
 - 3. Section 077200 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.

- b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
B. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.07 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.

1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 FLANGED BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows-Type Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover consisting of exposed membrane bellows laminated to flexible, closed-cell support foam, and secured along each edge to 3- to 4-inch- wide metal flange.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corporation, Expando-O-Flash, or comparable product by one of the following:
 - a. Balco, Inc.
 - b. C/S Group.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Watson Bowman Acme Corp.
 2. Source Limitations: Obtain flanged bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
 3. Joint Movement Capability: Plus and minus 50 percent of joint size.
 4. Bellows: EPDM, Neoprene, or PVC flexible membrane, nominal 60 mils thick.
 5. Flanges: Galvanized steel, 0.022 inch thick.
 6. Configuration: Flat to fit cants, or angle formed to fit curbs, as applicable.
 7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 8. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
 9. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to drain or to exterior-wall expansion joint cover, as indicated on Drawings.
 - b. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed mineral-fiber insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.
- B. Materials:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 .
 2. EPDM Membrane: ASTM D 4637/D 4637M, type standard with manufacturer for application.
 3. Neoprene Membrane: Neoprene sheet recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil; and as standard with roof-expansion-joint manufacturer for application.
 4. PVC Membrane: ASTM D 4434/D 4434M, type standard with manufacturer for application.

2.04 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral-Fiber Blanket: ASTM C 665.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION**3.01 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. Commencement of installation shall indicate acceptance of conditions.

3.02 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 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.
- 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.
- E. 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.

END OF SECTION 077129

SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes exterior building expansion joint cover assemblies.
- B. Related Requirements:
 - 1. Section 077129 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion joint cover assemblies.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 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. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

- c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
- 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
- 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
- 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
- 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- 8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

1.06 COORDINATION

- A. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.
- B. Coordinate installation of exterior wall expansion joint systems with roof expansion assemblies to ensure that wall transitions are watertight.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Source Limitations: Obtain all exterior architectural joint systems through one source from a single manufacturer.
- B. Furnish units in longest practicable lengths to minimize field splicing.
- C. 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.

2.02 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 by a qualified testing agency.
 1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.
- B. Expansion Joint Design Criteria:
 1. Type of Movement:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.

2.03 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.

2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
 - F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
 - G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
 - I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.04 EXTERIOR EXPANSION JOINT COVERS

- A. Precoated Expanding Foam Seal: Precoated expanding foam seal with silicone face coating.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide EMSEAL Joint Systems Ltd.; Colorseal (non-fire rated) and EMSHIELD (fire rated), or comparable product by one of the following:
 - b. EMSEAL Joint Systems, Ltd.
 - d. Watson Bowman Acme Corp.
 2. Foam Material: Polyurethane.
 - a. Exposed Face Coating: High grade, low-modulus silicone, factory applied.
 - b. Color: As selected by Architect from manufacturer's full range.
 3. Fire-Resistance Rating: For joints in fire rated assemblies, provide joint system and fire-barrier assembly with a rating not less than that indicated on Drawings.

2.05 MATERIALS

- A. Expanding Foam Seals: Extruded, compressible foam designed to function under compression.

2.06 ACCESSORIES

- A. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.
- B. Adhesive: Manufacturer's standard adhesive for installation of expansion joint cover assemblies.
- C. Silicone Sealant: Standard silicone sealant of manufacturer for use at edge of silicone facing of precoated expanding foam seals.

- D. Intumescent Sealant: Intumescent sealant standard of manufacturer for use with fire rated precoated expanding foam seals.

PART 3 - EXECUTION

3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 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.

3.03 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. Foam Seals: Install with adhesive and silicone sealants as recommended by manufacturer. To ensure continuity of the seal, install with factory-fabricated transition and corner pieces at changes in plane or direction.
 - 1. Apply intumescent sealant to exposed faces of foam at joints in foam seals to provide a continuous fire barrier, meeting instructions and recommendations of manufacturer.
- C. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

3.04 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 077129 "Manufactured Roof Expansion Joints." Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.05 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 079513.16

SECTION 080314 - HISTORIC TREATMENT OF WOOD DOORS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes historic treatment of wood doors in the form of the following:
 - 1. Repairing wood doors and trim.
 - 2. Repairing, refinishing, and replacing hardware.

1.03 DEFINITIONS

- A. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.
- B. Door: Generally, this term includes door frame, leaves, hardware, side panels or lights, fan light and transom, etc. unless otherwise indicated by context.
- C. Storm Vestibule: Removable winter enclosure erected on a covered porch, which includes side panels or lights and door leaf and may include top panels.
- D. Wood Door Component Terminology: Wood door components for historic treatment work include the following classifications:
 - 1. Frame Components: Head, jambs, stop, and threshold or sill.
 - 2. Leaf Components: Stiles, rails, and muntins.
 - 3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
 - 4. Interior Trim: Casing.

1.04 SEQUENCING AND SCHEDULING

- A. Perform historic treatment of wood doors in the following sequence, which includes work specified in this and other Sections:
 - 1. Label each door frame with permanent opening-identification number in inconspicuous location.
 - 2. Tag existing door leaves, storm doors, and storm-vestibule panels with opening-identification numbers and remove for on-site or off-site repair. Indicate on tags the locations on door of each component, such as "left-hand door leaf," "right-hand reverse door leaf," "top dutch-door leaf," "bottom dutch-door leaf," "first left-side storm-vestibule panel," and "second left-side storm-vestibule panel."
 - 3. Remove door, dismantle hardware, and tag hardware with door opening-identification numbers.
 - 4. In the shop, label each leaf, storm door, storm-vestibule panel, and screen-door unit with permanent opening-identification number in inconspicuous location and remove site-applied tags.
 - 5. Install temporary protection and security at door openings.
 - 6. Sort units by condition, separating those that need extensive repair.
 - 7. Clean surfaces.
 - 8. General Wood-Repair Sequence:
 - a. Remove paint to bare wood.
 - b. Rack frames slightly to inject adhesive into mortise and tenon joints; square frames to proper fit before adhesive sets.
 - c. If glass thicker than original is required, rout existing muntins to required rebate size.
 - d. Repair wood by consolidation, member replacement, partial member replacement, and patching.
 - e. Sand, prime, fill, sand again, and prime surfaces again for refinishing.

9. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
10. Install glazing.
11. Remove temporary protection and security at door openings.
12. Reinstall units.
13. Apply finish coats.
14. Install remaining hardware and weather stripping.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Shop Drawings: For locations and extent of wood-door repair and replacement work.
 1. Include plans, elevations, sections, and details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood door, accessory items, and finishes.
 2. Include field-verified dimensions and the following:
 - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relation of existing to new components.
 - b. Templates and directions for installing hardware and anchorages.
 - c. Identification of each new unit and its corresponding door locations in the building on annotated plans and elevations.
 - d. Provisions for sealant joints and flashing weather sweeps as required for location.
- C. Samples for Initial Selection: For each type of exposed wood and finish.
 1. Identify wood species, cut, and other features.
 2. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
 1. Replacement Units: 12-inch- long, full-size frame and leaf sections with applied finish.
 2. Replacement Members: 12 inches long for each replacement member, including parts of frame, leaf, exterior trim, and interior trim.
 - a. Additional Samples of replacement members that show fabrication techniques, materials, and finishes as requested by Architect.
 3. Repaired Wood Door Members: Prepare Samples using existing wood door members removed from site, repaired, and prepared for refinishing.
 4. Refinished Wood Door Members: Prepare Samples using existing wood door members removed from site, repaired, and refinished.
 5. Hardware: Full-size units with each factory-applied or restored finish.
 6. Weather Stripping: 12-inch- long sections.
 7. Glass: Full-size units of each type and appearance.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For workers and wood-repair-material manufacturer.
- B. Preconstruction Test Reports: For historic treatment of wood doors.

1.07 QUALITY ASSURANCE

- A. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

- B. Mockups: Prepare mockups of historic treatment repair processes to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are as inconspicuous as practicable.
 - 1. Locate mockups on existing wood materials where directed by Architect.
 - 2. Wood Door Repair: Prepare one entire door unit to serve as mockup to demonstrate Samples of each type of repair of wood door members including frame, leaves, glazing, and hardware.
 - 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.

1.08 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Perform preconstruction testing on historic wood doors.
 - 1. Provide test specimens representative of proposed materials and existing construction.
 - 2. Test historic treatment products and methods for effectiveness and compliance with specified requirements.
- B. Wood Species and Paint Color: Perform paint analysis and wood analysis to determine original paint color and original species of wood doors and trim.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.
- B. Store products inside a well-ventilated area, protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with historic treatment of wood doors only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.01 HISTORIC TREATMENT OF WOOD DOORS, GENERAL

- A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grades of wood doors, and other requirements unless otherwise indicated.
 - 1. Exception: Industry practices cited in the "Architectural Woodwork Standards," Section 12, Article 1.5, "Industry Practices," do not apply to the work of this Section.

2.02 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
 - 1. Species: Match species of original wood, as determined by wood species analysis.
- B. Frame Heads and Jambs and Exterior Trim: Match species of original wood, as determined by wood species analysis.
- C. Exterior Trim: Match species of original wood, as determined by wood species analysis.
- D. Leaf Components: Match species of original wood, as determined by wood species analysis.

- E. Interior Trim: Match species of original wood, as determined by wood species analysis.

2.03 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated because of weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. ConServ Epoxy LLC.
 - c. Gougeon Brothers, Inc.
 - d. Protective Coating Company.
 - e. System Three Resins, Inc.
- C. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated because of weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. Advanced Repair Technology, Inc.
 - c. ConServ Epoxy LLC.
 - d. Gougeon Brothers, Inc.
 - e. Polymeric Systems, Inc.
 - f. Protective Coating Company.
 - g. System Three Resins, Inc.

2.04 HARDWARE

- A. Primary Door Hardware, General: Provide complete sets of door hardware consisting of hinges, pulls, locks, latches, and accessories indicated for each door or required for proper operation. Sets shall include replacement hardware to complement repaired and refinished, existing hardware. Door hardware shall smoothly operate, tightly close, and securely lock wood doors and be sized to accommodate frequency of use, glazing weight, and dimensions.
- B. Other Hardware, General: Provide complete sets of hardware for each type of door consisting of hinges, pulls, latches, fasteners, clips, and accessories indicated or required for proper operation. Hardware shall smoothly operate, tightly close, and secure units appropriately for frequency of use, unit weight, and dimensions.
- C. Replacement Hardware: Replace existing damaged or missing hardware with new hardware manufactured by one of the following:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Resource Center (The).
 - b. Ball and Ball.
 - c. Blaine Window Hardware Inc.
- D. Material and Design:
1. Material: Solid bronze or alloy indicated unless otherwise indicated.
 2. Design: Match type and appearance of existing hardware.
 3. Replacement Door Hardware: Regardless of mechanisms within, match existing, exposed door hardware of the following types:
 - a. Door knobs, levers, and escutcheons.

- b. Door latches.
 - c. Handles.
- 4. Date Identification: Emboss on a concealed surface of the metal body of each new hardware item, in easily read characters, "MADE <Insert year>." Manufacturer's name may also be embossed. For cast iron or other brittle metals, add the identification to the mold pattern before casting. For malleable metals, stamp identification with an imprinting tool.
- E. Hardware Finishes: Match original hardware. Comply with BHMA A156.18 for base material and finish requirements.

2.05 WEATHER STRIPPING

- A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when door is closed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
 - 2. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
 - a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C 509.
 - b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C 864.
- B. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
 - 2. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.
- C. Metal Weather Stripping: Bronze or zinc weather stripping; designed either as one piece to seal door at head and jambs by door sliding against it or as two pieces that interlock; and completely concealed when door is closed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accurate Metal Weatherstrip Co. Inc.
 - b. Zero International, Inc.

2.06 MISCELLANEOUS MATERIALS

- A. Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; complying with AWWA P5; containing no boric acid.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. Nisus Corporation.
 - c. System Three Resins, Inc.

- B. Cleaning Materials:
 - 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
 - 2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure conditions.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 - 2. Use concealed fasteners for interconnecting wood components.
 - 3. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
 - 4. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 - 5. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.
- E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and door accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B 633 for SC 3 (Severe) service condition.

2.07 WOOD DOOR FINISHES

- A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.
 - 1. Field finish priming and painting of historic wood is specified in Section 090391 "Historic Treatment of Plain Painting."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent materials from damage by historic treatment of wood doors.
- B. Clean wood doors of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.03 HISTORIC TREATMENT OF WOOD DOORS, GENERAL

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from the door interior at 10 feet away and from the door exterior at 20 feet away.
- B. General: In treating historic items, disturb them as minimally as possible and as follows:
 - 1. Stabilize and repair wood doors to reestablish structural integrity and weather resistance while maintaining the existing form of each item.

2. Remove coatings and apply borate preservative treatment before repair. Remove coatings according to Section 090391 "Historic Treatment of Plain Painting," unless otherwise indicated.
 3. Repair items in place where possible.
 4. Install temporary protective measures to protect wood door work that is indicated to be completed later.
 5. Refinish historic wood windows according to Section 090391 "Historic Treatment of Plain Painting," unless otherwise indicated.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.
- D. Repair and Refinish Existing Hardware: Dismantle door hardware; strip paint, repair, and refinish it to match finish Samples; and lubricate moving parts just enough to function smoothly.
- E. Repair Wood Doors: Match existing materials and features, retaining as much original material as possible to perform repairs.
1. Unless otherwise indicated, repair wood doors by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 2. Where indicated, repair wood doors by limited replacement matching existing material.
- F. Replace Wood Units: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
1. Compatible substitute materials may be used.
- G. Protection of Openings: Where doors are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.
- H. Identify removed doors, frames, leaves, and members with numbering system corresponding to door locations to ensure reinstallation in same location. Key doors, leaves, and members to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.04 WOOD DOOR PATCH-TYPE REPAIR

- A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.
1. Remove leaves from door frames before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated. Reglaze units prior to reinstallation.
 2. Verify that surfaces are sufficiently clean and free of paint residue before patching.
 3. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
 4. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.

3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
5. Clean spilled compound from adjacent materials immediately.

3.05 WOOD DOOR MEMBER-REPLACEMENT REPAIR

- A. General: Replace parts of wood door members at locations where damage is too extensive to patch.
 1. Remove leaves from doors before performing member-replacement repairs unless otherwise indicated.
 2. Verify that surfaces are sufficiently clean and free of paint residue before repair.
 3. Remove broken, rotted, and decayed wood down to sound wood.
 4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
 5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Glazing: Reglaze units before reinstallation.
 1. Mill new and rout existing glazed members to accommodate new glass thickness.
 2. Provide replacement glazing stops coordinated with glazing system indicated.
 3. Provide glazing stops to match contour of door frames.
- F. Reinstall units removed for repair into original openings.
- G. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter weather stripping for each exterior leaf.

3.06 GLAZING

- A. Comply with combined written instructions of manufacturers of glass, glazing system, and glazing materials, unless more stringent requirements are indicated.
- B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.
- C. Remove existing glass and glazing where indicated on Drawings and prepare surfaces for reglazing.
- D. Remove glass and glazing from openings and prepare surfaces for reglazing.
- E. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.
- F. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.
- G. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.
- H. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.
- I. Install glazing points.
- J. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless otherwise indicated.

3.07 WEATHER STRIPPING INSTALLATION

- A. Install weather stripping for tight seal of joints as determined by preconstruction testing and demonstrated in mockup.

3.08 FIELD QUALITY CONTROL

- A. Manufacturers Field Service: Engage a factory-authorized, wood-repair-material service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

3.09 ADJUSTING

- A. Adjust existing and replacement operating leaves, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.10 CLEANING AND PROTECTION

- A. Protect door surfaces from contact with contaminating substances resulting from construction operations. Monitor door surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact door surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after historic treatment of wood doors. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 080314

SECTION 080352 - HISTORIC TREATMENT OF WOOD WINDOWS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes historic treatment of wood windows in the form of the following:
 - 1. Repairing wood windows and trim.
 - 2. Replacing wood window frames and sash units.
 - 3. Reglazing.
 - 4. Repairing, refinishing, and replacing hardware.
 - 5. Providing new storm-window units.
- B. Related Requirements:
 - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.
 - 2. Section 024296 "Historic Removal and Dismantling" for historic removal and dismantling work.

1.03 DEFINITIONS

- A. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.
- B. Window: Includes window frame, sash, hardware, storm window, and exterior and interior shutters unless otherwise indicated by context.
- C. Wood Window Component Terminology: Wood window components for historic treatment work include the following classifications:
 - 1. Frame Components: Head, jambs, and sill.
 - 2. Sash Components: Stiles and rails, parting bead, stop, and muntins.
 - 3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
 - 4. Interior Trim: Casing, stool, and apron.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic treatment of wood windows.
 - 2. Review methods and procedures related to historic treatment of wood windows including, but not limited to, the following:
 - a. Historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Fire-protection plan.
 - d. Wood window historic treatment program.
 - e. Coordination with building occupants.

1.05 SEQUENCING AND SCHEDULING

- A. Perform historic treatment of wood windows in the following sequence, which includes work specified in this and other Sections:
 - 1. Label each window frame with permanent opening-identification number in inconspicuous location.

2. Tag existing window sash, storm windows, and shutters with opening-identification numbers and remove for on-site or off-site repair. Indicate on tags the locations on window of each component, such as "top sash," "bottom sash," "left shutter," and "right shutter."
3. Remove window, dismantle hardware, and tag hardware with opening-identification numbers.
4. Install temporary protection and security at window openings.
5. In the shop, label each sash, storm window, shutter, and louvered blind unit with permanent opening-identification number in inconspicuous location and remove site-applied tags.
6. Sort units by condition, separating those that need extensive repair.
7. Clean surfaces.
8. General Wood-Repair Sequence:
 - a. Remove paint to bare wood.
 - b. Rack frames slightly to inject adhesive into mortise and tenon joints; square frames to proper fit before adhesive sets.
 - c. If thicker than original glass is required, rout existing muntins to required rebate size.
 - d. Repair wood by consolidation, member replacement, partial member replacement, and patching.
 - e. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
9. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
10. Install glazing.
11. Remove temporary protection and security at window openings.
12. Reinstall units.
13. Apply finish coats.
14. Install remaining hardware and weather stripping.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood window, accessory items, and finishes.
 2. Include field-verified dimensions and the following:
 - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relation of existing to new components.
 - b. Templates and directions for installing hardware and anchorages.
 - c. Identification of each new unit and its corresponding window locations in the building on annotated plans and elevations.
 - d. Provisions for sealant joints, [and flashing as required for location.
- C. Samples for Initial Selection: For each type of exposed wood and finish.
 1. Identify wood species, cut, and other features.
 2. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
 1. Replacement Units: 12-inch- long, full-size frame and sash sections with applied finish.
 2. Replacement Members: 12 inches long for each replacement member, including parts of frame, sash, exterior trim, and interior trim.
 - a. Additional Samples of replacement members that show fabrication techniques, materials, and finishes as requested by Architect.

3. Repaired Wood Window Members: Prepare Samples using existing wood window members removed from site, repaired, and prepared for refinishing.
4. Refinished Wood Window Members: Prepare Samples using existing wood window members removed from site, repaired, and refinished.
5. Hardware: Full-size units with each factory-applied or restored finish.
6. Weather Stripping: 12-inch- long sections.
7. Glass: Full-size units of each type and appearance.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For historic treatment specialist,] and wood-repair-material manufacturer.
- B. Wood Window Historic Treatment Program: Submit before work begins.
- C. Preconstruction Test Reports: For historic treatment of wood windows.

1.08 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic wood window specialist, experienced in repairing, refinishing, and replacing wood windows in whole and in part. Experience only in fabricating and installing new wood windows is insufficient experience for wood-window historic treatment work.
- B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.
- C. Wood Window Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site.
 1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
- D. Mockups: Prepare mockups of historic treatment repair processes to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are as inconspicuous as practicable.
 1. Locate mockups on existing windows where directed by Architect.
 2. Wood Window Repair: Prepare one entire window unit to serve as mockup to demonstrate samples of each type of repair of wood window members including frame, sash, glazing, and hardware.
 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.

1.09 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing on historic wood windows.
 1. Provide test specimens representative of proposed materials and existing construction.
 2. Test historic treatment products and methods for effectiveness and compliance with specified requirements.
- B. Wood Species and Paint Color: Perform paint analysis and wood analysis to determine original paint color and original species of wood doors and trim.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products are not deformed, broken, or otherwise damaged.
- B. Store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with historic treatment of wood windows only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS**2.01 HISTORIC TREATMENT OF WOOD WINDOWS, GENERAL**

- A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grades of wood windows, and other requirements unless otherwise indicated.
 - 1. Exception: Industry practices cited in Section 12, Article 1.5, Industry Practices, of the Architectural Woodwork Standards do not apply to the work of this Section.

2.02 REPLICATED WOOD WINDOW UNITS

- A. Replicated Wood Window Frames and Sash: Custom-fabricated replacement wood units and trim, with operating and latching hardware.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Architectural Millwork Co.
 - b. Allegheny Restoration & Builders Inc.
 - c. Architectural Components, Inc.
 - d. Bear Wood Windows, Inc.
 - e. Cleary and Son, Inc.
 - f. Custom Wood Reproductions Inc.
 - g. Grabill Windows & Doors.
 - h. H. Hirschmann LTD.
 - i. Kingsland Architectural Millwork.
 - j. Olek Lejbzon & Co.
 - k. Parrett Manufacturing, Inc.
 - l. Replica Windows.
 - m. Smith Restoration Sash.
 - n. Weston Millwork Company.
 - o. Wewoka Window Works.
 - p. Woodstone Company (The).
 - q. Wood Window Workshop.
 - 2. Joint Construction: Joints matching existing.
 - 3. Wood Species: Match wood species of exterior window trim and sash parts, as determined by wood species analysis.
 - 4. Wood Cut: Match cut of existing exterior wood window trim and sash parts.
 - 5. Wood Window Members and Trim: Match profiles and detail of existing window members and trim.
 - 6. Glazing: Clear insulating glass unit, meeting requirements of Section 088000 "Glazing."
 - a. Overall Unit Thickness: 7/16" (11 mm)
 - b. Interspace Content: Argon.

7. Glazing Stops: Provide replacement glazing stops coordinated with glazing system indicated.
8. Exposed Hardware: Reuse. If hardware is too deteriorated to reuse, match existing exposed window hardware.
9. Weather Stripping: Full-perimeter and meeting rail weather stripping for each operable sash.
10. Date Identification: Emboss on a concealed surface of each replaced window frame and sash, in easily read characters, "WINDOW MADE <Insert year>" or "SASH MADE <Insert year>." Manufacturer's name may also be embossed.

2.03 STORM WINDOWS

- A. General: Custom fabricated, tight fitting and with operating and latching hardware.
 1. Fabricate storm windows for installation on inside of primary window.
 2. Fabricate storm window frame and sash so as not to be visible from the exterior.
 3. Make storm windows removable for cleaning and storage.
- B. Wood Storm Windows:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Window Inc.
 - b. Cleary and Son, Inc.
 - c. Kingsland Architectural Millwork.
 - d. Smith Restoration Sash.
 - e. Weston Millwork Company.
 - f. Wewoka Window Works.
 - g. Woodstone Company (The).
 - h. Wood Window Workshop.
 2. Joint Construction: Mortise and tenon joints.
 3. Wood Species: Cedar.
 4. Wood Storm-Window Members: As indicated on Drawings.
 5. Hardware: As required to secure storm window to window frames.
 6. Glazing Material: Clear, laminated glass.

2.04 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
 1. Species: Ponderosa pine unless otherwise indicated.
- B. Frame Heads and Jambs and Exterior Trim: Ponderosa pine, eastern white pine, or Idaho white pine.
- C. Sills: All-heart vertical grain redwood
- D. Sash Components: Ponderosa pine, eastern white pine, or Idaho white pine.
- E. Interior Trim: Ponderosa pine, eastern white pine, or Idaho white pine.

2.05 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood.
 - b. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100.
 - c. Gougeon Brothers, Inc.; West System.

- d. Protective Coating Company; PC-Petrifier or PC-Rot Terminator.
 - e. System Three Resins, Inc.; RotFix.
- C. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood with WoodEpoxy.
 - b. Advanced Repair Technology, Inc.; Primatrate with Flex-Tec HV.
 - c. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
 - d. Gougeon Brothers, Inc.; West System thickened with filler.
 - e. Polymeric Systems, Inc.; QuickWood.
 - f. Protective Coating Company; PC-Woody.
 - g. System Three Resins, Inc.; Sculpwood.

2.06 GLAZING MATERIALS

- A. Glass:
- 1. Replacement Glass in Existing Units to Remain: Clear float glass to match existing, meeting requirements of Section 088000 "Glazing."
 - 2. Glass in Replacement Window Units: Clear, insulating glass units, as specified for replacement window units, meeting requirements of Section 088000 "Glazing."
 - 3. Storm Windows: Clear, laminated glass units meeting requirements of Section 088000 "Glazing."
- B. Glazing Systems:
- 1. Traditional Glazing Products: Glazing points and oil-based glazing putty or latex glazing compound. Tint to required color according to manufacturer's written instructions.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) DAP Products Inc.; DAP 33 Glazing or DAP Latex Window Glazing.
 - 2) Sarco Putty Company, Inc.; SarcoSeal Dual Glaze Elastic Glazing Compound or SarcoSeal Multi-Glaze Elastic Glazing Compound Type M.
 - 3) United Gilsonite Laboratories; Glazol Glazing Compound.
 - 2. Modern Glazing Products: Glazing points and single-component polyurethane glazing compound; ASTM C 920, Type S, Grade NS, Class 25, Use G; struck uniformly to match taper of existing glazing putty (removed); colored as required to match painted sash.
 - 3. Primers and Cleaners for Glazing: As recommended in writing by glazing material manufacturer.

2.07 HARDWARE

- A. Window Hardware: Provide complete sets of window hardware consisting of sash balances, hinges, pulls, latches, and accessories indicated for each window or required for proper operation. Sets shall include replacement hardware to complement repaired and refinished, existing hardware. Window hardware shall smoothly operate, tightly close, and securely lock wood windows and be sized to accommodate sash or ventilator weight and dimensions.
- B. Other Hardware: Provide complete sets of hardware for each type of storm window consisting of hinges, pulls, latches, and accessories indicated or required for proper operation. Hardware shall smoothly operate, tightly close, and secure units appropriately for unit weight and dimensions.
- C. Replacement Hardware: Replace existing damaged or missing hardware with new hardware manufactured by one of the following:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Resource Center (The).

- b. Ball and Ball.
 - c. Blaine Window Hardware Inc.
 - d. Bronze Craft Corporation (The).
 - e. Phelps Company.
 - f. Smith Restoration Sash.
- D. Material and Design:
 - 1. Material: Cast or wrought aluminum unless otherwise indicated.
 - 2. Design: Match type and appearance of existing hardware.
 - 3. Spring Sash-Balance: Concealed spring-loaded, block-and-tackle type; size and capacity to hold sash stationary at any open position.
 - 4. Replacement Window Hardware: Match existing window hardware of the following types:
 - a. Projected window hinge.
 - b. Window lock.
 - c. Window latch.
 - d. Handle.
- E. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated by the following:
 - 1. BHMA 689: Aluminum painted; over any base metal.

2.08 WEATHER STRIPPING

- A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when window is closed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
 - 2. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
 - a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C 509.
 - b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C 864.
- B. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
 - 2. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.
- C. Metal Weather Stripping: Zinc weather stripping; designed either as one piece to seal by sliding into a groove in the sash or as two pieces that interlock; and completely concealed when window is closed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accurate Metal Weatherstrip Co. Inc.
 - b. Zero International, Inc.

2.09 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; complying with AWWA P5; containing no boric acid.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. Nisus Corporation.
 - c. System Three Resins, Inc.
- B. Cleaning Materials:
 - 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
 - 2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- C. Adhesives: Wood adhesives for exterior exposure, with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 - 2. Use concealed fasteners for interconnecting wood components.
 - 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable.
 - 4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
 - 5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 - 6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.
- E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B 633 for SC 3 (Severe) service condition.

2.10 WOOD WINDOW FINISHES

- A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.
 - 1. Field finish priming and painting of historic wood is specified in Section 090391 "Historic Treatment of Plain Painting."

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect adjacent materials from damage by historic treatment of wood windows.
- B. Clean wood windows of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.02 HISTORIC TREATMENT OF WOOD WINDOWS, GENERAL

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from the window interior at 5 feet away and from the window exterior at 20 feet away.
- B. General: In treating historic items, disturb them as minimally as possible and as follows:
 - 1. Stabilize and repair wood windows to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 - 2. Remove coatings and apply borate preservative treatment before repair. Remove coatings according to Section 090391 "Historic Treatment of Plain Painting," unless otherwise indicated.
 - 3. Repair items in place where possible.
 - 4. Install temporary protective measures to protect wood window work that is indicated to be completed later.
 - 5. Refinish historic wood windows according to Section 090391 "Historic Treatment of Plain Painting," unless otherwise indicated.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.
- D. Repair and Refinish Existing Hardware: Dismantle window hardware; strip paint, repair, and refinish it to match finish samples; and lubricate moving parts just enough to function smoothly.
- E. Repair Wood Windows: Match existing materials and features, retaining as much original material as possible to perform repairs.
 - 1. Unless otherwise indicated, repair wood windows by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 - 2. Where indicated, repair wood windows by limited replacement matching existing material.
 - 3. Sash Balance: Repair sash balances to function according to type as specified in "Hardware" Article" above. Provide missing sash balances.
- F. Replace Wood Units: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
 - 1. Compatible substitute materials may be used.
- G. Protection of Openings: Where sash or windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.
- H. Identify removed windows, frames, sash, and members with numbering system corresponding to window locations to ensure reinstallation in same location. Key windows, sash, and members to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.03 WOOD WINDOW PATCH-TYPE REPAIR

- A. General: Patch wood members that exhibit depressions, holes, or similar voids, and that have limited amounts of rotted or decayed wood.
 - 1. Remove **sash** from windows before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated. Reglaze units before reinstallation.
 - 2. Verify that surfaces are sufficiently clean and free of paint residue before patching.
 - 3. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.

- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
 - 1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 - 2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
 - 3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
 - 4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
 - 5. Clean spilled compound from adjacent materials immediately.

3.04 WOOD WINDOW MEMBER-REPLACEMENT REPAIR

- A. General: Replace parts of or entire wood window members at locations indicated on Drawings and where damage is too extensive to patch.
 - 1. Remove sash from windows before performing member-replacement repairs unless otherwise indicated.
 - 2. Verify that surfaces are sufficiently clean and free of paint residue before repair.
 - 3. Remove broken, rotted, and decayed wood down to sound wood.
 - 4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
 - 5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Glazing: Reglaze units before reinstallation.
 - 1. Mill new and rout existing glazed members to accommodate new glass thickness.
 - 2. Provide replacement glazing stops coordinated with glazing system indicated.
 - 3. Provide glazing stops to match contour of sash frames.
- F. Reinstall units removed for repair into original openings.
- G. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter and meeting rail weather stripping for each operable sash.

3.05 GLAZING

- A. Comply with combined written instructions of manufacturers of glass, glazing systems, and glazing materials, unless more stringent requirements are indicated.
- B. Remove existing glass and glazing where indicated on Drawings and prepare surfaces for reglazing.
- C. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.
- D. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.
- E. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.
- F. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.
- G. Install glazing points.
- H. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless otherwise indicated.

3.06 WOOD WINDOW UNIT REPLACEMENT

- A. General: Replace existing wood window frame, and sash units with new custom-fabricated units to match existing at locations indicated on Drawings and where damage is too extensive to repair.
- B. Apply borate preservative treatment to accessible surfaces before finishing. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Mill glazed members to accommodate glass thickness. Glaze units before installation.
- D. Install units, hardware, weather stripping, accessories, and other components.
- E. Install units level, plumb, square, true to line, without distortion or impeding movement; anchored securely in place to structural support; and in proper relation to wall flashing, trim, and other adjacent construction.
- F. Set sill members in bed of sealant for weathertight construction unless otherwise indicated.
- G. Install window units with new anchors into existing openings.
- H. Weather Stripping: Install full-perimeter and meeting rail weather stripping for each operable sash.
- I. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- J. Disposal of Removed Units: Remove from Owner's property and legally dispose of them.

3.07 STORM WINDOW INSTALLATION

- A. Install wood storm windows at each window jamb indicated.
- B. Install units by mounting to window frames as indicated on Drawings and according to manufacturer's written instructions.

3.08 WEATHER STRIPPING INSTALLATION

- A. Install weather stripping for tight seal of joints as determined by preconstruction testing and demonstrated in mockup.

3.09 FIELD QUALITY CONTROL

- A. Manufacturers Field Service: Engage wood-repair-material manufacturers' factory-authorized service representatives for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

3.10 ADJUSTING

- A. Adjust existing and replacement operating sash, screens, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.11 CLEANING AND PROTECTION

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. Monitor window surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact window surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after historic treatment of wood windows. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction.

END OF SECTION 080352

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior and interior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior and interior entrance doors and door-frame units.
- B. Related Requirements:
 - 1. Section 084113.13 "Aluminum-Framed Window Walls" for aluminum-framed window wall and ribbon wall systems.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of storefront system. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule.
 - 2. Warranty provisions and requirements.
 - 3. Required quality assurance and quality control procedures, testing and inspections.
 - 4. Code considerations.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Review flashing details, details where storefront connect with other components of exterior enclosure system, and any special and unique details and conditions.
 - 7. Support structure conditions, including loading limitations.

8. Temporary conditions, and procedures for coping with inclement weather.
9. Protection of complete work.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.

7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Product Schedule: For aluminum-framed doors, including hardware schedule. Use same designations indicated on Drawings.
 1. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts.
 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency, or.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum-framed entrance and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations; with minimum 5 years of documented experience.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, and have 5 years minimum experience documented experience in designing, detailing and installing products specified in this Section.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty - Anodic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 SUSTAINABLE DESIGN REQUIREMENTS**

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.

- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.

- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Fixed Framing and Glass Area:
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.38 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - c. Condensation Resistance Factor (CRFf): Fixed framing shall have a condensation resistance factor of no less than 68 as determined according to AAMA 1503.
 2. Entrance Doors:
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - c. Condensation Resistance Factor (CRFf): Fixed framing shall have a condensation resistance factor of no less than 55 as determined according to AAMA 1503.

- I. Sound Transmission: Storefront systems shall have Sound Transmission Class (STC) ratings varying from 26 to 40. See Drawings for exact STC ratings required, and locations for each.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- K. Accessibility Requirements:
 - 1. Swinging door surfaces within 10 inches of finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door.
 - 2. **Entrance doors** having a bottom rail with the top leading edge tapered at 60 degrees minimum from the horizontal are exempt from the 10-inch bottom-rail height requirement.

2.03 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kawneer North America.
 - 2. Oldcastle BuildingEnvelope.
 - 3. Wausau Window and Wall Systems.
 - 4. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.04 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - a. Interior Storefront: Framing members for interior applications are not required to be thermally broken or thermally improved, and may be nonthermal.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated on Drawings.
 - 4. Finish: Clear anodic finish.
 - 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. High Performance Subsill: Extruded aluminum high performance subsill receptor of manufacturer, with end dams/caps to prevent water from draining off ends of subsill.
- E. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.05 ENTRANCE DOOR SYSTEMS

- A. Exterior Entrance Doors: Manufacturer's standard glazed exterior entrance doors for manual-swing operation.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, AA250 or AA425 (as required per stile width indicated), or comparable product by one of the following:
 - a. Kawneer North America.
 - b. Oldcastle BuildingEnvelope.
 - c. TRACO.
 - d. Wausau Window and Wall Systems.
 - e. YKK AP America Inc.
 - 2. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 3. Door Design: As indicated.
 - 4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. For doors with a bottom rail less than 10 inches high, provide tapered profile at 60 degrees minimum from the horizontal to meet accessibility requirements.
- B. Interior Entrance Doors: Manufacturer's standard glazed interior entrance doors for manual-swing operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C.R. Laurence Co., Inc.; U.S. Aluminum.
 - b. Kawneer North America.
 - c. Oldcastle BuildingEnvelope.
 - d. Wausau Window and Wall Systems.
 - e. Wilson Partitions.
 - f. YKK AP America Inc.
 - 2. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 3. Door Design: As indicated.
 - 4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. For doors with a bottom rail less than 10 inches high, provide tapered profile at 60 degrees minimum from the horizontal to meet accessibility requirements.

2.06 AUTOMATIC ENTRANCES

- A. Swinging Automatic Doors: As specified in Section 084229.33 "Swinging Automatic Entrances."
- B. Sliding Automatic Entrances: Complying with Section 084229.23 "Sliding Automatic Entrances."

2.07 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- D. Silencers: BHMA A156.16, Grade 1.
- E. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.08 GLAZING

- A. General: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers, complying with Section 088000 "Glazing."
- C. Glazing Sealants: As recommended by manufacturer, and complying with Section 088000 "Glazing."

2.09 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Where exposed fasteners are unavoidable, use fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Exposed Flashing: Aluminum sheet, 0.032 inch thick, finished to match framing members.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Perimeter Joint Sealant: As specified in Section 079200 "Joint Sealants."
- F. Insulating Materials: As specified in Section 072100 "Thermal Insulation."
- G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-milthickness per coat.

2.10 FABRICATION

- A. Steel Reinforcing: Provide extruded aluminum framing members with internal reinforcement of structural steel members, as required to meet structural performance requirements.
- B. Form or extrude aluminum shapes before finishing.
- C. 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.
- D. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing.

6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- E. Water Penetration: Fabricate components to resist water penetration by one of following methods:
 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within storefront to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of storefront system and secondary seal weeped and vented to exterior.
- F. Deflectors: Provide water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- G. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- H. 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.
- I. 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.
- J. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- K. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
1. Turn up ends and edges of sill flashings; seal to adjacent work to form water tight dam.
 2. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- D. Subsill: Install subsill, with end dams sealed to direct water draining from jamb down into subsill and out weeps, away from the interior of the building. Shim to level and to allow weeps to drain properly and install perimeter sealant meeting requirements of Section 079005, without clogging weeps.
- E. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
1. Install water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- F. Air Barrier Seal: Coordinate attachment and seal of perimeter air barrier materials.
- G. Insulation: Coordinate installation of insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier, as specified in Section 072100.
- H. Install components plumb and true in alignment with established lines and grades.
- I. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- J. Install glazing as specified in Section 088000 "Glazing."
- K. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
 3. Set thresholds in bed of mastic and secure.
- L. Install perimeter sealant in accordance with Section 079200 "Joint Sealants."

3.03 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.05 CLEANING AND PROTECTION

- A. Clean framing and glazing meeting instructions and recommendations of manufacturer. Remove dirt from all corners.
- B. Remove excess sealant by method acceptable to sealant manufacturer.
- C. Protect installed products from damage during subsequent construction.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
- E. Touch-Up:
 1. General: Touch-up or restore damaged work so there is no evidence of corrective work as acceptable to Architect. If work is not acceptable to Architect, remove and replace damaged units.
 2. Coatings: Clean and touch-up minor abrasions in finish coatings with air dried coating that is compatible with and matches type, color and sheen of factory applied coating and blends with initial surface.
- F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084113

SECTION 084113.13 - ALUMINUM-FRAMED WINDOW WALLS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior aluminum-framed window wall system.
 - 2. Architectural terrace doors located within window wall system.
 - 3. Aluminum windows located within window wall system.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for exterior storefront framing.
 - 2. Section 084413 "Glazed Aluminum Curtain Walls" for curtain wall framing.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of window wall system. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule.
 - 2. Warranty provisions and requirements.
 - 3. Required quality assurance and quality control procedures, testing and inspections.
 - 4. Code considerations.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Review flashing details, details where window wall connect with other components of exterior enclosure system, and any special and unique details and conditions.
 - 7. Support structure conditions, including loading limitations.

8. Temporary conditions, and procedures for coping with inclement weather.
9. Protection of complete work.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.

7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Shop Drawings: For aluminum-framed window walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed window wall, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Delegated-Design Submittal: For aluminum-framed window walls.
 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer .
- B. Energy Performance Certificates: For aluminum-framed window wall, accessories, and components, from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed window wall.
- C. Product Test Reports: For aluminum-framed window wall, for tests performed by manufacturer and witnessed by a qualified testing agency, or a qualified testing agency.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed window wall to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum-framed window wall that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations; with minimum 5 years of documented experience.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, and have 5 years minimum experience documented experience in designing, detailing and installing products specified in this Section.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.09 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as directed by Architect.
 - 2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed window wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Glazing: As specified in Section 088000 "Glazing."
- C. Special Finish Warranty - Anodized Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- D. Special Finish Warranty - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 SUSTAINABLE DESIGN REQUIREMENTS**

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed window wall.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed window wall representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed window wall shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Fixed Framing and Glass Area:

- a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.38 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - c. Condensation Resistance Factor (CRFf): Fixed framing shall have a condensation resistance factor of no less than 68 as determined according to AAMA 1503.
2. Entrance Doors:
- a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.52 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - c. Condensation Resistance Factor (CRFf): Fixed framing shall have a condensation resistance factor of no less than 55 as determined according to AAMA 1503.
- I. Sound Transmission: Window wall systems shall have Sound Transmission Class (STC) ratings varying from 26 to 40. See Drawings for exact STC ratings required, and locations for each.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.03 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Kawneer North America.
 - 2. Oldcastle BuildingEnvelope.
 - 3. Wausau Window and Wall Systems.
 - 4. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed window wall system, including framing doors, venting windows and accessories, from single manufacturer.

2.04 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads. System shall have head and sill members continuous.
- 1. Construction: Thermally broken.
 - 2. Glazing System: Retained, mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated on Drawings.
 - 4. Finish: Clear anodic finish, and high-performance organic finish, as indicated on Drawings.
 - 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. High Performance Subsill: Extruded aluminum high performance subsill receptor of manufacturer, with end dams/caps to prevent water from draining off ends of subsill.
- E. Materials:
- 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.

- b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
- d. Structural Profiles: ASTM B 308/B 308M.
- 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.05 ARCHITECTURAL TERRACE DOORS

- A. Architectural Terrace Doors: As specified in Section 084256 "Architectural Terrace Doors."

2.06 ALUMINUM WINDOWS

- A. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."

2.07 GLAZING

- A. General: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers, complying with Section 088000 "Glazing."
- C. Glazing Sealants: As recommended by manufacturer, and complying with Section 088000 "Glazing."

2.08 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Where exposed fasteners are unavoidable, use fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Exposed Flashing: Aluminum sheet, 0.032 inch thick, finished to match framing members.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Perimeter Joint Sealant: As specified in Section 079200 "Joint Sealants."
- F. Insulating Materials: As specified in Section 072100 "Thermal Insulation."
- G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.09 FABRICATION

- A. Steel Reinforcing: Provide extruded aluminum framing members with internal reinforcement of structural steel members, as required to meet structural performance requirements.
- B. Form or extrude aluminum shapes before finishing.
- C. 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.

- D. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- E. Water Penetration: Fabricate components to resist water penetration by one of following methods:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within window wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of window wall system and secondary seal weeped and vented to exterior.
- F. Provide water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- G. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- H. Door Frames: Reinforce as required to support loads imposed by door operation and for installing door hardware.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. High-Performance Organic Finish: Premium two-coat (mica) 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.
 - 1. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.03 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
1. Turn up ends and edges of sill flashings; seal to adjacent work to form water tight dam.
 2. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- D. Subsill: Install subsill, with end dams sealed to direct water draining from jamb down into subsill and out weeps, away from the interior of the building. Shim to level and to allow weeps to drain properly and install perimeter sealant meeting requirements of Section 079200 "Joint Sealants," without clogging weeps.
- E. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
1. Install water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- F. Air Barrier Seal: Coordinate attachment and seal of perimeter air barrier materials.
- G. Insulation: Coordinate installation of insulation in shim spaces at perimeter of assembly and behind slab edge cover to maintain continuity of thermal barrier, as specified in Section 072100 "Thermal Insulation."
- H. Install components plumb and true in alignment with established lines and grades.
- I. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- J. Install glazing as specified in Section 088000 "Glazing."
- K. Architectural Terrace Doors: Install architectural terrace doors in accordance with Section 084256 "Architectural Terrace Doors."
- L. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."
- M. Sealant: Install perimeter sealant in accordance with Section 079200 "Joint Sealants."

3.04 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed window wall to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed window wall as selected by Architect and qualified testing and inspection agency.
 - 1. Air Infiltration Tests: Test installed window wall system meeting requirements of ASTM E783. Perform a minimum of two tests in areas as directed by Architect, at each of the following progress intervals: 10 percent, 50 percent, and 75 percent.
 - 2. Water Penetration Testing: Test installed window wall system for water penetration in accordance with ASTM E1105. Perform a minimum of two tests, in areas as directed by Architect, at each of the following progress intervals: 10 percent, 50 percent, and 75 percent.
- C. Aluminum-framed window wall will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.06 CLEANING AND PROTECTION

- A. Clean framing and glazing meeting instructions and recommendations of manufacturer. Remove dirt from all corners.
- B. Remove excess sealant by method acceptable to sealant manufacturer.
- C. Protect installed products from damage during subsequent construction.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
- E. Touch-Up:
 - 1. General: Touch-up or restore damaged work so there is no evidence of corrective work as acceptable to Architect. If work is not acceptable to Architect, remove and replace damaged units.
 - 2. Coatings: Clean and touch-up minor abrasions in finish coatings with air dried coating that is compatible with and matches type, color and sheen of factory applied coating and blends with initial surface.
- F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084113.13

SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes exterior and interior, sliding, power-operated automatic entrances.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for and forming recesses in concrete for recessed thresholds.
 - 2. Section 084229.33 "Swinging Automatic Entrances."

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- D. AAADM: American Association of Automatic Door Manufacturers.
- E. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- F. IBC: International Building Code.
- G. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- H. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.04 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.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of entrance system. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, qualified technical representative of entrance manufacturer, Quality Control Service, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
1. Work schedule.
 2. Warranty provisions and requirements.
 3. Required quality assurance and quality control procedures, testing and inspections.
 4. Code considerations.
 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 6. Review flashing details, details where entrance connects with other components of exterior enclosure system, and any special and unique details and conditions.
 7. Support structure conditions, including loading limitations.
 8. Temporary conditions, and procedures for coping with inclement weather.
 9. Protection of complete work.

1.06 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 Submittals:
1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.

- b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer 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. Field quality-control reports.

- D. Sample Warranties: For manufacturer's special warranties.

1.08 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.09 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.
- C. Certified Inspector Qualifications: Certified by AAADM.

1.10 COORDINATION

- A. Hardware: Coordinate with installation of other components that comprise the exterior enclosure, anchorage to supporting construction, and door hardware installation. Furnish setting drawings, templates and installation instructions for installing inserts, anchorages, and like item in supporting construction. Obtain templates, template reference number and/or physical hardware from door hardware supplier in order to prepare the doors and frames to receive the finish hardware items.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system, if applicable.

1.11 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 - Anodic Finish: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special Finish Warranty - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."
- J. Flooring: Flooring shall comply with the requirements of the California Department of Public Health (CDPH) Standard Method v1.1-2010.

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

- 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 codes and standards of authorities having jurisdiction.
 - 1. 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. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - 3. Condensation Resistance Factor (CRFf): Fixed framing shall have a condensation resistance factor of no less than 55 as determined according to AAMA 1503.
- G. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
- H. 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.
- I. Entrapment-Prevention Force:
 - 1. Power-Operated Sliding Doors: Not more than 30 lbf required to prevent stopped door from closing.
- J. 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

2.04 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. Configuration: Biparting-sliding doors with two sliding leaves, transom, and sidelites on each side.
 - a. Traffic Pattern: Two way.
 - b. Emergency Breakaway Capability: As indicated on Drawings.
 - c. Mounting: Between jambs, unless otherwise indicated on Drawings.
 - 2. 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.

3. 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.
4. 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.
5. 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 on each side 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. 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.
6. Finish: Finish framing, door(s), and header with finish matching adjacent storefront.

2.05 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. Stile and Rail Doors: 1-3/4-inch- thick, glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
 1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 2. Stile Design: As indicated on Drawings.
 3. Rail Design: As indicated on Drawings.
- C. Sidelite(s) and Transom: 1-3/4-inch- deep sidelite(s) and transom with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members matching door design.
 1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
- D. 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.
- E. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. 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.

2.06 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. Glazing: As specified in Section 088000 "Glazing."
- D. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match framing members.
- H. Concealed Flashings: Manufacturer standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- I. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.
- J. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- K. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.07 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.

2.08 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 087100 "Door Hardware."
 - a. Keying: Integrate into building master key system.
 - 2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
- D. Weather Stripping: Replaceable components.
 - 1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.09 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
 - 1. Fabricate tubular and channel frame assemblies with 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 and breakaway sidelites.

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.

2.10 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.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION**3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 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 painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous 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. Connect control wiring according to Division 26 "Electrical" low-voltage electrical power conductors and cables section.
- E. Glazing: Install glazing as specified in Section 088000 "Glazing." Air Barrier Seal: Coordinate attachment and seal of perimeter air and vapor barrier materials.
- F. Insulation: Coordinate installation of insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier, as specified in Section 072100 "Thermal Insulation."
- G. Sealants: Comply with requirements specified in Section 079200 "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.
- H. Signage: Apply signage on both sides of each door and breakaway sidelite as required by cited BHMA standard for direction of pedestrian travel.
- I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.03 FIELD QUALITY CONTROL

- A. 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.
- B. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 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.
 - 1. Adjust exterior doors for weathertight closure.
- 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.

3.05 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 088000 "Glazing" for cleaning and maintaining glass.

3.06 PROTECTION

- A. Protect automatic entrance surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact entrance surfaces, remove contaminants immediately according to manufacturer's written instructions.
- B. Touch-up or restore damaged work so there is no evidence of corrective work as acceptable to Architect. If work is not acceptable to Architect, remove and replace damaged units.
- C. Replace damaged components.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.07 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 quarterly 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.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.23

SECTION 084229.33 - SWINGING AUTOMATIC ENTRANCES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior and interior, swinging, power-assist and low-energy automatic entrances.
 - 2. Section 084229.33 "Sliding Automatic Entrances" for sliding, power-operated automatic entrances.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- D. AAADM: American Association of Automatic Door Manufacturers.
- E. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- F. Double-Egress Doors: A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
- G. Double-Swing Doors: A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
- H. IBC: International Building Code.
- I. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- J. For automatic door terminology, refer to BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.04 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats 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 and access-control system.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of entrance system. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, qualified technical representative of entrance manufacturer, Quality Control Service, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule.
 - 2. Warranty provisions and requirements.
 - 3. Required quality assurance and quality control procedures, testing and inspections.
 - 4. Code considerations.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Review flashing details, details where entrance connects with other components of exterior enclosure system, and any special and unique details and conditions.
 - 7. Support structure conditions, including loading limitations.
 - 8. Temporary conditions, and procedures for coping with inclement weather.
 - 9. Protection of complete work.

1.06 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 Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.

4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- 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 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. Product Schedule: For doors, including hardware schedule. Use same designations indicated on Drawings.

1. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Delegated-Design Submittal: For automatic entrances.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, and manufacturer.
- B. Energy Performance Certificates: For swinging automatic entrances, accessories, and components, from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each swinging automatic entrance.
- C. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.
- D. Field quality-control reports.
- E. Sample Warranties: For manufacturer's special warranties.

1.08 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.09 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.
- C. Certified Inspector Qualifications: Certified by AAADM.

1.10 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 - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 20 years from date of Substantial Completion.
- C. Special Finish Warranty - Anodic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Warranty Period: 5 years from date of Substantial Completion.
- D. Special Finish Warranty - High Performance Organic Finish: 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

2.01 AUTOMATIC ENTRANCE ASSEMBLIES

- A. Source Limitations: Obtain swinging 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.
- D. Power-Assist and Low-Energy Door Standard: BHMA A156.19.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.
- 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 codes and regulations of authorities having jurisdiction:
 - 1. 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. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor): Glazing and framing areas shall have U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - 3. Condensation Resistance Factor (CRFf): Framing shall have a condensation resistance factor of no less than 55 as determined according to AAMA 1503.
- G. 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. Power-Operated Swinging Doors: Not more than 30 lbf required to manually open door if power fails.
 - 3. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.
 - 4. Power-Assist and Low-Energy Doors: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door if power fails.
 - 5. Accessible, Power-Assist Interior Doors: Not more than 5 lbf to push or pull door to fully open position.
- H. Entrapment-Prevention Force:
 - 1. Power-Operated Swinging Doors: 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.
 - 2. Low-Energy Doors: Not more than 15 lbf required to prevent stopped door from closing or opening.

- I. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
- J. 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.

2.04 SWINGING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, framing, headers, door operators, controls, and accessories required for a complete installation.
- B. Swinging, Low-Energy, Power-Operated Automatic Entrance:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DORMA Automatics; Division of DORMA Group North America.
 - b. Horton Automatics; a division of Overhead Door Corporation.
 - c. Nabco Entrances Inc.
 - d. Tormax Technologies, Inc.
 - 2. Configuration: As indicated on Drawings.
 - 3. Operator Features:
 - a. Power opening and power-assist spring closing.
 - b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero and 30 seconds.
 - d. Adjustable backcheck and latching.
 - e. Obstruction recycle.
 - f. Automatic door re-open if stopped while closing.
 - g. On-off/hold-open switch to control electric power to operator, key operated.
 - 4. Activation Device: Push-plate switch on each side of door to activate door operator.
 - 5. Finish: Finish framing, door(s), and header with finish matching adjacent curtain wall.

2.05 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.
- B. Stile and Rail Doors: 1-3/4-inch- thick, glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
 - 1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - 2. Stile Design: As indicated on Drawings.
 - 3. Rail Design: As indicated on Drawings.
 - 4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.
- C. Sidelite(s) and Transom: 1-3/4-inch- deep sidelite(s) and transom with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members matching door design.
 - 1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 - 2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- D. 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.
- E. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Signage: As required by cited BHMA standard.
 - 1. Application Process: Door manufacturer's standard process.

2. Provide sign materials with instructions for field application after glazing is installed.

2.06 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. Glazing: As specified in Section 088000 "Glazing." Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- G. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match framing members.
- H. Concealed Flashings: Manufacturer standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- I. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107; of consistency suitable for application.

2.07 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. 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. Push-Plate Switch: Momentary-contact door-control switch with flat push-plate actuator with contrasting-colored, engraved message.
 1. Configuration: Rectangular push plate with 2-by-4-inch junction box.
 - a. Mounting: Recess mounted in door jamb.
 2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
 3. Message: International symbol of accessibility and "Push to Open."
- E. 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.

2.08 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. Manual Opening for Power-Operated Swinging Doors: Provide hardware that, in a power failure, allows door to open with a manual force stipulated in "Performance Requirements" Article.
- C. 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.
- D. Manual Opening for Power-Assist and Low-Energy Doors: Provide hardware that, in a power failure, allows door to open with a manual force as stipulated in "Performance Requirements" Article.
- E. Hinges:
 - 1. Offset Pivots: BHMA A156.4, Grade 1, with exposed parts of cast-aluminum alloy as specified in Section 087100 "Door Hardware."
- F. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- long throw bolt; BHMA A156.5, Grade 1.
 - 1. Cylinders and Deadbolts: As specified in Section 087100 "Door Hardware."
 - a. Keying: Integrate into building master key system.
- G. Push Bars: As specified in Section 087100 "Door Hardware".
- H. Pull Handles: As specified in Section 087100 "Door Hardware".
- I. Thresholds: BHMA A156.21, extruded-aluminum raised thresholds; with beveled edges with a slope of not more than 1:2 and a maximum height of 1/2 inch. Provide cutouts as required for door operating hardware.
- J. Weather Stripping: Replaceable components.
 - 1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
 - 2. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 3. Weather Sweeps: Nylon brush sweep mounted to underside of door bottom.

2.09 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
 - 1. Fabricate tubular and channel frame assemblies with 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 and breakaway sidelites.
 2. Provide compression-type weather stripping at fixed stops of exterior doors. At locations without fixed stops, provide sliding-type weather stripping retained in adjustable strip mortised into door edge.
 3. Provide weather sweeps mounted to underside of door bottoms of exterior 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.

2.10 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.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION

3.01 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. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- D. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 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 painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous 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, 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. Provide thresholds at exterior doors, and where indicated.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Access-Control Devices: Connect access-control devices to access-control system as specified in access control section of Division 28 "Electronic Safety and Security."
- E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to low-voltage Electrical power conductors and cables section in Division 26 "Electrical."
- F. Glazing: Install glazing as specified in Section 088000 "Glazing." Air Barrier Seal: Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Insulation: Coordinate installation of insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier, as specified in Section 072100 "Thermal Insulation."
- H. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
 - 1. Set thresholds, framing members, and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- I. Signage: Apply signage on both sides of each door and breakaway sidelite as required by cited BHMA standard for direction of pedestrian travel.
- J. 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.

3.03 FIELD QUALITY CONTROL

- A. 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.
- B. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 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.
 - 1. Adjust exterior doors for weathertight closure.

- 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.

3.05 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 088000 "Glazing" for cleaning and maintaining glass.

3.06 PROTECTION

- A. Protect swinging automatic entrance surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact entrance surfaces, remove contaminants immediately according to manufacturer's written instructions.
- B. Touch-up or restore damaged work so there is no evidence of corrective work as acceptable to Architect. If work is not acceptable to Architect, remove and replace damaged units.
- C. Replace damaged components.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.33

SECTION 084256 - ARCHITECTURAL TERRACE DOORS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes architectural terrace doors for exterior locations.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units on the building exterior.
 - 2. Section 084113.13 "Aluminum-Framed Window Walls" for coordinating finish among aluminum fenestration units on the building exterior.
 - 3. Section 085113 "Aluminum Windows" for related aluminum-framed transom and sidelite windows and mullions and for coordinating finishes among aluminum fenestration units on the building exterior.
 - 4. Section 087100 "Door Hardware" for hardware not specified in **this Section**.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this Section to review conditions associated with installation of architectural terrace doors. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, Quality Control Service, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule.
 - 2. Warranty provisions and requirements.
 - 3. Required quality assurance and quality control procedures, testing and inspections.
 - 4. Code considerations.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Review flashing details, details where door connects with other components of exterior enclosure system, and any special and unique details and conditions.

7. Support structure conditions, including loading limitations.
8. Temporary conditions, and procedures for coping with inclement weather.
9. Protection of complete work.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of architectural terrace door.
 1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
- B. Sustainable Design Submittals:
 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.

7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Shop Drawings: For architectural terrace doors.
 1. Include plans, elevations, sections, and details; hardware; attachments to other work, and between doors, if any; and operational clearances.
- D. Samples for Initial Selection: For each type of architectural terrace door.
 1. Include Samples of hardware and accessories involving color selection.
- E. Samples for Verification: For architectural terrace doors and components required, prepared on Samples of size indicated below:
 1. Main Framing Member: 12-inch-long section with weather stripping, glazing bead and factory-applied color finish.
 2. Hardware: Full-size units with factory-applied finish.
- F. Product Schedule: For architectural terrace doors, including hardware schedule. Use same designations indicated on Drawings.
 1. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Energy Performance Certificates: For architectural terrace doors, accessories, and components, from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each architectural terrace door.
- C. Product Test Reports: For each architectural terrace door, for tests performed by a qualified testing agency, or performed by manufacturer and witnessed by a qualified testing agency, and for each class and performance grade indicated, tested at AAMA gateway size.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's special warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating architectural terrace doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations, with minimum 5 years of documented experience.

- B. Installer Qualifications: An installer acceptable to architectural terrace door manufacturer for installation of units required for this Project, with minimum 5 years of documented experience.

1.09 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of architectural terrace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection.
 - c. Excessive water leakage or air infiltration.
 - d. Faulty operation of movable panels and hardware.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - f. Failure of glazing units.
 - 2. Warranty Period:
 - a. Architectural Terrace Door: Five years from date of Substantial Completion.
 - b. Glazing Units: As specified in Section 088000 "Glazing."
- B. Special Finish Warranty - Anodized Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special Finish Warranty - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kawneer North America; an Alcoa company.
 - 2. Oldcastle BuildingEnvelope.
 - 3. Wausau Windows and Doors; Apogee Wausau Group, Inc.
 - 4. YKK AP America, Inc.
- B. Source Limitations: Obtain architectural terrace doors from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Product Certification: AMMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: Class CW.
 - 2. Minimum Performance Grade: Grade 40, or Performance Grade equivalent to specified design wind load, whichever is more stringent.
- C. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of 0.45 Btu/sq. ft. x h x deg F.
 - 2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum total fenestration product SHGC of 0.25.

3. Condensation-Resistance Factor (CRF): Provide architectural terrace doors tested for thermal performance according to AAMA 1503, showing a CRF of minimum 55.
- D. Sound Transmission: Architectural terrace doors shall have Sound Transmission Class (STC) ratings varying from 26 to 40. See Drawings for exact STC ratings required, and locations for each.
- E. Thermal Movements: Provide architectural terrace doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.04 ARCHITECTURAL TERRACE DOORS

- A. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 1. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.
 2. Finish: Clear anodic finish, and high performance organic finish, as indicated on Drawings.
- B. Threshold: Provide extruded-aluminum threshold of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior; with manufacturer's standard finish.
 1. Low-Profile Threshold: All thresholds shall be ADA-ABA compliant meeting requirements and codes of authorities having jurisdiction. Standard, non-ADA compliant thresholds are not allowed.

2.05 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal, complying with requirements indicated in Section 088000 "Glazing."
 1. Glazing Type: Double glazed insulated, clear, low-e coated glazing units, as specified in Section 088000 "Glazing."

2.06 HARDWARE

- A. General: Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with aluminum complying with AAMA 907 and designed to smoothly operate, tightly close, and securely lock architectural terrace doors.
- B. Other Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- C. Hinges: 5-knuckle, full mortise, butt hinges with non-removable stainless steel pins; finished to match door and frame; minimum of 3 hinges per door.
- D. Lock: Install manufacturer's standard multipoint locking device on each operable panel, lockable from the inside only.
 1. Design: As selected from manufacturer's full range.
 2. Type: Thumbturn inside, no outside cylinder.
 3. Finish: As selected from manufacturer's full range of finishes.
- E. Weather Stripping: Manufacturer's standard replaceable components.
 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.07 ACCESSORIES

- A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for architectural terrace doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- C. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- D. Perimeter Joint Sealant: As specified in Section 079200 "Joint Sealants."
- E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.08 FABRICATION

- A. Fabricate architectural terrace doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Fabricate architectural terrace doors that are reglazable without dismantling panel framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each door panel.
- D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- F. Factory-Glazed Fabrication: Glaze architectural terrace doors in the factory where practical and possible for applications indicated. Comply with requirements in Section 088000 "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

2.09 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

- B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight architectural terrace door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Install architectural terrace doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- D. Install architectural terrace doors and components to drain condensation, water-penetrating joints, and moisture migrating within doors to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Coordinate installation of insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier, as specified in Section 072100 "Thermal Insulation."
- G. Install operating hardware not pre-installed by manufacturer as specified in Section 087100 "Door Hardware."
- H. Install perimeter sealant in accordance with Section 079200 "Joint Sealants."

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Test and inspect installed architectural terrace doors as follows:
 - 1. Testing Methodology: Test architectural terrace doors for air infiltration and water resistance according to AAMA 502, Test Method B.
 - a. Air-Infiltration Testing:
 - 1) Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - 2) Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - b. Water-Resistance Testing:
 - 1) Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - 2) Allowable Water Infiltration: No water penetration.
 - a) Water penetration, or water leakage, is defined as any water penetrating assemblies or water that appears on any indoor surface of the fenestration product from sources other than condensation.
 - 2. Testing Extent: Three architectural terrace doors of each type as selected by Architect and a qualified independent testing and inspecting agency, at each of the following progress intervals: 10 percent, 50 percent, and 75 percent. Conduct tests after perimeter sealants have cured.
 - 3. Test Reports: Prepared according to AAMA 502.
- C. Architectural terrace door will be considered defective if it does not pass tests and inspections.

3.04 ADJUSTING, CLEANING, AND PROTECTION

- A. Lubricate hardware and moving parts.
- B. Adjust operating panels to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- C. Clean exposed surfaces immediately after installing architectural terrace doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect architectural terrace door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact architectural terrace door surfaces, remove contaminants immediately according to manufacturer's written instructions.
- F. Refinish or replace architectural terrace doors with damaged finishes.
- G. Replace damaged components.

END OF SECTION 084256

SECTION 085113 - ALUMINUM WINDOWS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes aluminum windows for exterior locations.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
 - 2. Section 084113.13 "Aluminum-Framed Window Walls" for coordinating finish among aluminum fenestration units on the building exterior.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this Section to review conditions associated with installation of sliding glass doors. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include, Quality Control Service, installer of work under this section, and installers of related work including but not limited to weather barriers, and masonry cavity wall. Record discussions of meeting and furnish a copy of record to each participant.
 - 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 and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
 - 3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 - 4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.
 - a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
 - 3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 - 4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - 5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 - 6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 - 7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.

- b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- 8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Shop Drawings: For aluminum windows.
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- D. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of hardware and accessories involving color selection.
- E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
 - 1. Exposed Finishes: 2 by 4 inches .
 - 2. Exposed Hardware: Full-size units.
- F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Energy Performance Certificates: For sliding aluminum-framed glass doors, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each type aluminum window.
- C. Product Test Reports: For each sliding aluminum-framed glass door, for tests performed by a qualified testing agency, or performed by manufacturer and witnessed by a qualified testing agency, and for each class and performance grade indicated, tested at AAMA gateway size.
- D. Sample Warranties: For manufacturer's warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- 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 mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: As specified in Section 088000 "Glazing."
- B. Special Finish Warranty - Anodized Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special Finish Warranty - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 1. Window Certification: AAMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 1. Minimum Performance Class: CW.
 2. Minimum Performance Grade: 40, or Performance Grade equivalent to specified design wind load, whichever is more stringent.
- C. Structural Performance: Provide windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for project that passes AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 1. Design Wind Loads: As indicated on Drawings.
- D. Energy Performance: Certify and label energy performance according to NFRC as follows:
 1. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.45 Btu/sq. ft. x h x deg F.
 2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.25.
 3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 68.
- E. Sound Transmission: Aluminum windows shall have Sound Transmission Class (STC) ratings varying from 26 to 40. See Drawings for exact STC ratings required, and locations for each.

- F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.04 ALUMINUM WINDOWS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kawneer North America; an Alcoa company.
 2. Oldcastle BuildingEnvelope.
 3. Wausau Window and Wall Systems; Apogee Wausau Group.
 4. YKK AP America Inc.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Single hung.
 2. Fixed.
- C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
 2. Finish: Clear anodic finish, and high performance organic finish, as indicated on Drawings.
- D. Glass: As specified in Section 088000 "Glazing."
1. Kind: Fully tempered where indicated on Drawings, and required by codes and standards of authorities having jurisdiction.
- E. Insulating-Glass Units: Double glazed, insulated, clear, low-e coated glazing units, as specified in Section 088000 "Glazing."
- F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- G. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- H. Hung Window Hardware:
1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide limit device and custodial locks.
 3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- I. Limit Devices: Provide adjustable limit devices designed to restrict sash or ventilator opening, for the following:
1. Typical: For all operable windows, limit clear opening to 4 inches for ventilation; with custodial key release.
- J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

2.05 ACCESSORIES

- A. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- B. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 - 1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.
- D. Dividers (False Muntins): Provide extruded-aluminum divider grilles in designs indicated for each sash lite.
 - 1. Type: Permanently located at exterior lite.
 - 2. Pattern: As indicated on Drawings.
 - 3. Profile: As selected by Architect from manufacturer's full range.
- E. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- F. Perimeter Joint Sealant: As specified in Section 079200 "Joint Sealants."
- G. Insulating Materials: As specified in Section 072100 "Thermal Insulation."
- H. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.06 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location: Half, outside for single-hung sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
 - 2. Finish: Match aluminum window members.
- C. Glass-Fiber Mesh Fabric: 16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.
 - 1. Mesh Color: As selected by Architect from full range of manufacturer.

2.07 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Internal Reinforcement: Provide steel internal reinforcement in mullions as required to meet loading requirements.
- C. Glaze aluminum windows in the factory.
- D. Weather strip each operable sash to provide weathertight installation.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- G. Fabricate components with smallest possible clearances and shim spacing around perimeter of assembly that will enable window installation and dynamic movement of perimeter seal.

- H. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- I. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.08 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.09 ALUMINUM FINISHES

- A. General: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- C. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Dark bronze, to match Architect's sample.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Where required, install sill and sill end angles. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

- F. Coordinate installation of thermal insulation at shim spaces at frame perimeter as specified in Section 072100 "Thermal Insulation."
- G. Install perimeter sealant in accordance with Section 079200 "Joint Sealants."

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
 - a. Air-Infiltration Testing:
 - 1) Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - 2) Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - b. Water-Resistance Testing:
 - 1) Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - 2) Allowable Water Infiltration: No water penetration.
 - a) Water penetration, or water leakage, is defined as any water penetrating assemblies or water that appears on any indoor surface of the fenestration product from sources other than condensation.
 - 2. Testing Extent: Three mockup windows of each type as selected by Architect and a qualified independent testing and inspecting agency, at each of the following progress intervals: 10 percent, 50 percent, and 75 percent. Windows shall be tested after perimeter sealants have cured.
 - 3. Test Reports: Prepared according to AAMA 502.
- C. Windows will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.04 ADJUSTING, CLEANING, AND PROTECTION

- A. Clear weep holes of dirt, debris and obstructions
- B. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- C. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
- F. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.
- G. Replace damaged components.

END OF SECTION 085113

SECTION 088000 - GLAZING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, interior borrowed lites, storefront framing, window wall framing, and glazed curtain walls.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 057313 "Glazed Decorative Metal Railings" for glazing in railings.
 - 2. Section 088300 "Mirrors."

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- D. IBC: International Building Code.
- E. Interspace: Space between lites of an insulating-glass unit.

1.04 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated with installation of glazing assemblies. Participants shall include installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 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.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product, provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.

- a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
 3. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
 4. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
 5. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
- C. Glass Samples: For each type of the following products; 12 inches square.
1. Coated glass.
 2. Laminated glass.
 3. Insulating glass.
- D. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths.
- 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.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, manufacturers of insulating-glass units with sputter-coated, low-E coatings, and glass testing agency, and.
- B. Product Certificates: For glass.
- C. Product Test Reports: For coated glass, insulating glass,, for tests performed by a qualified testing agency.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.08 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. Fabricator Qualifications: Company or companies specializing in performing the work of this section with minimum 5 years documented experience in design, detailing, fabrication and installation of products specified in this section.
- C. 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.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- F. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" and Section 084413 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 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: Ten years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: Five 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: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
1. AGC Glass Company North America, Inc.
 2. Cardinal Glass Industries.
 3. Guardian Industries Corp.
 4. Oldcastle BuildingEnvelope.
 5. Pilkington North America Inc.
 6. PPG Industries, Inc.
 7. Saint-Gobain Corporation.
 8. Schott North America, Inc.
 9. Viracon, Inc.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- C. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- D. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- E. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- 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 6 mm thick, unless otherwise 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.

2.04 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. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Temporary Labeling: Provide temporary label on each light of glass identifying manufacturer or brand, and glass type, quality and nominal thickness. Temporary labels shall remain intact until glass installation is approved.
 - 1. Low-E Coatings: Provide temporary label indicating location of low-e coatings on insulated units to ensure units are installed in proper orientation, with low-e coating on specified surface.
- E. 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.
- F. Strength: Where annealed float glass is indicated, provide 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.

2.05 GLASS PRODUCTS

- A. 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.
- B. 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.

2.06 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 or ionomeric polymer interlayer per application specified below and to comply with interlayer manufacturer's written instructions.
 - a. Polyvinyl Butyral Interlayer: Glazing with edges concealed and protected in frame.
 - b. Ionomeric Polymer Interlayer: Exposed edge glazing applications, and where required to meet performance requirements.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.07 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 manufacturer's standard primary and secondary sealants.
 - 2. Spacer: Polypropylene-covered stainless steel warm edge spacer.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide the following or equal, as acceptable to Architect.
 - 1) Technoform; I-Spacer Warm Edge IG Spacer.
 - b. Color: Match frame color, as acceptable to Architect.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.08 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. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 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. Dow Corning Corporation; 791 or 795.

2.09 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 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**3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 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.

3.03 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.

3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 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.

3.06 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.

3.07 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.

3.08 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-1A: Clear heat-strengthened float glass.
 - 1. Minimum Thickness: 6 mm.
- B. Glass Type GL-1B: Clear fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

3.09 INSULATING GLASS SCHEDULE

- A. Glass Type GL-3A - Vision Glazing: Low-E-coated, clear insulating glass, heat strengthened or tempered as required to meet code requirements of authorities having jurisdiction.
1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL (2) + Clear.
 2. Interspace Content: Air or argon, as required to meet specified fenestration U-value.
 3. Low-E Coating: Sputtered on second surface.
 4. Performance:
 - a. Winter Nighttime U-Factor: 0.28 maximum.
 - b. Summer Daytime U-Factor: 0.26 maximum.
 - c. Visible Light Transmittance: 64 percent minimum.
 - d. Solar Heat Gain Coefficient: 0.27 maximum.
 - e. Visible Light Reflectance: 12 percent maximum.
 - f. Ultraviolet Transmittance: 6 percent maximum.
 5. STC Rating: Varying from 26 to 40 for fenestration system. See Drawings for exact STC ratings required, and locations for each.
- B. Glass Type GL-3B - Acoustic Vision Glazing: Low-E-coated, clear insulating laminated acoustic glass, heat strengthened or tempered as required to meet code requirements of authorities having jurisdiction.
1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL (2) + Clear.
 2. Interspace Content: Air or argon, as required to meet specified fenestration U-value.
 3. Low-E Coating: Sputtered on second surface.
 4. Performance:
 - a. Winter Nighttime U-Factor: 0.28 maximum.
 - b. Summer Daytime U-Factor: 0.26 maximum.
 - c. Visible Light Transmittance: 64 percent minimum.
 - d. Solar Heat Gain Coefficient: 0.27 maximum.
 - e. Visible Light Reflectance: 12 percent maximum.
 - f. Ultraviolet Transmittance: 6 percent maximum.
 5. STC Rating: Varying from 26 to 40 for fenestration system. See Drawings for exact STC ratings required, and locations for each.
- C. Glass Type GL-3C - Spandrel Glazing: Ceramic-coated, low-E, insulating spandrel glass, heat strengthened or tempered as required to meet code requirements of authorities having jurisdiction.
1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL (2) + Clear.
 2. Coating Color: As selected by Architect from manufacturer's full range.
 3. Interspace Content: Air or argon, as required to meet specified fenestration U-value.
 4. Indoor Lite: Heat-strengthened float glass.
 5. Low-E Coating: Sputtered on second surface.
 6. Opaque Coating Location: Fourth surface.
 7. Performance:
 - a. Winter Nighttime U-Factor: 0.28 maximum.
 - b. Summer Daytime U-Factor: 0.26 maximum.
 - c. Visible Light Transmittance: 4 percent minimum.
 - d. Solar Heat Gain Coefficient: 0.21 maximum.
 - e. Visible Light Reflectance: 18 percent maximum.
 8. STC Rating: Varying from 26 to 40 for fenestration system. See Drawings for exact STC ratings required, and locations for each.
- D. Glass Type GL-3D - Acoustic Spandrel Glazing: Ceramic-coated, low-E, insulating laminated acoustic spandrel glass, heat strengthened or tempered as required to meet code requirements of authorities having jurisdiction.
1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL (2) + Clear.
 2. Coating Color: As selected by Architect from manufacturer's full range.
 3. Interspace Content: Air or argon, as required to meet specified fenestration U-value.
 4. Low-E Coating: Sputtered on second surface.

5. Opaque Coating Location: Fourth surface.
6. Performance:
 - a. Winter Nighttime U-Factor: 0.28 maximum.
 - b. Summer Daytime U-Factor: 0.26 maximum.
 - c. Visible Light Transmittance: 4 percent minimum.
 - d. Solar Heat Gain Coefficient: 0.21 maximum.
 - e. Visible Light Reflectance: 18 percent maximum.
7. STC Rating: Varying from 26 to 40 for fenestration system. See Drawings for exact STC ratings required, and locations for each.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
 - 2. Section 081416 "Flush Wood Doors" for louvers in flush wood doors.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- D. 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.
- E. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- F. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- G. 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.
- H. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.04 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 Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Multi-Attribute Optimization: Documentation for products that comply with LEED requirements for multi-attribute optimization.

- a. Include product data showing third party certification information for global warming potential (greenhouse gases), in CO₂e; depletion of the stratospheric ozone layer, in kg CFC-11; acidification of land and water sources, in moles H⁺ or kg SO₂; eutrophication, in kg nitrogen or kg phosphate; formation of tropospheric ozone, in kg NO_x, kg O₃, or kg ethene; and depletion of nonrenewable energy resources, in MJ.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
 - c. Include product cost. For assemblies, the cost amount contributing toward credit is based on weight.
3. Raw Materials: Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
 - a. Acceptable CSR frameworks include the following: Global Reporting Initiative (GRI) Sustainability Report, Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises, U.N. Global Compact: Communication of Progress, and ISO 26000: 2010 Guidance on Social Responsibility.
4. Leadership Extraction Practices: Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
 - a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - c. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
5. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
6. Material Ingredient Optimization: Documentation for products that comply with LEED requirements for material ingredient optimization.
 - a. Acceptable documentation includes the following: GreenScreen v1.2 Benchmark, Cradle to Cradle certification (v2 Gold, v2 Platinum, v3 Silver, v3 Gold, and v3 Platinum), and International Alternative Compliance Path - REACH Optimization. Include statement of costs.
7. Supply Chain Optimization: Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
 - a. Include statement of costs.
 - b. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. Low-Emitting Materials:
 - a. Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.
 - b. Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with the California Department of Public Health (CDPH) Standard Method v1.1-2010.

- 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 Initial Selection: For each finish product specified, complete sets of color chips representing manufacturer's full range of available finishes, colors, and textures.
- E. Samples for Verification: Submit samples 2 by 2 inches in size illustrating each type finish and color of exterior surfaces.
- F. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 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.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing louvers with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this Section with documented experience in detailing and installation of products specified in this Section.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 WARRANTY

- A. Special Warranty on Finishes - Anodic Finish: 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. Finish Warranty Period: 5 years from date of Substantial Completion.
- B. Special Finish Warranty - High Performance Organic Finish: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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.

2.02 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.

- B. Multi-attribute Optimization: At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
 - 1. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- C. Raw Materials: At least 20 different products from at least five different manufacturers shall have publically released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
- D. Leadership Extraction Practices: Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices: Extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
 - 3. Recycled Content: For recycled content, do not include plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.
- E. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.
- F. Material Ingredient Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
- G. Supply Chain Optimization: At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.
 - 1. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.
 - 2. Regional Materials: products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.
- H. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 as specified in Division 01 Section "Sustainable Design Requirements."
- I. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the VOC content limits of the SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as specified in Division 01 Section "Sustainable Design Requirements."

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

- C. 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.
- D. 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.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.04 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven-Rain-Resistant Louver:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Greenheck Fan Corporation.
 - d. Industrial Louvers, Inc.
 - e. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: As indicated on Drawings.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
 - 4. Louver Performance Ratings:
 - a. Free Area: As indicated on Drawings.
 - b. Air Performance: As indicated on Drawings.
 - c. Wind Driven Rain Resistance: Louvers shall provide wind-driven rain resistant performance when tested in compliance with AMCA 500-L.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.05 LOUVER SCREENS

- A. General: Provide screens at each exterior louver as follows, unless otherwise indicated.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, 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:
 - a. Insect Screen: Rewirable frames with a driven spline or insert.
 - b. Bird Screen: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inchwire.
 - 2. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inchwire.

2.06 BLANK-OFF PANELS

- A. General: Provide inactive areas of each exterior louver with blank-off panels, unless otherwise indicated.
- B. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - 1. Thickness: 1 inch.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Rigid, glass-fiber-board insulation.

4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels with clips.

2.07 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. 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.
- D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location meeting requirements of Section 076200 "Sheet Metal Flashing and Trim."
- E. Perimeter Sealant: As specified in Section 079200 "Joint Sealants."
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.08 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, unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing 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.
- 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.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.09 ALUMINUM FINISHES

- A. General:
 1. Finishes shall be in compliance with NAAMM - Metal Finishes Manual for Architectural and Metal Products.
 2. Finish louvers after assembly.
- B. Finish: Provide from the following, as required to match adjacent materials, as acceptable to Architect.
 1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2. High-Performance Organic Finish - Two-Coat Fluoropolymer: AAMA 2605. Two-coat 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.
 - a. Color and Gloss: Match adjacent materials, as acceptable to Architect.
3. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: Match adjacent materials, as acceptable to Architect.

PART 3 - EXECUTION

3.01 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. Commencement of installation indicates acceptance of conditions.

3.02 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.

3.03 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
- G. Blank-Off Panels: Provide inactive areas of each exterior louvers with blank-off panels, unless otherwise indicated.

3.04 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 089119

SECTION 090391 - HISTORIC TREATMENT OF PLAIN PAINTING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes historic treatment of plain painting as follows:
 - 1. Removing existing paint.
 - 2. Repairing substrates.
 - 3. Plain painting of historic surfaces.
- B. Related Requirements:
 - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

1.03 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.
- H. Historic Paint Materials: Paint materials manufactured to match historic paint formulations; either custom-formulated products or standard products of manufacturers of historic paint materials.
- I. Modern Paint Materials: Paint materials not designed to match historic paint formulations but that may be required to match historic paint colors.
- J. Plain Painting: For historic treatment, this means painting that requires attention to historic treatment requirements, but no special, decorative or artistic painting skill.
- K. Very Low-Pressure Spray: Less than 100 psi standard City water pressure without augmentation.
- L. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic treatment of painting.
 - 2. Review methods and procedures related to historic treatment of painting including, but not limited to, the following:
 - a. Verify historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, colors, patterns, and sequencing.
 - c. Fire-protection plan.
 - d. Plain painting historic treatment program.
 - e. Coordination with construction sequencing.

1.05 SEQUENCING AND SCHEDULING

- A. Perform historic treatment of painting in the following sequence, which includes work specified in this and other Sections:
 - 1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.
 - 2. Verify that temporary protections have been installed.
 - 3. Examine condition of surfaces to be painted.
 - 4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
 - 5. Apply paint system.
 - 6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Samples: For each type of paint system and each pattern, color, and gloss; in sizes indicated below.
 - 1. Include stepped Samples defining each separate coat, including fillers and primers. Resubmit until each required sheen, color, and texture is achieved.
 - 2. For each painted color being matched to a standardized color-coding system, include the color chips from the color-coding-system company with Samples.
 - 3. Include a list of materials for each coat of each Sample.
 - 4. Label each Sample for location and application.
 - 5. Sample Size:
 - a. Plain Painted Surfaces: 4-by-8-inch Samples for each color and material, on hardboard.
- C. Product List: For each paint product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For historic treatment specialist(s) and paint-remover manufacturer.
- B. Plain Painting Historic Treatment Program: Submit before work begins.
- C. Color Matching Certificate: For computer color matching of historic colors.
- D. Preconstruction Test Reports: For cleaning materials, paint removers and paint coatings and systems.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra paint materials, from the same production run, that match products applied and that are packaged with protective covering for storage and identified with labels describing contents, including material, finish, source, and location on building.
 - 1. Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. or one case, as appropriate, of each material and color applied.

1.09 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic painting specialist with expertise in matching and touching up existing painting. Experience only in new painting work is insufficient experience for historic treatment work.

- B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing paint removers that have been used for similar historic painting applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.
- C. Color Matching: Custom computer-match paint colors to colors indicated in Paint analysis Report. For colors indicated by a standardized coding system, obtain a color chip for each color indicated from the color-coding-system company; computer match paint colors to the color chips.]
- D. Plain Painting Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site and control of runoff during cleaning, paint removal, repainting, and other processes.
 - 1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
- E. Mockups: Prepare mockups of historic treatment processes for each type of coating system and substrate indicated and each color and finish required to demonstrate aesthetic effects and to set quality standards for materials and execution. Duplicate appearance of approved Sample submittals.
 - 1. Locate mockups on existing surfaces where directed by Architect.
 - 2. Surface-Preparation Mockups: On existing surfaces using applicable specified methods of cleaning and other surface preparation, provide mockup sample of at least 100 sq. ft..
 - 3. Coating Mockups: Two wall surfaces of at least 100 sq. ft. to represent surfaces and conditions for application of each type of coating system under same conditions as the completed Work.
 - a. Plain painted surfaces.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing of paint layers and colors for each indicated type of historic painted surface.
 - 1. Paint Color.
 - 2. Paint Finish
 - 3. Sequence of Layers
 - 4. Coordinate Munsell System numbers to Benjamin Moore colors
- B. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing of cleaning materials, paint removers and compatibility of paint coatings and systems for each indicated type of historic painted surface.
 - 1. Use test areas as indicated and representative of proposed materials and existing construction.
 - 2. Propose changes to materials and methods to suit Project.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste daily.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with historic treatment of painting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.
- B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer for surface preparation and during paint application and drying periods.
- D. Concealed and undocumented historic items, murals, and similar objects encountered during historic treatment remain Owner's property. Carefully protect each item or object.
 - 1. Coordinate with Owner's historical adviser, who will establish special procedures for protection.

PART 2 - PRODUCTS

2.01 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.
- D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.02 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABR Products, Inc.; 800 Brush Grade.
 - b. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover.
 - c. EaCo Chem, Inc.; Stripper Cream.
 - d. Hydrochemical Techniques, Inc.; HydroClean HT-716 Heavy Duty Paint Remover.
 - e. PROSOCO, Inc.; Sure Klean Heavy-Duty Paint Stripper or Sure Klean Heavy-Duty Paint Stripper D.
 - f. Shore Corporation; 2200 Alka Strip.
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline paste or gel formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABR Products, Inc.; 800 Fast Acting Grip 'N Strip.
 - b. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 404 Rip-Strip.
 - c. Dumond Chemicals, Inc.; Peel Away 1.

- C. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Diedrich Technologies Inc., a division of Sandell Construction Solutions; 505 Special Coatings Stripper.
 - b. Hydrochemical Techniques, Inc.; HydroClean HT-300 Solvent Paint Remover.
 - c. PROSOCO, Inc.; Sure Klean Fast Acting Stripper.
 - d. Shore Corporation; 2210 SB Paint Remover or 2230 Shore Strip.
- D. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methanol or methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABR Products, Inc.; ABR Citrus Paint Removers or Super Bio Strip Gel.
 - b. Cathedral Stone Products, Inc.; S-301, S-303, or S-305.
 - c. Dumond Chemicals, Inc.; Peel Away 7 without paper covering Smart Strip Smart Strip Pro.
 - d. EaCo Chem, Inc.; InStrip.
 - e. PROSOCO, Inc.; Enviro Klean SafStrip or Enviro Klean SafStrip 8.
- E. Covered, Solvent-Type Paste Paint Remover: Manufacturer's standard, low-odor, covered, water-rinsable, solvent-type paste or gel formulation for removing paint from masonry, stone, wood, plaster, or metal as required to suit Project; and containing no methanol or methylene chloride.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dumond Chemicals, Inc.; Peel Away 6 or Peel Away 7.
 - b. PROSOCO, Inc.; Enviro Klean Safety Peel 1.

2.03 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
 - a. Colors: Colors to be determined by paint analysis on existing construction.
 - b. Color: Match colors indicated in Paint Analysis Report.

2.04 MODERN PAINT MATERIALS, GENERAL

- A. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

2.05 MODERN PAINT MATERIAL MANUFACTURERS

- A. Benjamin Moore & Co.
- B. PPG Architectural Finishes, Inc.
- C. Sherwin-Williams Company (The)

2.06 MODERN PAINT MATERIALS

- A. As specified in Section 099113 "Exterior Painting" in Exterior Painting Schedule for each type asubstrate.

2.07 PATCHING MATERIALS

- A. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood with WoodEpoxy.
 - b. Advanced Repair Technology, Inc.; Primatrate with Flex-Tec HV.
 - c. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
 - d. Gougeon Brothers, Inc.; West System (thickened with filler).
 - e. Polymeric Systems, Inc.; QuickWood.
 - f. Protective Coating Company; PC-Woody.
 - g. System Three Resins, Inc.; Sculpwood.

PART 3 - EXECUTION

3.01 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
 - 3. Neutralize and collect alkaline and acid wastes before disposal.
 - 4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.02 HISTORIC TREATMENT OF PAINTING, GENERAL

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from building interior at 5 feet away from painted surface and from building exterior at 20 feet away from painted surface.
- B. Execution of the Work: In treating historic items, disturb them as minimally as possible and as follows:
 - 1. Remove failed coatings and corrosion and repaint.
 - 2. Verify that substrate surface conditions are suitable for painting.
 - 3. Allow other trades to repair items in place and retain as much original material as possible before repainting.
 - 4. Reproduce original, historic paint systems where indicated or scheduled.
 - 5. Install temporary protective measures to protect historic painted surfaces that shall be treated later.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail. Do not use abrasive methods such as rotary sanding, rotary wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.
- D. Heat Processes: Do not use torches, heat guns, or heat plates.

3.03 EXAMINATION

- A. Examine substrates and conditions, with historic treatment specialist present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:
 - 1. Concrete: 12 percent.
 - 2. Gypsum Board: 12 percent.
 - 3. Gypsum Plaster: 12 percent.
 - 4. Masonry (Clay and CMU): 12 percent.
 - 5. Portland Cement Plaster: 12 percent.
 - 6. Wood: 15 percent.
- C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - 1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Architect in writing.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.04 PREPARATORY CLEANING

- A. General: Use only the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
- C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.
- D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
- E. Chemical Rust Removal:
 - 1. Remove loose rust scale with approved abrasives for ferrous-metal cleaning.
 - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
 - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
 - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
 - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

F. Mechanical Rust Removal:

1. Remove rust with approved abrasives for ferrous-metal cleaning. Clean to bright metal.
2. Wipe off residue with mineral spirits and either steel wool or soft rags.
3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.05 PAINT REMOVAL**A. General:** Remove paint where indicated. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.

1. Application: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
 - a. Apply materials to all surfaces, corners, contours, and interstices, to provide a uniform final appearance without streaks.
 - b. After work is complete, remove protection no longer required. Remove tape and adhesive marks.
2. Brushes: Use brushes that are resistant to chemicals being used.
 - a. Metal Substrates: If using wire brushes on metal, use brushes of same metal composition as metal being treated.
 - b. Wood Substrates: Do not use wire brushes.
3. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. Unless otherwise indicated, hold spray nozzle at least 6 inches from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with nozzle having a cone-shaped spray.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

B. Paint Removal with Hand Tools: Remove paint manually using hand-held scrapers, wire brushes, sandpaper, and metallic wool as appropriate for the substrate material. Do not use other methods except as indicated as part of the historic treatment program and as approved by Architect.**C. Paint Removal with Alkaline Paste Paint Remover:**

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with brushes.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with cold water applied by low -pressure spray to remove chemicals and paint residue.
5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
6. Repeat process if necessary to remove all paint.

D. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with brushes or as recommended in writing by manufacturer.

3. Apply cover according to manufacturer's written instructions.
 4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 5. Scrape off paint and remover.
 6. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
 7. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
 8. For spots of remaining paint, apply alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph.
- E. Paint Removal with Solvent-Type Paste Paint Remover:
1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply thick coating of paint remover to dry, painted surface with natural-fiber cleaning brush, deep-nap roller, or large paintbrush. Apply in one or two coats according to manufacturer's written instructions.
 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
 5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
 6. Repeat process if necessary to remove all paint.
- F. Paint Removal with Covered, Solvent-Type Paste Paint Remover:
1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply paint remover to dry, painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush or as recommended in writing by manufacturer.
 3. Apply cover according to manufacturer's written instructions.
 4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 5. Scrape off paint and remover.
 6. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
 7. Use mechanical methods recommended in writing by manufacturer to remove remaining chemicals and paint residue.

3.06 SUBSTRATE REPAIR

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Wood Substrate:
1. Repair wood defects including dents and gouges more than 1/8 inch in size and all holes and cracks by filling with wood-patching compound and sanding smooth. Reset or remove protruding fasteners.
 2. Where existing paint is allowed to remain, sand irregular buildup of paint, runs, and sags to achieve a uniformly smooth surface.
- C. Gypsum-Plaster and Gypsum-Board Substrates:
1. Repair defects including dents and chips more than 1/8 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

3.07 PAINT APPLICATION, GENERAL

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.
- B. Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.
- C. Apply a transition coat over incompatible existing coatings.
- D. Blending Plain Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Notify testing agency in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until testing agency has had reasonable opportunity to inspect work areas at lift device or scaffold location.
- C. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection and provide on-site assistance when requested by Architect.
- D. Paint Material Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for composition and dry film thickness.
 - 1. Paint Composition: The following procedure may be performed at any time and as often as Owner deems necessary during the period when paints are being applied:
 - a. Testing agency will sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance of paint materials with product requirements.
 - c. If test results show materials being used do not comply with product requirements, Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.
 - 2. Dry Film Thickness:
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.09 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 090391

SECTION 099600 - HIGH-PERFORMANCE COATINGS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete, vertical and surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
- B. Related Requirements:
 - 1. Division 05 "Metals" for shop priming of structural steel with primers specified in this Section.
 - 2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
 - 3. Section 099113 "Exterior Painting" for general field painting.
 - 4. Section 099123 "Interior Painting" for general field painting.

1.03 DEFINITIONS

- A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Sustainable Design Submittals:
 - 1. EPDs: Environmental Product Declarations (EPDs) complying with LEED requirements.
 - a. Include documentation stating whether the EPD is product-specific or industry-wide and whether it is a Type III EPD.
 - 2. Material Ingredient Reporting: Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
 - a. Include product data demonstrating the chemical inventory of the product to at least 0.1 percent (1000 ppm).
 - b. Acceptable documentation includes the following: Manufacturer inventory, Health Product Declaration with full disclosure, and Cradle to Cradle v2 Basic level or v3 Bronze level certification. Include statement of costs.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- B. Coating Maintenance Manual: Upon completion of the Work the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report, or equal as acceptable to Architect. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product, color and finish was used, product data pages, Material Safety Data Sheets (MSDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- C. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.
- B. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 COORDINATION

- A. Coordinate topcoats with primer selections for shop primed fabrications. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another. Provide intermediate coats as required to ensure compatibility between coats.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.09 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in High Performance Coating Schedules in this Section, or comparable product by one of the following:
1. Benjamin Moore & Co.
 2. Devoe Paint Company; Akzo Nobel.
 3. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 4. PPG Architectural Finishes, Inc.
 5. Sherwin-Williams Company (The).
 6. Tnemec Company, Inc.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 3. Products shall be of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and sustainable design requirements.
- C. Colors and Gloss: As indicated on Drawings. Colors and gloss not indicated on drawings will be selected later by Architect from the manufacturer's full line.

2.03 SUSTAINABLE DESIGN REQUIREMENTS

- A. EPDs: At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
- B. Material Ingredient Reporting: At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (Clay and CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Clean using methods recommended in writing by coating manufacturer. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Clean using methods recommended in writing by coating manufacturer. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 10/NACE No. 2.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.03 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.06 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Vertical Surfaces:
 - 1. Acrylic Waterproof Coating: Waterproof acrylic coating system; high solids content, and ultraviolet, wind driven rain, alkali, and mildew resistant; breathable and blister resistant; smooth texture.
 - a. Topcoat: Waterproof acrylic coating.
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide M. A. Bruder and Sons, Incorporated, Modac; or comparable product by one of the following:
 - a) Textured Coatings of America, Inc.
- B. CMU Substrates:
 - 1. Acrylic Waterproof Coating: Waterproof acrylic coating system; high solids content, and ultraviolet, wind driven rain, alkali, and mildew resistant; breathable and blister resistant; smooth texture.
 - a. Primer: Heavy duty block filler as recommended by top coat manufacturer for exterior concrete unit masonry surfaces.
 - b. Topcoat: Waterproof acrylic coating.
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide M. A. Bruder and Sons, Incorporated, Modac; or comparable product by one of the following:
 - a) Textured Coatings of America, Inc.
- C. Steel Substrates:
 - 1. High Performance Polyurethane Coating System: One finish coat acrylic polyurethane over an intermediate coat and primer; abrasion resistant with superior color and gloss retention for outdoor applications.
 - a. Primer: Zinc-rich metal primer. Coat required on items with bare surfaces.
 - 1) Basis-of-Design Product:
 - a) Tnemec Company, Inc.; 90-97 Tneme-Zinc.
 - b. Intermediate Coat: Epoxy.
 - 1) Basis-of-Design Product:
 - a) Tnemec Company, Inc.; Series L69 Hi-Build Epoxoline II.
 - c. Topcoat: Waterborne acrylic polyurethane.
 - 1) Basis-of-Design Product:
 - a) Tnemec Company, Inc.; Series 1080 or 1081 Endura-Shield.

END OF SECTION 099600