

## SECTION 07190 - WATER REPELLENTS

### 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 penetrating water-repellent treatments for the following vertical and horizontal surfaces:
  - 1. Cast-in-place concrete.
  - 2. Precast concrete.
  - 3. Concrete unit masonry.
  - 4. Clay brick masonry.
  - 5. Portland cement plaster (stucco).
- B. Related Sections:
  - 1. Division 4 Section "Unit Masonry Assemblies" for integral water-repellent admixture for unit masonry assemblies.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.
  - 1. Water Repellents: Comply with performance requirements specified, as determined by testing substrate assemblies representing those indicated for this Project.
- B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.
  - 1. Cast-in Place Concrete: ASTM C 642.
  - 2. Precast Concrete: ASTM C 642.
  - 3. Concrete Masonry Units: ASTM C 140.
  - 4. Clay Brick: ASTM C 67.
  - 5. Portland Cement Plaster (Stucco): ASTM D 6532.
- C. Water-Vapor Transmission: Comply with one or both of the following:

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1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.
  2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.
- D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.
- E. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.
- F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
1. Reduction of Water Absorption: 80 percent.
  2. Reduction in Chloride Content: 80 percent.

**1.4 PRECONSTRUCTION TESTING**

- A. Preconstruction Testing: Installed water repellents shall comply with performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard substrate assemblies by a qualified testing agency.

**1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated.
1. Include manufacturer's printed statement of VOC content.
  2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
  3. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.
- B. Samples: For each type of water repellent and substrate indicated, **12 by 12 inches** in size, with specified water-repellent treatment applied to half of each Sample.
- C. Qualification Data: For qualified Applicator.
- D. Product Certificates: For each type of water repellent, from manufacturer.
- E. Field quality-control reports.
- F. Warranty: Special warranty specified in this Section.

## **1.6 QUALITY ASSURANCE**

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."
- C. Mockups: Apply water repellent to each type of substrate required.
  - 1. Locate each test application as directed by Architect.
  - 2. Size: **10 sq. ft.**
  - 3. Final approval by Architect of water-repellent application will be from test applications.

## **1.7 PROJECT CONDITIONS**

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

## **1.8 WARRANTY**

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

## **PART 2 - PRODUCTS**

### **2.1 PENETRATING WATER REPELLENTS**

- A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
- B. Siloxane, Penetrating Water Repellent: Clear, containing 10 percent or more solids of oligomeric alkylalkoxysiloxanes; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
- C. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.
- D. Siliconate, Penetrating Water Repellent: Clear, methyl siliconate water repellent with 400 g/L or less of VOCs.
- E. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following products:
  - 1. Sure Klean Weather Seal Siloxane WB
  - 2. Hydrozo Enviroseal Double 7 For Brick
  - 3. Huls Chem-Trete BSM20 and Aqua-Trete

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
  - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
  - 2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
  - 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
  - 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
  - 5. Mortars and grout shall have been allowed to cure a minimum of 28 days.
  - 6. Remove and repoint any damaged mortar or cracks in the mortar joints exceeding .02".
  - 7. Allow repointed mortar to cure 7 days prior to application.
  - 8. All caulking and sealant work must be done and allowed to cure completely before application of water repellents. Refer to manufacturer's recommendations.

- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

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

### **3.3 APPLICATION**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. All materials, along with surrounding air, must be maintained above 45 Fahrenheit degrees during application.
- C. Test a small area of surface to insure compatibility with existing conditions, and to establish proper coverage rates.
- D. Do not dilute or alter water repellents.
- E. Apply water repellent from the bottom of the wall up. Initially fog the wall down with a fine mist, followed by flooding the wall with a minimum 8 inch rundown using a manual-pump low-pressure sprayer. Roll or brush out excessive drip areas.
- F. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi-pressure spray with a fan-type spray nozzle, roller or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes.

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Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Precast Concrete: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.
- G. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

**3.4 FIELD QUALITY CONTROL**

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

**3.5 CLEANING**

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

**END OF SECTION 07190**

## SECTION 07210 - BUILDING INSULATION

### 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. This Section includes the following:
  - 1. Concealed building insulation – forced foam installation in masonry.
  - 2. Cavity-wall insulation.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.

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3. Combustion Characteristics: ASTM E 136.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration by 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 plastic insulation as follows:
  1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Forced Foam insulation in Masonry:
    - a. Core-Fill 500 by Tailored Chemical Products, Inc.
    - b. Thermco Foam Insulation by Thermco Corporation of America.
    - c. cfiFOAM, Inc. by Southern Foam Insulation, Inc.
  2. Glass-Fiber Insulation:
    - a. CertainTeed Corporation.
    - b. Johns Manville Corporation.
    - c. Knauf Fiber Glass.
    - d. Owens Corning
  3. Spray Foam Polyurethane.
    - a. BioBased 501 (0.5 lb/ft<sup>3</sup> spray foam polyurethane semi-open celled insulation)
    - b. Manufacturer by BioBased Systems, LLC – 800-803-5189 – [www.biobased.net](http://www.biobased.net)

## **2.2 INSULATING MATERIALS**

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
  - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Faced Formaldehyde-Free Mineral-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass, slag wool, or rock wool.

## **2.3 AUXILIARY INSULATING MATERIALS**

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

## **2.4 INSULATION FASTENERS**

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Adhesively Attached, Spindle-Type Anchors:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  - 2. Insulation-Retaining Washers:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
  - 3. Anchor Adhesives:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.

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- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
  - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Crawlspace.
    - b. Ceiling plenums.
    - c. Attic spaces.
    - d. Where indicated.
- C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
  - 1. Air Space: 1 inch.
  - 2. Air Space: 2 inches.
  - 3. Air Space: 3 inches.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

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

**3.3 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### **3.4 INSTALLATION OF MASONRY CELL INSULATION**

- A. Foam wall insulation is to be pumped into open block cavities indicated to receive insulation, taking care to fill voids completely. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close ports after confirming complete coverage. Follow manufacturer's recommendations for product liquid ratios at mixing gun.
- B. Foam wall insulation shall be installed from exterior face of masonry units wherever possible so that holes in masonry will be covered with exterior finish material.

### **3.5 INSTALLATION OF GENERAL BUILDING INSULATION**

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
- D. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
  - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

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- E. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5-lb/cu. ft.

**3.6 INSTALLATION OF VAPOR RETARDERS**

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

**3.7 PROTECTION**

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

**END OF SECTION 07210**

## **SECTION 07411 - METAL ROOF PANELS**

### **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. Standing-seam metal panels for low-slope (1/2:12 minimum) roof.
- B. Related Sections:
  - 1. Division 5 Section "Steel Deck" for steel roof deck supporting metal roof panels.
  - 2. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal wall panels.
  - 3. Division 6 Section "Rough Carpentry" for wood nailers & other wood materials required for the assembly of the roofing and related components.
  - 4. Division 7 Section "Sheet Metal Flashing and Trim" for field-formed fasciae, copings, flashings, roof drainage systems, and other sheet metal work not part of metal roof panel assemblies.
  - 5. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

#### **1.3 DEFINITIONS**

- A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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- C. Air Infiltration: Air leakage through assembly of not more than **0.06 cfm/sq. ft.** of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
1. Test-Pressure Difference: Negative **1.57 lbf/sq. ft.**
  2. Positive Preload Test-Pressure Difference: Greater than or equal to **15.0 lbf/sq. ft.** and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
  3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
- D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
1. Test-Pressure Difference: **2.86 lbf/sq. ft.**
  2. Positive Preload Test-Pressure Difference: Greater than or equal to **15.0 lbf/sq. ft.** and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
  3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
- G. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
- H. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure as indicated on Drawings.
  2. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 of the span.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): **120 deg F**, ambient; **180 deg F**, material surfaces.

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- J. Energy Performance: Provide roof panels with solar reflectance index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- K. Energy Performance: Provide roof panels that are listed on the U.S. Department of Energy's ENERGY STAR Roof Products Qualified Product List for low-slope roof products.
- L. Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

**1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.
- B. LEED Submittals:
  - 1. Product Test Reports for Credit SS 7.2: For roof panels, indicating that panels comply with solar reflectance index requirement.
  - 2. Product Data for Credit MR 4.1 and Credit MR 4.2: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.
    - a. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
  - 1. Accessories: Include details of the following items, at a scale of not less than **1-1/2 inches per 12 inches**:
    - a. Flashing and trim.
    - b. Gutters.
    - c. Downspouts.
    - d. Roof curbs.
- D. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

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1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
  2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
  3. Accessories: 12-inch- long Samples for each type of accessory.
- F. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:
1. Roof panels and attachments.
  2. Purlins and rafters.
  3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
- H. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
1. Submit evidence of meeting performance requirements.
- I. Qualification Data: For qualified Installer, professional engineer and testing agency.
- J. Material Certificates: For thermal insulation and vapor retarders, from manufacturer.
- K. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- L. Field quality-control reports.
- M. Maintenance Data: For metal roof panels to include in maintenance manuals.
- N. Warranties: Samples of special warranties.

**1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

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- D. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof 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 roof panel installation, including manufacturer's written instructions.
  4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
  5. Review structural loading limitations of deck during and after roofing.
  6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
  7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
  8. Review temporary protection requirements for metal roof panel assembly during and after installation.
  9. Review roof observation and repair procedures after metal roof panel installation.
  10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
- B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.
- E. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

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2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

**1.8 PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

**1.9 COORDINATION**

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

**1.10 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof 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 for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PANEL MATERIALS**

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
  2. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, **G90** coating designation; structural quality.
  3. Surface: Smooth, flat finish.
  4. Exposed Coil-Coated Finish:
    - a. 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Panel Sealants:
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, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
  3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

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**2.2 FIELD-INSTALLED THERMAL INSULATION**

- A. Refer to Division 7 Section "Building Insulation."
- B. Polyethylene Vapor Retarders: ASTM D 4397, **6 mils** thick, with maximum permeance rating of **0.13 perm**.
- C. Faced, Polyisocyanurate Board Insulation, 3 inches thick: ASTM C 1289, Type I, Class 1 aluminum foil with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

**2.3 UNDERLAYMENT MATERIALS**

- A. Self-Adhering, High-Temperature Sheet: **30 to 40 mils** thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: Stable after testing at **240 deg F**; ASTM D 1970.
  - 2. Low-Temperature Flexibility: Passes after testing at minus **20 deg F**; ASTM D 1970.
  - 3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
    - b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
    - c. Henry Company; Blueskin PE200 HT.
    - d. Metal-Fab Manufacturing, LLC; MetShield.
    - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

**2.4 MISCELLANEOUS METAL FRAMING**

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, **G40** hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Hat-Shaped, Rigid Furring Channels:
  - 1. Nominal Thickness: As required to meet performance requirements.
  - 2. Depth: As indicated.

- C. Cold-Rolled Furring Channels: Minimum **1/2-inch-** wide flange.
  - 1. Nominal Thickness: As required to meet performance requirements.
  - 2. Depth: As indicated.
  - 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of **0.040 inch**.
  - 4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.062-inch-** diameter wire, or double strand of **0.048-inch-** diameter wire.
- D. Z-Shaped Furring: With slotted or nonslotted web, face flange of **1-1/4 inches**, wall attachment flange of **7/8 inch**, and depth required to fit insulation thickness indicated.
  - 1. Nominal Thickness: As required to meet performance requirements.
- E. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for **15-mil** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Wood Members, Units: Comply with requirements of Division 6 Section "Rough Carpentry" for nailers, blocking, shims, walkway units, and other wood members indicated as roofing system work. Provide wood pressure treated with waterborne preservatives for above-ground use (AWPB LP-2). Provide sufficient quantities of adequately sized members and sections for correct alignment, support and securing of roofing finishes and related components as required.

## **2.6 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.

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- B. Integral-Standing-Seam Metal Panels for low-slope (1/2:12) roof: Formed with integral ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DrexelMetals DMC 200S Standing Seam Panels or comparable product by one of the following:
    - a. AEP-Span.
    - b. ATAS International, Inc.
    - c. Cheney Flashing Company.
    - d. Petersen Aluminum Corporation.
  2. Material: Zinc-coated (galvanized) 22 gauge steel sheet.
    - a. Exterior Finish: Standard Kynar 500..
    - b. Color: "Regal White" (SR .70 / TE .87).
  3. Height: 2" Nominal
  4. Width: 16"
  5. Clips: Floating to accommodate thermal movement.
    - a. Material: **0.064-inch-** nominal thickness, zinc-coated (galvanized) steel sheet.

**2.7 ACCESSORIES**

- A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
  2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
  3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

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- B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum **0.018 inch** thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
- C. Gutters: Formed from same material roof panels. Match profile of gable trim, 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.
- D. 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.
- E. Roof Curbs: Fabricated from same material as roof panels, minimum **0.048 inch** thick; with bottom of skirt profiled to match roof panel profiles, and welded top box and integral full-length cricket. Fabricate curb subframing of minimum **0.0598-inch-** thick, 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.

## **2.8 FABRICATION**

- A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. 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 roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
  - 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.

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2. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. End Seams for Other Than Aluminum: Fabricate nonmoving seams 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 elastomeric sealant 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 of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

## **2.9 FINISHES**

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
- B. 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.
- C. 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.
- D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

- E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Substrate Board: Install substrate boards over roof deck on entire roof surface. Attach with substrate-board fasteners.
  - 1. 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.
  - 2. Comply with UL requirements for fire-rated construction.
- C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

### **3.3 UNDERLAYMENT INSTALLATION**

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches**. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
  - 1. Roof perimeter for a distance up from eaves of **24 inches** beyond interior wall line.
  - 2. Valleys, from lowest point to highest point, for a distance on each side of **18 inches**. Overlap ends of sheets not less than **6 inches (150 mm)**.
  - 3. Rake edges for a distance of **18 inches**.
  - 4. Hips and ridges for a distance on each side of **12 inches**.
  - 5. Roof to wall intersections for a distance from wall of **18 inches**.
  - 6. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches**.
- B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than **2 inches**.
  - 1. Apply over entire roof surface.

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2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than **3 inches**, in shingle fashion to shed water.
- C. Apply slip sheet over underlayment before installing metal roof panels.
- D. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

**3.4 THERMAL INSULATION INSTALLATION**

- A. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.
- B. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 7 Section "Building Insulation."
  1. Erect insulation and hold in place with Z-shaped furring members spaced **24 inches** o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced **24 inches** o.c.
  2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

**3.5 METAL ROOF PANEL INSTALLATION, GENERAL**

- A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
- B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Pre-drill panels for fasteners.
  1. Point of Fixity: Fasten each panel along a single line of fixing located at eave.
  2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
- C. Install metal roof panels as follows:
  1. Commence metal roof panel installation and install minimum of **300 sq. ft.** in presence of factory-authorized representative.
  2. Field cutting of metal panels by torch is not permitted.
  3. Install panels perpendicular to purlins.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Provide metal closures at rake edges, rake walls and each side of ridge and hip caps.

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6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
7. Install ridge and hip caps as metal roof panel work proceeds.
8. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
9. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Roof Panels: Use copper, stainless-steel, or hardware-bronze fasteners.

E. 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.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

### **3.6 METAL ROOF PANEL INSTALLATION**

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

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3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

**3.7 ACCESSORY INSTALLATION**

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet** 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).
- C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than **36 inches** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch** away from walls; locate fasteners at top and bottom and at approximately **60 inches** o.c. in between.
  1. Provide elbows at base of downspouts to direct water away from building.
  2. Connect downspouts to underground drainage system indicated.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.
- G. Pressure Treated Wood Blocking, Nailers, and Shims. Install as required to provided proper alignment, support, and securing of roofing material finishes, accessories, and related components.

### **3.8 ERECTION TOLERANCES**

- A. Installation Tolerances: Shim and align metal roof 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.

### **3.9 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.10 CLEANING**

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

**END OF SECTION 07411**

## **SECTION 07415 - COMPOSITE WALL PANELS**

### **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 metal-faced composite wall panels.
- B. Related Sections:
  - 1. Division 5 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
  - 2. Division 7 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.

#### **1.3 DEFINITION**

- A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Air Infiltration: Air leakage through assembly of not more than **0.06 cfm/sq. ft.** of wall area when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: **1.57 lbf/sq. ft.**
- C. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: **6.24 lbf/sq. ft.**

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- D. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure as indicated on Drawings.
  2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

**1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a. Flashing and trim.
    - b. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches. Include fasteners, closures, and other metal-faced composite wall panel accessories.
    - a. Composite Panels: Include four-way joint.
  2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.

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3. Accessories: 12-inch-long Samples for each type of accessory.
  4. Exposed Gaskets: 12 inches long.
  5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.
- D. Delegated-Design Submittal: For metal-faced composite wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Wall panels and attachments.
- F. Qualification Data: For professional engineer and testing agency.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- I. Field quality-control reports.
- J. Maintenance Data: For metal wall panels to include in maintenance manuals.
- K. Warranties: Samples of special warranties.

**1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated in subparagraphs below:

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1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - a. Perform tests under environmental conditions replicating those that will exist during installation.
2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed **120 deg F**.
- D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

**1.8 PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

## **1.9 COORDINATION**

- A. Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## **1.10 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PANEL MATERIALS**

- A. Aluminum Sheet: Coil-coated sheet, **ASTM B 209 (ASTM B 209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
  - 1. Surface: Smooth, flat finish.
  - 2. Exposed Anodized Finishes:
    - a. Clear Anodic Finish: AAMA 611, or thicker.
  - 3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil**.
- B. Panel Sealants:
  - 1. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

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**2.2 MISCELLANEOUS METAL FRAMING**

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

**2.3 MISCELLANEOUS MATERIALS**

- A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

**2.4 METAL-FACED COMPOSITE WALL PANELS**

- A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
  - 1. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
- B. Aluminum-Faced Composite Wall Panels Basis of Design Product: Subject to compliance with requirements, provide Reynobond with Kevlar Dry Joint Detail Wall Panels by Reynolds Metals Company dba Alcon Architectural Products or a comparable product.
- C. Attachment System Components: Formed from extruded aluminum.
  - 1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.

## **2.5 ACCESSORIES**

- A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.
- B. Flashing and Trim: Formed from **0.018-inch**-minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim 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-faced composite wall panels.

## **2.6 FABRICATION**

- A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
  - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
  - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
  - 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
  - 4. Dimensional Tolerances:
    - a. Panel Bow: 0.8 percent maximum of panel length or width.
    - b. Squareness: **0.25 inch** maximum.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

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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 elastomeric sealant 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 by metal-faced composite wall panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

## **2.7 GENERAL FINISH REQUIREMENTS**

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall 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-faced composite wall panel manufacturer.

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2. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

### **3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION**

- A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- B. Fasteners:
  1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
  1. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall

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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.
  2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.
- F. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant. Install sealant according to requirements of panels manufacturer.

### **3.4 ACCESSORY INSTALLATION**

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet** 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).

### **3.5 ERECTION TOLERANCES**

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of **1/4 inch in 20 feet**, nonaccumulative, on level, plumb, and

location lines as indicated and within **1/8-inch** offset of adjoining faces and of alignment of matching profiles.

### **3.6 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than **6.24 lbf/sq. ft.**
- C. Water-Spray Test: After completing the installation of **75-foot-by-2-story** minimum area of metal-faced composite wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal-faced composite wall panel installation, including accessories.
- E. Metal-faced composite wall panels will be considered defective if they do not pass tests and inspections.
- F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

### **3.7 CLEANING**

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

**END OF SECTION 07415**

## SECTION 07511 - BUILT-UP ASPHALT ROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Four Ply White Coated Mineral Surfaced Fiber Glass Built-Up Roofing System.
- B. This Section also includes the following roofing related work:
  - 1. Roof insulation.

#### 1.3 DEFINITIONS

- A. Thermal Resistance (R-value) is the reciprocal of thermal conductance (C-value) which is the rate of heat flow through a material of the thickness indicated. Thermal resistance (R-value) is expressed by the temperature difference in degrees F between the two exposed faces required to cause 1 Btu to flow through 1 sq. ft. per hour at the mean temperature indicated.

#### 1.4 SUBMITTALS

- A. General: Submit the following according to Supplementary General Provisions.
- B. Product data, including manufacturer's technical product information, installation instructions, and recommendations for each type of roofing product required. Include data substantiating that materials comply with requirements.
  - 1. For asphalt bitumen, provide a label on each container or certification with each load of bulk bitumen, indicating flash point (FP), softening point (SP), and equiviscous temperature (EVT).

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- C. LEED Submittals:
1. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
  2. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
- D. Manufacturer's Certification indicating that all bulk bituminous materials delivered to Project comply with required standards. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.
1. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported prior to final heating and application on roof.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced Installer (Roofer) to perform built-up asphalt roofing work who has specialized in installing built-up asphalt roofing systems similar to that required for this Project and who is acceptable to manufacturer of primary roofing materials.
1. Installer Certification: Obtain written certification from manufacturer of built-up roofing system certifying that Installer is approved by manufacturer to install specified roofing system. Provide copy of certification for Architect prior to awarding roofing work.
  2. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on job site during times that built-up asphalt roofing work is in progress and who is experienced in installing roofing systems similar to type and scope required for this Project.
- B. Manufacturer Qualifications: Obtain primary products, including each type of roofing sheet (felt), bitumen, composition flashings, and any vapor retarder, from a single manufacturer. Provide secondary products as recommended by manufacturer of primary products to use with roofing system specified.
- C. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.
- D. UL Listing: Provide built-up roofing system and component materials that have been tested for application and slopes indicated and that are listed by UL for Class A external fire exposure.
1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.

2. Provide built-up roofing system that can be installed to comply with UL requirements for Fire Classified and Class 120 uplift resistance requirements.
- E. FM Listing: Provide built-up roofing system and component materials that have been evaluated by FM System for fire spread, uplift resistance (specific FM I-120 test of roof assembly not required), and hail damage and are listed in "Factory Mutual Approval Guide" for Class I construction.
1. Provide roof covering materials bearing FM approval marking on bundle, package, or container, indicating that material has been subjected to FM's examination and follow-up inspection service.
- F. Fire Performance Characteristics: Provide insulation materials that are identical to materials whose fire performance characteristics, per requirements listed in Part 2 of this Section, have been determined from tests by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- G. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- H. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- I. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.
- J. Preapplication Roofing Conference: Approximately 2 weeks prior to scheduled commencement of built-up roofing installation and associated work, meet at Project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work--including mechanical work, Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with work performance, including Owner's insurers, test agencies, and governing authorities, where applicable.
1. Review foreseeable methods and procedures related to roofing work, including, but not necessarily limited to, the following:
    - a. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
    - b. Review structural loading limitations of steel deck and inspect deck for loss of flatness and for required mechanical fastening.
    - c. Review roofing system requirements: drawings, specifications, and other contract documents.
    - d. Review required submittals, both complete and incomplete.

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- e. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - f. Review required inspection, testing, certifying, and material use accounting procedures.
  - g. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing, if it is not a mandatory requirement.
2. Record (Contractor) discussions of conference, including decisions and agreements or disagreements reached, and furnish a copy for each attendee. If substantial disagreements exist at the conclusion of the conference, determine how disagreements will be resolved and set a date for reconvening the conference.

**1.6 PROJECT CONDITIONS**

- A. Weather Condition Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements. Do not proceed with work if rain is forecasted for the duration of each days work.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store and handle roofing materials to ensure dryness. Store in a dry, well-ventilated, weather-tight place. Unless protected from weather or other moisture sources, do not leave unused felts on the roof overnight or when roofing work is not in progress. Store rolls of felt and other sheet materials on end on pallets or another raised surface. Handle and store materials or equipment in a manner to avoid significant or permanent deck deflection.

**1.8 WARRANTY**

- A. Special Project Warranty: Submit two executed copies of industry standard 2-year water tightness Roofing Warranty on the form included at the end of this Section, covering work of this Section, including roofing membrane, composition flashing, roof insulation, any vapor retarders, and roofing accessories, signed and countersigned by Installer (Roofer) and Contractor. Warranty is for water tightness of complete installation including but not limited to all flashings, and coping.
- B. Manufacturer's Warranty: Submit executed copy of roofing manufacturer's standard Limited Service Warranty agreement, including flashing endorsement, signed by an authorized representative of built-up roofing system manufacturer, on form that was published with product literature as of date of Contract Documents.
- C. Warranty Period: 20 years from date of Substantial Completion.

- D. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## **PART 2 - PRODUCTS**

### **2.1 ROOF INSULATION**

- A. Rigid roof insulation board composed of closed cell polyisocyanurate foam core bonded in the manufacturing process to universal fiber glass reinforced facer: For use over metal decks. Meet ASTM C 1289, Type II, Class 1, Grade 2. Rated FM Global fire- and wind-resistant systems for Built-Up Roof. UL Class A . Comply with EPA requirements  
Flat board thickness: 3 inches, minimum. Tapered board thickness: 3 inches, minimum.
1. Provide rigid roof insulation board product approved by the built-up roof membrane system manufacturer.
  2. Basis of Design: Johns Manville “ENRGY 3”.

### **2.2 BUILT-UP ROOF MEMBRANE SYSTEM**

- A. Basis of Design: Johns Manville 4GIC CR Four Ply White Coated Mineral Surfaced Fiber Glass Built-Up Roof. For use over Johns Manville insulation or other approved insulations, on inclines up to 6” per foot.
1. Composition: 3 plies Johns Manville “GlasPly Premier” Felt & 1 ply “GlasKap CR”.
  2. Products: Subject to compliance with requirements, one of the following built-up asphalt roofing system manufacturer’s may also be provided.
    - a. Celotex Corp.
    - b. GAF Corp.
    - c. GS Roofing Products Co.
    - e. Owens-Corning Fiberglas Corp.
    - f. Tamko Roofing Products, Inc.

### **2.3 BUILT-UP ASPHALT ROOFING SYSTEM EDGE/PENETRATION MATERIALS**

- A. Roofing Cement: Asphaltic cement, asbestos-free, complying with ASTM D 4586.
- B. Glass-Fiber Fabric: Minimum 1.5-lb woven glass-fiber sheet impregnated with asphalt, complying with ASTM D 1668.
- C. Preformed Edge Strips: Rigid insulation units matching roof insulation, or asphalt-impregnated organic-fiber insulation units, molded to form 3-1/2-by-3-1/2-inch by 45-degree cant strips and 1-5/8-by-18-inch tapered-edge strips to receive roofing ply-sheet courses and lift edges above main roofing surface.

## **2.4 SHEET METAL ACCESSORY MATERIALS**

- A. Coordinate below with Section 07600, "Flashing and Sheet Metal."
- B. Stainless Steel: ASTM A 167, AISI type 302/304, No. 2D finish, temper as required for forming and performance; 0.015 inch thick (28 gage), unless indicated otherwise.
- C. Solder for Sheet Metal: Unless indicated otherwise or recommended by metal manufacturer, provide 50:50 tin/lead type (ASTM B 32) for tinning and soldering joints; use rosin flux.
  - 1. Solder stainless steel joints with 60:40 tin/lead type solder.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Wood Members, Units: Comply with requirements of Division 6 Section "Rough Carpentry" for nailers, blocking, shims, walkway units, and other wood members indicated as roofing system work. Provide wood pressure treated with waterborne preservatives for above-ground use (AWPB LP-2). Provide sufficient quantities of adequately sized members and sections for correct alignment, support and securing of roofing finishes and related components.
- B. Walkway Protection Boards: Mineral-surfaced, bituminous composition boards, approximately 1/2 inch thick, manufactured specifically for hot bituminous application on built-up roofing as a protection course for foot traffic.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Carey-Tread, Celotex Corp.
    - b. J-Walk, Manville Building Materials Corp.
    - c. White Walk, W.R. Meadows, Inc.
- C. Substrate Joint Tape: 6-inch- or 8-inch-wide, coated, glass-fiber joint tape.
- D. Asphaltic Primer over concrete deck: Comply with ASTM D 41. Apply minimum of 1 gallon per square or as required by primer manufacturer.

## **2.6 FABRICATING SHEET METAL ACCESSORIES**

- A. SMACNA and NRCA Details: Conform metal work with details shown and with applicable fabrication requirements of Architectural Sheet Metal Manual by SMACNA. Comply with installation details of NRCA Roofing and Waterproofing Manual.
- B. Prefabricate units as indicated or provide standard manufactured units complying with requirements; fabricate from sheet metal indicated.

- C. Provide 4-inch-wide flanges set in roofing cement for applying built-up asphalt roofing system membrane concealed by composition stripping.
- D. Fabricate work with flat-lock soldered joints and seams; except where joint movement is necessary, provide 1-inch-deep interlocking hooked flanges filled with mastic sealant.
- E. Fabricate gravel rings and aggregate divider strips with 1-inch-high standing leg of folded sheet metal, notched from top with 5/8-inch-deep V notches. Space notches 3 inches o.c. where strip intersects flow of water on roof, 6 inches o.c. elsewhere. Fabricate rings to sizes and shapes indicated (but not less than 36 inches square), and fabricate running strips (as shown) in maximum 4-foot lengths for butt-joint installation (with 1/4-inch gaps).
- F. Fabricate penetration sleeves with minimum 8-inch-high stack of diameter 1 inch larger than penetrating element. Counterflashing is specified as work of another section of these specifications.

## **PART 3 - EXECUTION**

### **3.1 INSPECTING SUBSTRATE**

- A. Examine substrate surfaces to receive built-up roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing built-up roofing system.
- B. Protect other work from spillage of built-up roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace/restore other work damaged when installing built-up roofing system work.
- C. Insurance/Code Compliance: Install and test, where required, built-up roofing system to comply with governing regulations and the following insurance requirements:
  - 1. FM requirements for Class I or Noncombustible, including zoned wind resistance as specified by FM Class I-90 uplift approval.
  - 2. UL Fire Classified and Class 90 uplift resistance.
- D. Coordinate installing insulation, roofing sheets, flashings, stripping, coatings, and surfacings so that insulation and felts are not exposed to precipitation or exposed overnight. Provide cutoffs at end of each day's work to cover exposed felts and insulation with a course of coated felt with joints and edges sealed with roofing cement. Remove cutoffs immediately before resuming work.

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- E. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT more than 1 hour prior to application. Discard bitumen that has been held at a temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Determine flash point, FBT and EVT of bitumen, either by information from bitumen producer or by suitable tests. Determine maximum fire-safe handling temperature and do not exceed that temperature in heating bitumen. In no case heat bitumen to a temperature higher than 25 deg F (minus 4 deg C) below flash point. For aggregate-surfaced pour coats of bitumen, limit application temperature to minimum required for proper aggregate embedment and maximum that will permit retaining a coating of weight required (depends on slope of surface). Keep kettle lid closed except when adding bitumen.
- F. Bitumen Mopping Weights: For interply mopping, and for other moppings except as otherwise indicated, apply bitumen between plies at the rate of 28 lb of asphalt per roof square (plus or minus 10 percent on a total-job average basis).
- G. Substrate Joint Penetrations: Do not allow bitumen to penetrate substrate joints and enter building or damage insulation, vapor retarders, or other construction. Where mopping is applied directly to a substrate, tape joints or, in the case of steep asphalt, hold mopping back 2 inches from both sides of each joint.
- H. Cutoffs: At the end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary covering of two plies of No. 15 roofing felt set in full moppings of hot bitumen; remove at beginning of the next day's work. Glaze-coat areas of completed organic ply sheets that cannot be flood-coated and aggregate-surfaced before the end of each day's work.
- I. Coordinate with Owner to ensure building is unoccupied during roofing operations.

### **3.4 INSTALLING INSULATION**

- A. General: Comply with insulation manufacturer's instructions and recommendations handling, installing, and bonding or anchoring insulation to substrate.
- B. Secure insulation to deck using mechanical fasteners specifically designed and sized for attaching specified board-type insulation to deck type shown. Fasten insulation over entire area of roofing at spacing as required by FM for Windstorm Resistance Classification I-90. Run long joints for insulation in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.
- B. Two-Layer Installation: Where overall insulation thickness is 2 inches or greater, install required thickness in two layers with joints of second layer offset from joints of first layer a minimum of 12 inches each direction. Install second layer in full mopping of hot Type II asphalt applied within temperature range of EVT plus or minus 25 deg F (minus 4 deg C) and at rate of 30 lb per 100 sq. ft. (plus or minus 25 percent on total-job average basis).

### **3.5 ROOF MEMBRANE INSTALLATION**

- A. Shingling Plies: Except as otherwise indicated, install membrane with ply sheets shingled uniformly to achieve required amount of membrane thickness throughout. Shingle in proper direction to shed water on each large area of roofing where slope is significant (over 1/2 inch per foot). Follow manufacturer's installation recommendations.
  
- B. Cant Strips/Tapered-Edge Strips: Except as otherwise shown, install preformed 45-degree insulation cant strips at junctures of built-up asphalt roofing system membrane with vertical surface. Provide preformed, tapered-edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
  
- C. First Ply: Install one lapped course of base ply. Mop to insulation substrate with steep Type III asphalt, except use special adhesive where indicated.
  
- D. Interply Sheets: Install the number and type(s) of ply sheets (felts) indicated, lapped (shingled) amount specified to form a continuous, uniform membrane with continuous bitumen moppings between sheets so that ply sheet does not touch ply sheet. As ply-sheet membrane is laid up, glaze-coat top surface with a 20-lb mopping per square of same bitumen.
  - 1. Mop base of membrane to base ply.
  - 2. Extend built-up roofing membrane to 2 inches (nominal) above top edge of cant strip and terminate.
  - 3. Provide a folded-back envelope at edges and penetrations of built-up roofing membrane where it is not turned up on a tapered strip to provide positive protection against flow of bitumen into building or off the edge. Extend base sheet to form envelope or, where no base sheet is provided, install one ply of coated felt set in steep asphalt with joints sealed. Seal corners and other interruptions of envelope with large beads of roofing cement to protect against bitumen flow.
  - 4. Nail edges of roofing membrane to wood blocking at perimeter edges of roof prior to installing metal gravel stops/fascias. Space nails at minimum 8 inches o.c.

### **3.6 COMPOSITION FLASHING AND STRIPPING**

- A. Install composition flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Install two ply of glass-fiber-reinforced flashing, each set in a continuous coating of roofing cement and extended onto deck 4 inches and 6 inches, respectively. Nail or provide other forms of mechanical anchorage of composition flashing to vertical surfaces as recommended by manufacturer of primary roofing materials. Except where concealed by elastic flashing, apply a heavy coating of roofing cement over composition flashing.
  
- B. Install composition stripping where metal flanges are set on roofing. Provide not less than one ply of glass-fiber fabric and one ply of reinforced glass-fiber flashing; set each in a continuous coating of roofing cement and extended onto the deck 4 inches and 6

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inches, respectively. Except where concealed by aggregate surfacing or elastic flashing, apply a heavy coating of roofing cement over composition stripping.

- C. Allow for expansion of running metal flashing and edge trim that adjoins roofing.
- D. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with built-up roofing work are specified in other sections of these specifications.
- E. Roof Accessories: Miscellaneous sheet metal accessory items, including insulation vents and other devices, and any major items of roof accessories to be coordinated with built-up roofing system work are specified in other sections of these specifications.

**3.7 PROTECTING ROOFING**

- A. Upon completing roofing, including associated work, institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report with copies to Architect and Owner describing nature and extent of deterioration or damage found.
- B. Repair or replace, as required, deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to requirements of specified warranty.

**END OF SECTION 07511**

## SECTION 07620 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
  - 1. Manufactured through-wall flashing.
  - 2. Manufactured reglets.
  - 3. Formed low-slope roof flashing and trim.
  - 4. Formed wall flashing and trim.
  - 5. Formed equipment support flashing.
  
- B. Related Sections:
  - 1. Division 1 Section "LEED Requirements".
  - 2. Division 4 Section "Unit Masonry Assemblies".
  - 3. Division 4 Section "Clay Unit Masonry Assemblies" for through-wall flashing and trim.
  - 4. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
  - 5. Division 7 Section "Metal Roof Panels" for sheet metal flashing and trim integral with metal roof panels.
  - 6. Division 7 Section "APP Modified Bituminous Membrane Roofing" .

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement. All manufacturers shall meet ES-1 Wind Standards.
  
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.
  
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result

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of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
1. Identify material, thickness, weight and finish for each item and location in Project.
  2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams and dimensions.
  3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats and attachments to adjoining work.
  4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- B. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

#### **1.5 QUALITY ASSURANCE**

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

## **1.7 COORDINATION**

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure and noncorrosive installation.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### **2.2 SHEET METALS**

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
  - 1. Mill Finish: Standard two-sides bright.
  - 2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.
      - 1) Color: As selected by Architect from manufacturer's full range.
  - 4. Anodized Finish: Apply the following coil-anodized finish:
    - a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

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- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
  - 1. Finish: No. 2D (dull, cold rolled).
  
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 structural quality.
  - 3. Exposed Finishes. Apply the following coil coating:
    - a. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil topcoat.
      - 1) Color: As selected by Architect from manufacturer's full range.
    - b. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      - 1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified below:
        - a) Humidity Resistance: 2000 hours.
        - b) Salt-Spray Resistance: 2000 hours.
      - 2) Color: As selected by Architect from manufacturer's full range.
  
- D. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

**2.3 UNDERLAYMENT MATERIALS**

- A. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized paper, minimum 5-lb/100 sq. ft.

## **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts and other suitable fasteners designed to withstand design loads.
  - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
  - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
  - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
  - 4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- E. Burning Rod for Lead: Same composition as lead sheet.
- F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- K. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## **2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM**

- A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.
1. Stainless Steel: 0.0156 inch thick.
    - a. Products:
      - 1) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
      - 2) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
      - 3) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
- B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions .
1. Manufacturers:
    - a. Hickman, W.P. Company
    - b. Metal Era
  2. Material: Aluminum, 0.024 inch thick.
  3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
  6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  7. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
  8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

## **2.6 FABRICATION, GENERAL**

- A. General: Custom 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 item indicated. Shop fabricates

items where practicable. Obtain field measurements for accurate fit before shop fabrication.

- B. 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.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.
- H. Parapet Scuppers: Fabricate scuppers of dimensions required and as detailed on the drawings with no 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. Fabricate parapet scuppers from the following material:
    - a. Stainless Steel: 0.0187 inch thick.

## **2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS**

- A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Furnish with 6-inch wide joint cover plates.
  - 1. Joint Style: Butt, with 12-inch wide concealed backup plate.
  - 2. Fabricate with scuppers as shown on drawings. Fasten gravel guard angles to base of scupper.

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3. Fabricate scuppers from the following material:
  - a. Stainless Steel: 0.0187 inch thick.
  
- B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-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, seal, and solder or weld watertight.
  1. Joint Style: Butt, with 12-inch wide concealed backup plate.
  2. Fabricate copings from the following material:
    - a. Prepainted, Metallic-Coated Steel: 0.0396 inch thick.
  
- C. Base Flashing: Fabricate from the following material:
  1. Aluminum: 0.040 inch thick.
  2. Stainless Steel: 0.0187 inch thick.
  
- D. Counterflashing: Fabricate from the following material:
  1. Aluminum: 0.0320 inch thick.
  2. Stainless Steel: 0.0187 inch thick.
  
- E. Flashing Receivers: Fabricate from the following material:
  1. Aluminum: 0.0320 inch thick.
  2. Stainless Steel: 0.0156 inch thick.
  
- F. Roof-Penetration Flashing: Fabricate from the following material:
  1. Lead: 4.0-lb/sq. ft, hard tempered.
  
- G. Roof-Drain Flashing: Fabricate from the following material:
  1. Lead: 4.0-lb/sq. ft, hard tempered.

**2.8 WALL SHEET METAL FABRICATIONS**

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch high-end dams. Fabricate from the following material:
  1. Stainless Steel: 0.0156 inch thick.

**2.9 MISCELLANEOUS SHEET METAL FABRICATIONS**

- A. Equipment Support Flashing: Fabricate from the following material:
  1. Stainless Steel: 0.0187 inch thick.

## **2.10 FINISHES**

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 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, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
  - 1. Coat side of uncoated aluminum, stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

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- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. 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.
  - 1. Space cleats not more than 12 inches part. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
  - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
  - 2. Aluminum: Use aluminum or stainless steel fasteners.
  - 3. Copper Use copper or stainless steel fasteners.
  - 4. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
  - 1. Where sealant-filled joints are used, 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 moderate, between 40 and 70 deg F, set joint members for 50 percent movement either 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 Division 7 Section "Joint Sealants."
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
  - 1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
  - 2. Pretinning is not required for lead.
  - 3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.

4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
  5. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
  6. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

### **3.3 ROOF DRAINAGE SYSTEM INSTALLATION**

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
- C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

### **3.4 ROOF FLASHING INSTALLATION**

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified 150 mph wind zone.
1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified 150 mph wind zone.
1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
  2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

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- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a 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 a minimum of 4 inches and bed with elastomeric sealant.
  - 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant interlocking folded seam or blind rivets and sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
  - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
  - 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

**3.5 WALL FLASHING INSTALLATION**

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as 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 Division 4 Section "Unit Masonry Assemblies."
- C. Reglets: Installation of reglets is specified in Division 3 Section "Cast-in-Place Concrete and 4 Section "Unit Masonry Assemblies."

**3.6 MISCELLANEOUS FLASHING INSTALLATION**

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

**3.7 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including

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removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07620**

## SECTION 07920 - JOINT SEALANTS

### 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.
- B. Note that all exterior joints shall be approved by the Architect and Owner prior to completion.

#### 1.2 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Joints in exterior insulation and finish systems.
    - d. Joints between different materials listed above.
    - e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    - f. Control and expansion joints in ceilings and other overhead surfaces.
    - g. Other joints as indicated.
  - 2. Exterior joints in the following horizontal traffic surfaces:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Tile control and expansion joints.
    - c. Joints between different materials listed above.
    - d. Other joints as indicated.
  - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Tile control and expansion joints.
    - d. Vertical joints on exposed surfaces of walls and partitions.
    - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    - f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - g. Other joints as indicated.

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4. Interior joints in the following horizontal traffic surfaces:
  - a. Isolation joints in cast-in-place concrete slabs.
  - b. Control and expansion joints in tile flooring.
  - c. Other joints as indicated.

B. Related Sections:

1. Division 1 Section "LEED Requirements".
2. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
3. Division 4 Section "Clay Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
4. Division 8 Section "Glazing" for glazing sealants.
5. Division 9 Section "Gypsum Board" for sealing perimeter joints.
6. Division 9 Section "Ceramic Tile" for sealing tile joints.
7. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealants.

### **1.3 PERFORMANCE REQUIREMENTS**

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

### **1.4 SUBMITTALS**

- A. Product Data: For each joint-sealant product indicated.
- B. LEED Submittal:
  1. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

- F. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- G. Qualification Data: For Installer.
- H. Warranties: Special warranties specified in this Section.

### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

### **1.6 PROJECT CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

### **1.7 WARRANTY**

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

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2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

**2.2 MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealants, backings and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

**2.3 ELASTOMERIC JOINT SEALANTS**

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Single-Component Neutral-Curing Silicone Sealant:
  1. Products:
    - a. Dow Corning Corporation; 799.
    - b. GE Silicones; UltraGlaze SSG4000.

- c. GE Silicones; UltraGlaze SSG4000AC.
    - d. Polymeric Systems Inc.; PSI-631.
    - e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
    - f. Tremco; Proglaze SG.
    - g. Tremco; Spectrem 2.
    - h. Tremco; Tremsil 600.
  - 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 25.
  - 4. Use Related to Exposure: NT (nontraffic).
  - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
    - a. Use O Joint Substrates: Coated glass and ceramic tile.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
- 1. Products:
    - a. Pecora Corporation; 898.
    - b. Tremco; Tremsil 600 White.
    - c. Dow Corning.
  - 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 25.
  - 4. Use Related to Exposure: NT (nontraffic).
  - 5. Uses Related to Joint Substrates: M, G, A and, as applicable to joint substrates indicated, O.
    - a. Use O Joint Substrates: vertical surfaces of ceramic tile and at joints between walls and plumbing surfaces.
- F. Single-Component Nonsag Urethane Sealant:
- 1. Products:
    - a. Bostik Findley; Chem-Calk 900.
    - b. Bostik Findley; Chem-Calk 915.
    - c. Bostik Findley; Chem-Calk 916 Textured.
    - d. Bostik Findley; Chem-Calk 2639.
    - e. Pecora Corporation; Dynatrol I-XL.
    - f. Polymeric Systems Inc.; Flexiprene 1000.
    - g. Polymeric Systems Inc.; PSI-901.
    - h. Schnee-Morehead, Inc.; Permathane SM7100.
    - i. Schnee-Morehead, Inc.; Permathane SM7108.
    - j. Schnee-Morehead, Inc.; Permathane SM7110.
    - k. Sika Corporation, Inc.; Sikaflex - 15LM.
    - l. Tremco; DyMonic.
    - m. Tremco; Vulkem 921.

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- n. Tremco; Vulkem 931.
- 2. Type and Grade: S (single component) and NS (nonsag).
- 3. Class: 25
- 4. Use Related to Exposure: NT (nontraffic).

**2.4 LATEX JOINT SEALANTS**

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. For use to bridge joints between hollow metal frames and drywall surfaces and other similar conditions.
- C. Products:
  - 1. Pecora Corporation; AC-20+.
  - 2. Schnee-Morehead, Inc.; SM 8200.
  - 3. Sonneborn, Division of ChemRex Inc.; Sonolac.
  - 4. Tremco; Tremflex 834.

**2.5 ACOUSTICAL JOINT SEALANTS**

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
  - 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 2. Available Products:
    - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
  - 1. Products:
    - a. Pecora Corporation; BA-98.
    - b. Tremco; Tremco Acoustical Sealant.

## **2.6 PREFORMED JOINT SEALANTS**

- A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
1. Products:
    - a. Dow Corning Corporation; 123 Silicone Seal.
    - b. GE Silicones; UltraSpan US1100.
    - c. Pecora Corporation; Sil-Span.
    - d. Tremco; Spectrem Ez Seal.
- B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:
1. Products:
    - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
    - b. illbruck Sealant Systems, Inc.; Wilseal 600.
    - c. Polytite Manufacturing Corporation; Polytite B.
    - d. Polytite Manufacturing Corporation; Polytite Standard.
    - e. Sandell Manufacturing Co., Inc.; Polyseal.
  2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining and compatible with joint substrates and other joint sealants.
    - a. Density: Manufacturer's standard.

## **2.7 PREFORMED TAPE SEALANTS**

- A. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
- B. Expanded Cellular Tape Sealant: Closed-cell, PVC foam tape sealant; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

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1. Type 1, for applications in which tape acts as the primary sealant.
2. Type 2, for applications in which tape is used in combination with a full bead of liquid sealant.

**2.8 JOINT-SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

**2.9 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such

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contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
  - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

- a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
- I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
  - 1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
  - 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
  - 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
  - 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

### **3.4 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

**END OF SECTION 07920**