

SECTION 07146 – CRYSTALLINE CONCRETE WATERPROOFING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section covers the requirements for waterproofing of concrete structures as indicated on the drawings.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Army Corp. of Engineers (CRD).
- C. American Concrete Institute Reference 308.

1.3 SYSTEM DESCRIPTION

- A. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.
- B. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.

1.4 STORAGE, DELIVERY AND HANDLING

- A. Store manufacturer's sealed and labeled material containers in dry, protected environment off the ground.

1.5 SCHEDULING

- A. Coordinate with Section 03300 Cast-In-Place Concrete.

1.6 CO-ORDINATION

- A. All waterproofing materials shall be purchased from the local distributor with respect to the project.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Xypex Chemical Corporation, Richmond, B.C., Canada.
- B. Equivalent materials as approved by the engineer 10 days prior to acceptance of bids.

2.2 MATERIALS

- A. Xypex Admix C-1000.
- B. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.
- C. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.
- D. The concrete crystalline waterproofing admixture shall be specifically formulated as a concrete admixture.
- E. Waterproofing admixture shall meet the performance requirements outlined in Section 2.4.

2.3 MIXES

- A. The dosage rate for the Xypex Admix C-1000 shall be 3% by weight of cement.

2.4 PERFORMANCE CRITERIA

- A. U.S. Army Corps of Engineers CRD C48-73 “Permeability of Concrete” Requirement: No leakage when subjected to pressure of 150 psi for 24 hours. Only 1.5 mm of penetration after 120 hours.
- B. U.S. Army Corps of Engineers CRD C48-73 “Permeability of Concrete” Requirement: No leakage when subjected to head pressure of 224 feet for 10 days.
- C. DIN 1048 “Water Impermeability of Concrete” Requirement: No water penetration after 28 days under hydrostatic pressure.
- D. NSF 61 “Standard Water System Component Health Effects” Requirement: Certified for use in potable water in accordance with ANSI/NSF Std. 61.
- E. ASTM C 39 “Compressive Strength of Cylindrical Concrete Specimens” Requirement: After 28 days, a minimum of 10% increase in compressive strength.

- F. Crack Bridging Capability: Requirement: Crystalline Waterproofing shall be capable of sealing static cracks up to 1/64”.

PART 3 – APPLICATION

3.1 MATERIALS PREPARATION

- A. Xypex Admix C-1000 must be added to the concrete at the time of batching. It is recommended that the Admix powder be added first to the rock and sand and blended thoroughly for 2 – 3 minutes before adding cement and water.
- B. Blend total concrete mix using normal practices to ensure formation of homogeneous mixture.
- C. For precast concrete manufacturers this usually means adding the Xypex into their pan type mixers.
- D. For ready-mix batch plants the Xypex Admix C-1000 can be evenly distributed on a plant conveyor belt carrying the rock and sand, or the dry powder Admix can be added to the truck first and then 30 – 50% of the required water for the concrete batch is dispensed along with 300 – 500 pounds of aggregate and mixed thoroughly for 2 – 3 minutes. The rest of the materials are then added to the truck and mixed for at least 5 minutes.

3.2 APPLICATION

- A. Placement of concrete shall be in accordance with the Section 03300.
- B. Concrete that contains Xypex Admix C-1000 must be cured as per “Standard for Curing Concrete” (ACI 308).
- C. Normal backfilling procedures may be used after concrete has cured for at least 7 days.

END OF SECTION 07146

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. Insulation under slabs-on-grade.
2. Foundation wall insulation (supporting backfill).
3. Concealed building insulation.
4. Loose-fill building insulation.
5. Vapor retarders.

- B. Related Sections include the following:

1. Division 2 Section "Subdrainage" for insulated drainage panels.
2. Division 3 Section "**Cast-in-Place Concrete**" Division 4 Section "Unit Masonry Assemblies" for insulation installed in cavity walls and masonry cells.
3. Division 7 Section "EPDM-Single-Ply Membrane Roofing."
4. Division 9 Sections "Gypsum Board Assemblies and Gypsum Board Shaft-Wall Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
5. Division 15 Sections Duct Insulation and Equipment Insulation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Research/Evaluation Reports: For foam-plastic insulation.

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.
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.

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. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Knauf Fiber Glass.
 - d. Owens Corning.
 - e. **<Insert manufacturer.>**
 2. Perlite Loose-Fill Insulation:
 - a. Producer Members of Perlite Institute Inc.

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. Cellular Glass Insulation: ASTM C 552 Type I flat block, with unfaced insulation passing ASTM E 136 for combustion characteristics.
- C. Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
 1. Nominal density of **1.0 lb/cu. ft. (16 kg/cu. m)**, thermal resistivity of **3.7 deg F x h x sq. ft./Btu x in. at 75 deg F (25.7 K x m/W at 24 deg C)**.

2. Nominal density of not less than 1.5 lb/cu. ft. (24 kg/cu. m) nor more than 1.7 lb/cu. ft. (26 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
3. Combustion Characteristics: Passes ASTM E 136.

2.3 VAPOR RETARDERS

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Reinforced-Polyethylene Vapor Retarders:
 - a. Raven Industries, Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-65.
 - c. **<Insert manufacturer's name; product name.>**
 2. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders:
 - a. Raven Industries, Inc.; DURA-SKRIM 2FR.
 - b. Reef Industries, Inc.; Griffolyn T-55 FR.
 - c. **<Insert manufacturer's name; product name.>**
 3. Foil-Polyester Film Vapor Retarder:
 - a. Alumiseal Corporation; Zero Perm.
 - b. **<Insert manufacturer's name; product name.>**
- B. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
- C. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
- D. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either a nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.53 ng/Pa x s x sq. m), and flame-spread and smoke-developed indices of not more than 5 and 60, respectively.
- E. Foil-Polyester Film Vapor Retarder: 2 layers of 0.5-mil- (0.013-mm-) thick polyester film laminated to an inner layer of 1-mil- (0.025-mm-) thick aluminum foil, with maximum water-vapor transmission rate in flat condition of 0.0 g/h x sq. m and with maximum flame-spread and smoke-developed indices of 5.
- F. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.5 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:
- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 - 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. 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 (25 mm).
 - 2. Air Space: 2 inches (50 mm).
 - 3. Air Space: 3 inches (76 mm).
- E. 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 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. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.5 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 vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
- C. 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.
- D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
- E. 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.
- F. 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.

3.6 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. This Section includes the following:
 - 1. Factory-formed and field-assembled, concealed-fastener, flat-seam, and standing-seam metal roof and wall panels.
 - 2. Metal soffit panels.
- B. Related Sections include the following:
 - 1. Division 5 Section "Steel Deck" for steel roof deck supporting metal roof panels.
 - 2. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal roof panels.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for copings, flashings, and other sheet metal work not part of metal roof panel assemblies.
 - 4. 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: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Air Infiltration: Air leakage through assembly of not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** of roof area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: Negative **1.57 lbf/sq. ft. (75 Pa)**.

2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) 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.
- C. Water Penetration: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) 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. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.
- E. 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 330:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 60 lbf/sq. ft. acting inward or outward.
- F. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- G. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- H. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 236 or ASTM C 518.
- 1.5 SUBMITTALS
- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.
 - B. 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.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Roof and Soffit Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Vapor Retarders: 6-inch- (150-mm-) square Samples.
 4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
- D. Qualification Data: For Installer.
- E. Material Certificates: For vapor retarders, signed by manufacturers.
- F. Field quality-control inspection reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 1. Metal Roof and Soffit Panels: Include reports for air infiltration, water penetration, fire-test-response characteristics, and structural performance.
 2. Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- H. Maintenance Data: For metal roof panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 1. Engineering Responsibility: Preparation of data for metal roof panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

- E. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Combustion Characteristics: ASTM E 136.
 - 2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 3. Metal roof panels shall be identified with appropriate markings of applicable testing and inspecting agency.

- F. Surface-Burning Characteristics: Provide insulated metal roof panels having insulation core material 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:
 - 1. Flame-Spread Index: 25 or less, unless otherwise indicated.
 - 2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

- G. Preliminary Roofing Conference: Before starting roof sheathing construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof sheathing construction and metal roof panels including, but not limited to, the following:
 - 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 and sheathing 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 flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 - 7. Review temporary protection requirements for metal roof panels during and after installation.
 - 8. Review roof observation and repair procedures after metal roof panel installation.

- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - 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, purlin and rafter 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 and purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
 5. Review structural loading limitations of deck and purlins and rafters 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.
 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 assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."
- B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks and purlins and rafters 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 components of 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. Siliconized Polyester Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 15 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 2 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: 10 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Weathertight Warranty Period: 10 years from date of Substantial Completion.
- D. 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 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 5. Basis-of-Design Product: The design for each metal roof panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, **G90 (Z275)** coating designation; structural quality.
 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, **Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275)**; structural quality.
 3. Surface: Smooth, flat finish.

4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
 - a. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

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 (13 mm)** wide and **1/8 inch (3 mm)** 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.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: **6-mil- (0.15-mm-)** thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Building paper, minimum **5 lb/100 sq. ft. (0.24 kg/sq. m)**, rosin sized.

2.4 SUBSTRATE BOARDS

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
 1. Type and Thickness: Regular, **1/2 inch (13 mm)**.
 2. Product: Subject to compliance with requirements, provide "Dens-Dek" by Georgia-Pacific Corporation.
- B. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.5 MISCELLANEOUS MATERIALS

- A. 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.

1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.
1. Basis-of-Design Product: Berridge Manufacturing Company; "Cee-Lock" or a comparable product of one of the following:
 2. Manufacturers:
 - a. AEP-Span.
 - b. Architectural Building Components.
 - c. Architectural Roofing and Siding, Inc.
 - d. ATAS International, Inc.
 - e. Berridge Manufacturing Company.
 - f. BHP Steel Building Products USA Inc.
 - g. CENTRIA Architectural Systems.
 - h. Custom Panel Industries, LLC.
 - i. Delcoa Industries, Inc.
 - j. Fabral, Inc.
 - k. Innovative Metals Company, Inc.
 - l. K-Metals Inc.
 - m. MBCI; Div. of NCI Building Systems.
 - n. McElroy Metal, Inc.
 - o. Merchant & Evans, Inc.
 - p. Modern Metal Systems, Inc.

3. Material: Zinc-coated (galvanized) steel sheet, 0.0159 inch (0.40 mm) thick.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
4. Clips: Floating to accommodate thermal movement.
 - a. Material: 0.0209-inch- (0.55-mm-) thick, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
5. Panel Coverage: 16 inches (406 mm).
6. Panel Height: 1.5 inches (38 mm).
7. Uplift Rating: UL 90.

2.7 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal roof panels.
 1. Finish: Match finish and color of metal roof panels as indicated on Drawings.
- C. Flush-Profile Metal Soffit Panels : Solid panels formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.
 1. Basis-of-Design Product: Berridge Flush Seam Panel or a comparable product of one of the following:
 2. Available Manufacturers:
 - a. AEP-Span.
 - b. Architectural Building Components.
 - c. ATAS International, Inc.
 - d. Berridge Manufacturing Company.
 - e. BHP Steel Building Products USA Inc.
 - f. CENTRIA Architectural Systems.
 - g. Delcoa Industries, Inc.
 - h. MBCI; Div. of NCI Building Systems.
 - i. Merchant & Evans, Inc.
 - j. Metal-Fab Manufacturing, LLC.
 - k. Metal Sales Manufacturing Corporation.
 - l. Modern Metal Systems, Inc.
 - m. Petersen Aluminum Corporation.
 3. Material: Same material, finish, and color as metal roof and wall panels.
 4. Material: Zinc-coated (galvanized) steel sheet, 0.0159 inch (0.40 mm) thick.

- a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
5. Panel Coverage: 12 inches (305 mm).
 6. Panel Height: 0.5 inch (12.7 mm).
 7. Sealant: Factory applied within interlocking joint.

2.8 ACCESSORIES

- A. Roof Panel Accessories: Provide components 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. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
 3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- (0.64-mm-) thick, stainless-steel or nylon-coated aluminum sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, 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, 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 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match metal roof panels.
- D. Downspouts: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- (3-m-) long sections, complete with formed elbows and offsets. Finish downspouts to match metal roof panels.
- E. Roof Curbs: Fabricated from 0.0478-inch- (1.2-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; with welded top

box and bottom skirt, and integral full-length cricket. Fabricate curb subframing of minimum **0.0598-inch- (1.5-mm-)** 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.

- F. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.9 FABRICATION

- A. General: Fabricate and finish metal roof 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will 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.
 - 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 roof panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical 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, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. 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.
- C. 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 sheathing 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. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

- D. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."
- E. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet Underlayment: Install polyethylene sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for anchorage to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than **2 inches (50 mm)**.
- B. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated below, in shingle fashion to shed water, with lapped joints of not less than **2 inches (50 mm)**.
 - 1. Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than **3 inches (75 mm)**, in shingle fashion to shed water.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under metal roof panels. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses. Overlap side edges not less than **3-1/2 inches (90 mm)**. 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 (600 mm)** beyond interior wall line.
 - 2. Rake edges for a distance of **18 inches (460 mm)**.
 - 3. Hips and ridges for a distance on each side of **12 inches (300 mm)**.
 - 4. Roof to wall intersections for a distance from wall of **18 inches (460 mm)**.
 - 5. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches (460 mm)**.
- D. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."
- E. Apply slip sheet over underlayment before installing metal roof panels.

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

- A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cutting of metal roof panels by torch is not permitted.
 2. Install panels perpendicular to purlins.
 3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
 4. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge and hip caps.
 5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 6. Locate and space fastenings in uniform vertical and horizontal alignment.
 7. Install ridge and hip caps as metal roof panel work proceeds.
 8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.
- B. 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 or stainless-steel fasteners.
 4. Stainless-Steel Roof Panels: Use stainless-steel fasteners.
- C. 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 aluminum roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
- D. 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."

3.5 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

- A. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
 7. At panel splices, nest panels with minimum **6-inch (150-mm)** end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- B. 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.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
- C. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- D. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 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 (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than **4 feet (1.2 m)** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with **1-1/2-inch (38-mm)** telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **60 inches (1500 mm)** o.c. in between.
1. Tie 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.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

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

3.9 CLEANING AND PROTECTION

- 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 07412 - METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Factory-formed and field-assembled, concealed-fastener, vertical flush seam metal wall panels.
 - 2. Corrugated Metal siding.
- B. Related Sections include the following:
 - 1. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal wall panels.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for copings, flashings and other sheet metal work not part of metal wall panel assemblies.
 - 3. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITION

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

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Air Infiltration: Air leakage through assembly of not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** of wall area when tested according to ASTM E 283 at a static-air-pressure difference of **6.24 lbf/sq. ft. (300 Pa)**.

- C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
 - 1. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- D. Water Absorption: Maximum 1.0 percent absorption rate by volume when tested according to ASTM C 209.
- E. Structural Performance: Provide metal wall 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 330:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 60 lbf/sq. ft., acting inward or outward.
- F. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- G. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
 - 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 - a. Include four-way joint for composite panels.
 - 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 3. Vapor Retarders: 6-inch- (150-mm-) square Samples.
 - 4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
 - 5. Exposed Gaskets: 12 inches (300 mm) long.
 - 6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
 - D. Qualification Data: For Installer.
 - E. Material Certificates: For vapor retarders, signed by manufacturers.
 - F. 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.
 - G. Field quality-control test reports.
 - H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 - 1. Metal Wall Panels: Include reports for air infiltration, water penetration, and structural performance.
 - 2. Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
 - I. Research/Evaluation Reports: For metal-faced composite wall panels.
 - J. Maintenance Data: For metal wall panels to include in maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Installer Qualifications: Fabricator of metal-faced composite wall panels.

1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 3. Engineering Responsibility: Preparation of data for metal wall panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Fabricator Qualifications: Certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer's wall panel system.
- D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- E. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- G. Preliminary Siding Conference: Before starting wall framing construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to wall framing construction and metal wall panels including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 8. Review wall panel observation and repair procedures after metal wall panel installation.

- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 8. Review wall panel observation and repair procedures after metal wall panel installation.
 9. 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 wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. 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 (49 deg C).
- E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.
- F. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of 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 assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate metal 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 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, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 1. Weathertight Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 5. Basis-of-Design Products: The design for each metal wall panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 2. Surface: Smooth, flat finish.
 3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
 - a. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- 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 (13 mm) wide and 1/8 inch (3 mm) 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 wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 MISCELLANEOUS MATERIALS

- A. 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 wall panels by means of plastic caps or factory-applied coating.
 1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
 1. Basis-of-Design Product: Centria; Econolap ¾" (.75 inches) (19.05 mm):

2.5 EXPOSED-FASTENER, PERFORATED, CORRUGATED METAL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel, and uniform 3/8" dia. Holes, and 50% open air.
 - a. Basis-of-Design Product: CENTRIA PERFORATED SCREENWALLS or prior approval.
2. Material: Zinc-coated (galvanized) steel sheet, 0.0159 inch (0.40 mm).

2.6 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced and flat pan between panel edges; with flush joint between panels.
 - 1. Basis-of-Design Product: Berridge Manufacturing Company; Flush Seam Panel or a comparable product of one of the following:
 - 2. Material: Zinc-coated (galvanized) steel sheet, 0.0209 inch (0.55 mm) thick.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.

2.7 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal 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 wall panels, unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, 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 wall panels.

2.8 FABRICATION

- A. General: Fabricate and finish metal 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.

1. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- 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.
 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 wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical 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, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 - 1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. 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. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."
- C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."
- D. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cutting of metal wall panels by torch is not permitted.

2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
2. 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.
3. Copper Wall Panels: Use copper or stainless-steel fasteners.
4. Stainless-Steel Wall Panels: Use stainless-steel fasteners.

C. 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 wall panel manufacturer.

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

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

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

3.4 FIELD-ASSEMBLED METAL WALL PANEL INSTALLATION

- A. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
 7. At panel splices, nest panels with minimum **6-inch (150-mm)** end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- B. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.
- C. Metal Liner Panels: Install panels on exterior side of girts with girts exposed to the interior.
- D. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install thermal barrier, in number of layers required for fire rating, over subgirts, attached with thermal-barrier fasteners. Install second set of subgirts horizontally, fastened through thermal barrier into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.
1. Comply with UL requirements for fire-rated construction.
- E. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- F. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 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 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 (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)**, nonaccumulative, on level, plumb, and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- 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 ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than **6.24 lbf/sq. ft. (300 Pa)**.
- C. Water-Spray Test: After completing the installation of **75-foot- (23-m-)** by-2-story minimum area of metal 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 completed metal wall panel installation, including accessories. Report results in writing.

- E. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.
- F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING AND PROTECTION

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

END OF SECTION 07412

SECTION 07460 - SIDING

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. Fiber-cement siding.
 - 2. Fiber-cement soffit.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for building paper.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing, gutters, and other sheet metal work.
 - 3. Division 7 Section "Joint Sealants."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For siding and soffit.
- C. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 24-inch- (600-mm-) wide-by-36-inch- (900-mm-) high Sample panel of siding assembled on plywood backing.
 - 2. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.
- D. Product Certificates: For each type of siding and soffit, signed by product manufacturer.

1.4 QUALITY ASSURANCE

- A. Source Limitations for siding and soffit: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, through one source from a single manufacturer.

- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weathertight place.

1.6 PROJECT CONDITIONS

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

1.7 SEQUENCING

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

1. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
2. Warranty Period: 10 years from date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 3. 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.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
5. Basis-of-Design Product: The design for each siding and soffit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 SIDING

- A. Fiber-Cement Siding: Siding made from fiber-cement board that does not contain asbestos fibers; complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.
 1. Basis-of-Design Product: Eternit 'Natura' panels or approved equal by one of the following:
 2. Manufacturers:
 - a. Cemlank, Inc.
 - b. James Hardie Inc.
 - c. Eternit
 3. Horizontal Pattern: Boards 4'-0" x 8'-0" style.
 - a. Texture: Smooth
 4. Panel Pattern: 48-inch- (1219-mm-) wide sheets with smooth texture.
 5. Factory Priming: Manufacturer's standard acrylic primer.
- B. Fiber-Cement Soffit: Panels made from fiber-cement board that does not contain asbestos fibers; complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.
 1. Basis-of-Design Product: Eternit natura or an approved equal by one of the following:
 2. Manufacturers:
 - a. Same manufacturers listed for fiber-cement siding.
 3. Pattern: 48" wide sheets with smooth texture.
 4. Ventilation: Provide unperforated soffit, unless otherwise indicated.
 5. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

- A. Flashing: Provide galvanized sheet metal flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

- B. Elastomeric Joint Sealant: Single-component urethane joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates.
- C. Fasteners:
 - 1. For fastening fiber-cement siding, use stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 07460

SECTION 07552 - APP-MODIFIED BITUMINOUS MEMBRANE ROOF

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. APP-modified bituminous membrane roofing.
 - 2. Roof walkways.
- B. Related Sections include the following:
 - 1. Division 6 Section "Miscellaneous Carpentry" for wood nailers, cants, curbs, and blocking.
 - 2. Division 15 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.
- D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-For New Orleans conditions and this specific application.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
- D. Qualification Data: For Installer and manufacturer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- F. Research/Evaluation Reports: For components of roofing system.
- G. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Manufacturer's Warranty: Upon completion of the project, and after all post installation procedures have been completed, furnish the Owner with the manufacturer's 10, year labor and materials membrane guarantee. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and shall be issued at no additional cost to the Owner. This guarantee shall not exclude random areas of ponding from coverage.
 - 1. Warranty includes roofing membrane, base flashings, roofing membrane accessories, fasteners, roof walkway products and other components of roofing system.

PART 2 - PRODUCTS

- 2.1 ROOFING SYSTEM – Provide Johns Manville Specification 2CIN-W/2PIN-W or prior approved equal.

2.2 AUXILIARY ROOFING MEMBRANE MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

- a. Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
- B. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
 3. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

- B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - 1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
- D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.
- E. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches (100 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 1. Install stripping according to roofing system manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 PROTECTING AND CLEANING

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

END OF SECTION 07552

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 roof drainage system.
 - 4. Formed low-slope roof flashing and trim.
 - 5. Formed steep-slope roof flashing and trim.
 - 6. Formed wall flashing and trim.
 - 7. Formed equipment support flashing.
 - 8. Formed overhead-piping safety pans.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for installing reglets.
 - 2. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
 - 3. Division 5 Section "Architectural Joint Systems" for manufactured sheet metal expansion-joint covers.
 - 4. Division 6 Section **Miscellaneous Carpentry** for wood nailers, curbs, and blocking.
 - 5. Division 7 Section "**Built up bituminous roofing**" for installing sheet metal flashing and trim integral with roofing membrane.
 - 6. Division 7 Section "Sheet Metal Roofing" for custom-formed sheet metal roofing and flashing and trim not part sheet metal flashing and trim.
 - 7. Division 7 Section "Manufactured Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
 - 8. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 9. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

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.
- 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:
1. Wind Zone 1: For velocity pressures of **10 to 20 lbf/sq. ft. (0.48 to 0.96 kPa)**: **40-lbf/sq. ft. (1.92-kPa)** perimeter uplift force, **60-lbf/sq. ft. (2.87-kPa)** corner uplift force, and **20-lbf/sq. ft. (0.96-kPa)** outward force.
 2. Wind Zone 1: For velocity pressures of **21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa)**: **60-lbf/sq. ft. (2.87-kPa)** perimeter uplift force, **90-lbf/sq. ft. (4.31-kPa)** corner uplift force, and **30-lbf/sq. ft. (1.44-kPa)** outward force.
 3. Wind Zone 2: For velocity pressures of **31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa)**: **90-lbf/sq. ft. (4.31-kPa)** perimeter uplift force, **120-lbf/sq. ft. (5.74-kPa)** corner uplift force, and **45-lbf/sq. ft. (2.15-kPa)** outward force.
 4. Wind Zone 3: For velocity pressures of **46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa)**: **208-lbf/sq. ft. (9.96-kPa)** perimeter uplift force, **312-lbf/sq. ft. (14.94-kPa)** corner uplift force, and **104-lbf/sq. ft. (4.98-kPa)** outward force.
- 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 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 (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. 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.
- C. 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.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 1. Sheet Metal Flashing: **12 inches (300 mm)** long. Include fasteners, **cleats, clips,** closures, and other attachments.
 2. Trim: **12 inches (300 mm)** long. Include fasteners and other exposed accessories.
 3. Accessories: Full-size Sample.

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.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 2. Review methods and procedures related to sheet metal flashing and trim.
 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. 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.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

- A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, 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: **One-side.**
 - 2. 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.
 - 1)
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - 1. Finish: No. **2D (dull, cold rolled)**
- C. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
 - 1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, **G90 (Z275)** coating designation; structural quality[, **mill phosphatized for field painting**].
- E. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, **Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275)**; structural quality **with manufacturer's standard clear acrylic coating both sides**.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, **G90 (Z275)** coating designation; structural quality.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, **Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275)**; structural quality.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: **6-mil- (0.15-mm-)** 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 **3 lb/100 sq. ft. (0.16 kg/sq. m)**.

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 Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
- E. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- 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 [polyurethane] [polysulfide] [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 (0.4-mm) 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 (75-mm) intervals along length of flashing to provide an integral mortar bond. **Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.**
 - a. **Available Products:**
 - 1) Advanced Building Products Inc.; Cop-R-Loc Interlocking Flashing.
 - 2) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
 - 3) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
 - 4) Dur-O-Wal, Dayton Superior Corporation; Polytite Copper Flashing.
 - 5) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
 - 6) Sandell Manufacturing Company, Inc.; Three-Way Saw Tooth Flashing.
 - 7) York Manufacturing, Inc.; Cop-R-Loc Interlocking 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. Cheney Flashing Company, Inc.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products Inc.
 - d. Hickman, W. P. Company.
 - e. Keystone Flashing Company, Inc.
 - f. Sandell Manufacturing Company, Inc.
 - g. **<Insert manufacturer's name.>**

2. Material: **Stainless steel, 0.0187 inch (0.5 mm) 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 fabricate 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 (25 mm)** deep, filled with **[elastomeric] [butyl]** 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"[**and FMG Loss Prevention Data Sheet 1-49**] for application but not less than thickness of metal being secured.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum **96-inch- (2400-mm-)** long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers,[**gutter bead reinforcing bars,**] and gutter accessories from same metal as gutters.

1. Gutter Style: [A] [B] [C] [D] [E] [F] [G] [H] [I] [J].
2. Expansion Joints: [Lap type] [Butt type] [Built in].
3. Accessories: [Continuous removable leaf screen with sheet metal frame and hardware cloth screen] [Bronze wire ball downspout strainer] [Wire ball downspout strainer] [Valley baffles].
4. Gutters with Girth up to **15 Inches (380 mm)**: Fabricate from the following material:
 - a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <Insert weight or thickness>.
 - c. Aluminum: [**0.0320 inch (0.8 mm)**] <Insert thickness> thick.
 - d. Stainless Steel: [**0.0156 inch (0.4 mm)**] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <Insert thickness> thick.
 - f. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <Insert thickness> thick.
5. Gutters with Girth **16 to 20 Inches (410 to 510 mm)**: Fabricate from the following material:
 - a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <Insert weight or thickness>.
 - c. Aluminum: [**0.040 inch (1.0 mm)**] <Insert thickness> thick.
 - d. Stainless Steel: [**0.0187 inch (0.5 mm)**] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <Insert thickness> thick.
 - f. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <Insert thickness> thick.

1. Fabricate gutters with built-in expansion joints[**and gutter-end expansion joints at walls**].
 2. Accessories: [**Continuous removable leaf screen with sheet metal frame and hardware cloth screen**] [**Bronze wire ball downspout strainer**] [**Wire ball downspout strainer**].
 3. Fabricate built-in gutters from the following material:
 - a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <Insert weight or thickness>.
 - c. Stainless Steel: [**0.0156 inch (0.4 mm)**] <Insert thickness> thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <Insert thickness> thick.
 - e. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <Insert thickness> thick.
- C. Downspouts: Fabricate [**round**] [**rectangular**] [**open-face**] downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Manufactured Hanger Style: <Insert description.>
 2. Fabricate downspouts from the following material:
 - a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <Insert weight or thickness>.
 - c. Aluminum: [**0.024 inch (0.6 mm)**] <Insert thickness> thick.
 - d. Stainless Steel: [**0.0156 inch (0.4 mm)**] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <Insert thickness> thick.
 - f. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <Insert thickness> thick.
 - i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <Insert thickness> thick.
- D. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, **4-inch- (100-mm-)** wide wall flanges to interior, and base extending **4 inches (100 mm)** 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. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <Insert weight or thickness>.
 - c. Aluminum: [**0.0320 inch (0.8 mm)**] <Insert thickness> thick.
 - d. Stainless Steel: [**0.0187 inch (0.5 mm)**] <Insert thickness> thick.

- e. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
 - f. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - i. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes[, exterior flange trim] [, and] [built-in overflows].
1. Fabricate conductor heads from the following material:
 - a. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 - c. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
 - d. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
 - f. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - i. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide joint cover plates.
1. Joint Style: [Lap, 4 inches (100 mm) wide] [Butt, with 12-inch- (300-mm-) wide concealed backup plate] [Butt, with 6-inch- (150-mm-) wide exposed cover plates] [Butt, with 12-inch- (300-mm-) wide concealed backup plate and 6-inch- (150-mm-) wide exposed cover plates].
 2. Fabricate with scuppers spaced 10 feet (3 m) <Insert spacing> apart, of dimensions required with 4-inch- (100-mm-) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate scuppers from the following material:
 - a. Copper: [20 oz./sq. ft. (0.7 mm thick)] <Insert weight or thickness>.

- b. Lead-Coated Copper: [21.2 oz./sq. ft. (0.75 mm thick)] <Insert weight or thickness>.
 - c. Aluminum: [0.050 inch (1.2 mm)] <Insert thickness> thick.
 - d. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
 - f. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 - i. Zinc: [0.050 inch (1.2 mm)] [0.060 inch (1.5 mm)] <Insert thickness> thick.
- B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) 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- (300-mm-) wide concealed backup plate] [Butt, with 6-inch- (150-mm-) wide exposed cover plates] [Butt, with 12-inch- (300-mm-) wide concealed backup plate and 6-inch- (150-mm-) wide exposed cover plates].
 2. Fabricate copings from the following material:
 - a. Copper: [24 oz./sq. ft. (0.82 mm thick)] <Insert weight or thickness>.
 - b. Lead-Coated Copper: [25 oz./sq. ft. (0.87 mm thick)] <Insert weight or thickness>.
 - c. Aluminum: [0.050 inch (1.2 mm)] <Insert thickness> thick.
 - d. Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
 - e. Zinc-Tin Alloy-Coated Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
 - f. Galvanized Steel: [0.0396 inch (1.0 mm)] <Insert thickness> thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: [0.0396 inch (1.0 mm)] <Insert thickness> thick.
 - h. Prepainted, Metallic-Coated Steel: [0.0396 inch (1.0 mm)] <Insert thickness> thick.
 - i. Zinc: [0.050 inch (1.2 mm)] [0.060 inch (1.5 mm)] <Insert thickness> thick.
- C. [Roof] [and] [Roof to Wall Transition] [Roof to Sheet Metal Roof Edging Transition] Expansion-Joint Cover: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.050 inch (1.2 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0336 inch (0.85 mm)] <Insert thickness> thick.

7. Aluminum-Zinc Alloy-Coated Steel: [0.0336 inch (0.85 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0336 inch (0.85 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

D. Base Flashing: Fabricate from the following material:

1. Copper: [20 oz./sq. ft. (0.7 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [21.2 oz./sq. ft. (0.75 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.040 inch (1.0 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

E. Counterflashing: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

F. Flashing Receivers: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.

8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

G. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: [4.0 lb/sq. ft. (1.6 mm thick)] <Insert weight or thickness>, hard tempered.
2. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
3. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

H. Splash Pans: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.040 inch (1.0 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

I. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: [4.0 lb/sq. ft. (1.6 mm thick)] <Insert weight or thickness>, hard tempered.
2. Copper: [13.2 oz./sq. ft. (0.45 mm thick)] <Insert weight or thickness>.
3. Lead-Coated Copper: [12 oz./sq. ft. (0.4 mm thick)] <Insert weight or thickness>.
4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.

2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.

5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- B. Valley Flashing: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
 4. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
 5. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 6. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- C. Drip Edges: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- D. Eave, Rake[, Ridge, and Hip] Flashing: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.

8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- E. Base Flashing: Fabricate from the following material:
1. Copper: [20 oz./sq. ft. (0.7 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [21.2 oz./sq. ft. (0.75 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.040 inch (1.0 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 8. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- F. Counterflashing: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.
- G. Flashing Receivers: Fabricate from the following material:
1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
 2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
 3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
 4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
 5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
 6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
 9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

H. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: [4.0 lb/sq. ft. (1.6 mm thick)] <Insert weight or thickness>, hard tempered.
2. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
3. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

2.10 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
5. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

B. Openings Flashing in Frame Construction: Fabricate head, sill, [jamb,] and similar flashings to extend [4 inches (100 mm)] <Insert extension> beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.0320 inch (0.8 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0156 inch (0.4 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.015 inch (0.4 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0217 inch (0.55 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

C. Wall Expansion-Joint Cover: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Aluminum: [0.040 inch (1.0 mm)] <Insert thickness> thick.
4. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
6. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
8. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
9. Zinc: [0.031 inch (0.80 mm)] [0.040 inch (1.0 mm)] <Insert thickness> thick.

2.11 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [17.2 oz./sq. ft. (0.60 mm thick)] <Insert weight or thickness>.
3. Stainless Steel: [0.0187 inch (0.5 mm)] <Insert thickness> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [0.018 inch (0.5 mm)] <Insert thickness> thick.
5. Galvanized Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
6. Aluminum-Zinc Alloy-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.
7. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.

B. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Copper: [24 oz./sq. ft. (0.82 mm thick)] <Insert weight or thickness>.
2. Lead-Coated Copper: [25 oz./sq. ft. (0.87 mm thick)] <Insert weight or thickness>.
3. Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [0.0250 inch (0.65 mm)] <Insert thickness> thick.
5. Galvanized Steel: [0.0396 inch (1.0 mm)] <Insert thickness> thick.
6. Prepainted, Metallic-Coated Steel: [0.0276 inch (0.7 mm)] <Insert thickness> thick.

2.12 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.
- 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**] [**butyl**] 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 (300 mm)** apart. 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 (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with **[elastomeric] [butyl]** sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** 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] [butyl]** sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than **1 inch (25 mm)** into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between **40 and 70 deg F (4 and 21 deg C)**, 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 (4 deg C)**.
 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 (38 mm)** 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-coated copper] [zinc-tin alloy-coated stainless steel] [and] [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. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
 5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
 6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
 7. 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. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with **[elastomeric]** **[butyl]** sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored **[gutter brackets]** **[straps]** spaced not more than **36 inches (900 mm)** apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Fasten gutter spacers to front and back of gutter.
 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 3. Anchor and loosely lock back edge of gutter to continuous **[cleat]** **[eave or apron flashing]**.
 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **24 inches (600 mm)** apart.
 5. Anchor gutter with spikes and ferrules spaced not more than **[24 inches (600 mm)]** **[30 inches (750 mm)]** apart.
 6. Install gutter with expansion joints at locations indicated but not exceeding **50 feet (15.24 m)** apart. Install expansion joint caps.
 7. Install continuous gutter screens on gutters with noncorrosive fasteners, **[removable]** **[hinged to swing open]** for cleaning gutters.
- C. Built-in Gutters: Join sections with riveted and soldered or lapped joints sealed with **[elastomeric]** **[butyl]** sealant. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.
1. Install felt underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of **2 inches (50 mm)** over underlying course. Lap ends a minimum of **4 inches (100 mm)**. Stagger end laps between succeeding courses at least **72 inches (1830 mm)**. Fasten with roofing nails. Install slip sheet over felt underlayment.
 2. Anchor and loosely lock back edge of gutter to continuous **[cleat]** **[eave or apron flashing]**.
 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **24 inches (600 mm)** apart.
 4. Install gutter with expansion joints at locations indicated but not exceeding **50 feet (15.24 m)** apart. Install expansion joint caps.
- D. Downspouts: Join sections with **1-1/2-inch (38-mm)** telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **60 inches (1500 mm)** o.c. in between.
1. Provide elbows at base of downspout to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.

- E. 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.
 - 2. Loosely lock front edge of scupper with conductor head.
 - 3. Seal or solder exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim **1 inch (25 mm)** below [**scupper**] [**gutter**] discharge.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of **4 inches (100 mm)** in direction of water flow.
- H. Splash Pans: Install where downspouts discharge on low-sloped roofs. Set in [**asphalt roofing cement**] [**elastomeric sealant**] [**butyl sealant**] compatible with roofing membrane.

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 wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at [**24-inch (600-mm)**] [**16-inch (400-mm)**] <Insert spacing> centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at [**24-inch (600-mm)**] [**16-inch (400-mm)**] <Insert spacing> centers.
 - 2. Anchor interior leg of coping with screw fasteners and washers at [**24-inch (600-mm)**] [**20-inch (500-mm)**] [**18-inch (450-mm)**] <Insert spacing> centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for [**elastomeric**] [**butyl**] sealant, extending a minimum of **4 inches (100 mm)** 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 (100 mm)** over base flashing. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with [**elastomeric**] [**butyl**] 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**] [**anchor and washer at 36-inch (900-mm) centers**].

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**] [**butyl**] 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 [**manufactured**] [**formed**] through-wall flashing is specified in Division 4 Section "[**Unit Masonry Assemblies**] [**Stone Veneer Assemblies**]."
- C. Reglets: Installation of reglets is specified in Division [**3 Section "Cast-in-Place Concrete"**] [**4 Section "Unit Masonry Assemblies"**].
- D. Openings Flashing in Frame Construction: Install continuous head, sill, [**jamb**,] and similar flashings to extend [**4 inches (100 mm)**] <Insert extension> beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with [**elastomeric**] [**butyl**] 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 removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

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- 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 07710 - MANUFACTURED ROOF SPECIALTIES

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 manufactured roof specialties:

1. Copings.
2. Roof edge flashings.
3. Roof edge drainage systems.
4. Counterflashings and reglets.

- B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing reglets.
2. Division 4 Section "Unit Masonry Assemblies" for installing reglets.
3. Division 5 Section "Architectural Joint Systems" for manufactured sheet metal expansion-joint covers.
4. Division 6 Section "[**Rough Carpentry**] [**Miscellaneous Carpentry**]" for wood nailers, curbs, and blocking.
5. Division 7 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
6. Division 7 Section "Roof Expansion Assemblies" for manufactured roof expansion-joint cover assemblies.
7. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Division 7 Section "Joint Sealants" for field-applied sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. FMG Listing: Manufacture and install [**copings**] [**roof edge flashings**] that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-**[60]** **[75]** **[90]** **[105]** **[120]** <Insert number>. Identify materials with FMG markings.
- C. Manufacture and install [**copings**] [**roof edge flashings**] tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: <Insert design wind pressure.>
- D. Thermal Movements: Provide manufactured roof specialties 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 of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
 1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
 2. Details for expansion and contraction.
- C. Samples for Initial Selection: For each type of manufactured roof specialty indicated with factory-applied color finishes.
- D. Fabrication Samples: For [copings] [roof edge flashings] [roof edge drainage systems] [counterflashings and reglets] made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of [copings] [roof edge flashings] with performance requirements.
- F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 COORDINATION

- A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: [20] <Insert number> years from date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 3. 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.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 5. Basis-of-Design Product: The designs for [copings] [roof edge flashings] [roof edge drainage system] [and] [counterflashings and reglets] are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.

2.2 EXPOSED METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold rolled, mill finished.
- B. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
1. Surface: [**Smooth, flat**] [**Embossed**] finish.
 2. Mill finish.
 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**] [**AAMA 2605**].
 - b. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of **1.5 mil (0.038 mm)**; complying with AAMA 2605.
 4. Anodic Finish: Apply the following finish:
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - b. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - c. Class II, Color Anodic Finish: AA-M12C22A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M12C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- C. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
1. 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] [AAMA 2605].
 - b. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.
2. Anodic Finish: Apply the following finish:
- a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - b. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - c. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. [2B (bright, reflective)] [3 (reflective, polished directional satin)] [4 (fine reflective, polished directional satin)] finish.
- E. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation, structural quality, and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: [Smooth, flat] [Embossed] finish.
 2. High-Performance Organic Finish: 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 physical properties and coating performance requirements of [AAMA 2604] [AAMA 2605], except as modified below:
 - 1) Humidity Resistance: [1000] [2000] hours.

2) Salt-Spray Resistance: [1000] [2000] hours.

b. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

1) Humidity Resistance: [1000] [2000] hours.

2) Salt-Spray Resistance: [1000] [2000] hours.

2.3 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- D. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- H. Polyethylene Sheet: **6-mil- (0.15-mm-)** thick polyethylene sheet complying with ASTM D 4397.
- I. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding [**12 feet (3.6 m)**] **<Insert length>**, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.
 - 1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>** or a comparable product by one of the following:
 - 2. [**Available**] Manufacturers:
 - a. Architectural Products Co.
 - b. ATAS International, Inc.
 - c. Castle Metal Products.
 - d. Cheney Flashing Company.
 - e. Hickman, W. P. Company.
 - f. Merchant & Evans, Inc.
 - g. Metal-Era, Inc.
 - h. Metal-Fab Manufacturing LLC.
 - i. MM Systems Corporation.
 - j. Perimeter Systems, a division of Southern Aluminum Finishing Co.
 - k. Petersen Aluminum Corp.
 - l. **<Insert manufacturer's name.>**
 - 3. [**Available**] Products:
 - a. **<Insert, in separate subparagraphs, manufacturer's name; product name or designation.>**
 - 4. Coping Caps: [**Snap-on**] [**Face leg hooked to continuous cleat with back leg fastener exposed**], fabricated from the following exposed metal:
 - a. Copper: [**20 oz./sq. ft. (0.7 mm thick)**] **<Insert weight or thickness>**.
 - b. Aluminum: [**0.040 inch (1.0 mm)**] [**0.050 inch (1.2 mm)**] [**0.063 inch (1.6 mm)**] [**0.080 inch (2.0 mm)**] **<Insert thickness>** thick.
 - c. Prepainted, Zinc-Coated Steel: [**0.028 inch (0.7 mm)**] [**0.034 inch (0.85 mm)**] **<Insert thickness>** thick.

5. Coping Cap Color: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
6. Corners: [Continuously welded] [Mechanically clinched and sealed watertight] [Soldered].
7. Special Fabrications: [Radiussed sections] [Arched sections] [Bullnose face leg] [Two-way sloped coping cap].
8. Snap-on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches (300 mm) wide, 0.028 inch (0.7 mm) thick, with integral cleats.
9. Face Leg Cleats: Concealed, continuous [galvanized steel sheet] [stainless steel].

2.6 ROOF EDGE FLASHINGS

- A. Canted Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of [snap-on] [compression-clamped] metal fascia cover in section lengths not exceeding [12 feet (3.6 m)] <Insert length> and a continuous formed galvanized steel sheet cant dam, 0.028 inch (0.7 mm) thick, minimum, with integral drip edge cleat. Provide matching mitered and welded corner units.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 2. [Available]Manufacturers:
 - a. Architectural Products Co.
 - b. Castle Metal Products.
 - c. Cheney Flashing Company.
 - d. Hickman, W. P. Company.
 - e. Merchant & Evans, Inc.
 - f. Metal-Era, Inc.
 - g. Metal-Fab Manufacturing LLC.
 - h. MM Systems Corporation.
 - i. Perimeter Systems, a division of Southern Aluminum Finishing Co.
 - j. Petersen Aluminum Corp.
 - k. <Insert manufacturer's name.>
 3. [Available]Products:
 - a. <Insert, in separate subparagraphs, manufacturer's name; product name or designation.>
 4. Fascia Cover: Fabricated from the following exposed metal:
 - a. [Formed] [Extruded] Aluminum: [0.040 inch (1.0 mm)] [0.050 inch (1.2 mm)] [0.063 inch (1.6 mm)] [0.080 inch (2.0 mm)] <Insert thickness> thick.
 - b. Prepainted, Zinc-Coated Steel: [0.028 inch (0.7 mm)] [0.034 inch (0.85 mm)] <Insert thickness> thick.
 5. Fascia Cover Color: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
 6. Splice Plates: [Concealed] [Exposed], of same material, finish, and shape as fascia cover.

7. Special Fabrications: [**Radiussed sections**] [**Arched sections**] [**Bullnose fascia cover**] [**Cornice fascia cover**] [**Cove fascia cover**].
 8. Fascia Accessories: [**Fascia extenders with continuous hold-down cleats**] [**Wall cap**] [**Soffit trim**] [**Overflow scuppers**] [**Overflow scuppers with perforated screens**] [**Spillout scuppers**] [**Downspout scuppers with conductor head and downspout adapters**] [**Downspout scuppers with conductor head and downspout adapters and perforated screens**].
- B. Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding [**12 feet (3.6 m)**] <Insert length> and a continuous formed- or extruded-aluminum anchor bar with integral drip edge cleat to engage fascia cover. Provide matching mitered and welded corner units.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 2. [**Available**] Manufacturers:
 - a. Hickman, W. P. Company.
 - b. Metal-Era, Inc.
 - c. MM Systems Corporation.
 - d. <Insert manufacturer's name.>
 3. [**Available**] Products:
 - a. <Insert, in separate subparagraphs, manufacturer's name; product name or designation.>
 4. Fascia Cover: Fabricated from the following exposed metal:
 - a. [**Formed**] [**Extruded**] Aluminum: [**0.032 inch (0.8 mm)**] [**0.040 inch (1.0 mm)**] [**0.050 inch (1.2 mm)**] [**0.063 inch (1.6 mm)**] [**0.080 inch (2.0 mm)**] <Insert thickness> thick.
 - b. Prepainted, Zinc-Coated Steel: [**0.028 inch (0.7 mm)**] [**0.034 inch (0.85 mm)**] <Insert thickness> thick.
 5. Fascia Cover Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].
 6. Splice Plates: [**Concealed**] [**Exposed**], of same material, finish, and shape as fascia cover.
 7. Special Fabrications: [**Radiussed sections**] [**Arched sections**] [**Bullnose fascia cover**] [**Cornice fascia cover**] [**Cove fascia cover**].
 8. Fascia Accessories: [**Fascia extenders with continuous hold-down cleats**] [**Wall cap**] [**Soffit trim**] [**Overflow scuppers**] [**Spillout scuppers**] [**Downspout scuppers with integral conductor head and downspout adapters**].
- C. Gravel Stops: Manufactured, one-piece, formed-metal gravel stop in section lengths not exceeding [**12 feet (3.6 m)**] <Insert length>, with a horizontal flange and vertical leg fascia terminating in a drip edge, continuous hold-down cleat, and concealed splice plates of same material, finish, and shape as gravel stop. Provide mitered and welded or soldered corner units.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>** or a comparable product by one of the following:
2. **[Available]**Manufacturers:
 - a. Architectural Products Co.
 - b. ATAS International, Inc.
 - c. Castle Metal Products.
 - d. Cheney Flashing Company.
 - e. Hickman, W. P. Company.
 - f. Merchant & Evans, Inc.
 - g. Metal-Era, Inc.
 - h. MM Systems Corporation.
 - i. Perimeter Systems, a division of Southern Aluminum Finishing Co.
 - j. Petersen Aluminum Corp.
 - k. **<Insert manufacturer's name.>**
3. **[Available]**Products:
 - a. **<Insert, in separate subparagraphs, manufacturer's name; product name or designation.>**
4. Fabricate from the following exposed metal:
 - a. Copper: **[16 oz./sq. ft. (0.55 mm thick)]** **<Insert weight or thickness>**.
 - b. Aluminum: **[0.032 inch (0.8 mm)]** **[0.040 inch (1.0 mm)]** **[0.050 inch (1.2 mm)]** **<Insert thickness>** thick.
 - c. Stainless Steel: **[0.0250 inch (0.65 mm)]** **<Insert thickness>** thick.
 - d. Prepainted, Zinc-Coated Steel: **[0.028 inch (0.7 mm)]** **[0.034 inch (0.85 mm)]** **<Insert thickness>** thick.
5. Color: **[As indicated by manufacturer's designations]** **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]**.
6. Accessories: **[Fascia extenders with continuous hold-down cleats]** **[Wall cap]** **[Soffit trim]**.

2.7 ROOF EDGE DRAINAGE SYSTEMS

- A. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>** or a comparable product by one of the following:
- B. **[Available]**Manufacturers:
 1. Architectural Products Co.
 2. ATAS International, Inc.
 3. Berger Bros. Co.
 4. Castle Metal Products.
 5. Cheney Flashing Company.
 6. Hickman, W. P. Company.
 7. Merchant & Evans, Inc.
 8. Metal-Era, Inc.

9. Metal-Fab Manufacturing LLC.
10. MM Systems Corporation.
11. Obdyke, Benjamin Incorporated.
12. Perimeter Systems, a division of Southern Aluminum Finishing Co.
13. Petersen Aluminum Corp.
14. <Insert manufacturer's name.>

C. [Available]Products:

1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation.>

D. Gutters and Downspouts: Manufactured formed gutter in uniform section lengths not exceeding [12 feet (3.6 m)] <Insert length>, with mitered and welded or soldered corner units, end caps, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front gutter rim. Furnish with flat-stock gutter straps and gutter support brackets and expansion joints and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate gutter from the following exposed metal:
 - a. Aluminum: [0.032 inch (0.8 mm)] [0.040 inch (1.0 mm)] [0.050 inch (1.2 mm)] [0.063 inch (1.6 mm)] [0.080 inch (2.0 mm)] <Insert thickness> thick.
 - b. Prepainted, Zinc-Coated Steel: [0.028 inch (0.7 mm)] [0.034 inch (0.85 mm)] <Insert thickness> thick.
 - c. Copper: [20 oz./sq. ft. (0.7 mm thick)] <Insert weight or thickness>.
2. Gutter Style: [A] [B] [F] [G] [H] [I] [Half round] [Ogee] <Insert style> according to SMACNA's "Architectural Sheet Metal Manual."
3. Applied Fascia Cover: Exposed, formed [aluminum, 0.040 inch (1.0 mm) thick] [copper, 16 oz./sq. ft. (0.55 mm thick)], with mitered corners, end caps, and concealed splice joints.
4. Gutter Accessories: [Continuous removable leaf screen with sheet metal frame] [Bronze wire ball downspout strainer] [Wire ball downspout strainer].
5. Downspouts: [Rectangular closed-face] [Rectangular open-face] <Insert shape> with mitered elbows, manufactured from the following exposed metal. Furnish wall brackets, from same material and finish as downspouts, with anchors.
 - a. Formed Aluminum: [0.032 inch (0.8 mm)] [0.040 inch (1.0 mm)] [0.050 inch (1.2 mm)] [0.063 inch (1.6 mm)] [0.080 inch (2.0 mm)] <Insert thickness> thick.
 - b. Extruded Aluminum: [0.125 inch (3.2 mm)] <Insert thickness> thick.
 - c. Prepainted, Zinc-Coated Steel: [0.028 inch (0.7 mm)] [0.034 inch (0.85 mm)] <Insert thickness> thick.
 - d. Copper: [16 oz./sq. ft. (0.55 mm thick)] <Insert weight or thickness>.

E. Parapet Scuppers: Manufactured scuppers with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. [Fasten gravel guard angles to base of scupper.]

1. Manufacture parapet scuppers from the following exposed metal:

- a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Aluminum: [**0.0320 inch (0.8 mm)**] <Insert thickness> thick.
 - c. Stainless Steel: [**0.0187 inch (0.5 mm)**] <Insert thickness> thick.
 - d. Prepainted, Zinc-Coated Steel: [**0.0276 inch (0.7 mm)**] <Insert thickness> thick.
- F. Conductor Heads: Manufactured conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes[, **exterior flange trim,**] [**and**] [**built-in overflows**].
- 1. Fabricate conductor heads from the following exposed metal:
 - a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - b. Aluminum: [**0.0320 inch (0.8 mm)**] <Insert thickness> thick.
 - c. Stainless Steel: [**0.0156 inch (0.4 mm)**] <Insert thickness> thick.
 - d. Prepainted, Zinc-Coated Steel: [**0.0276 inch (0.7 mm)**] <Insert thickness> thick.

2.8 COUNTERFLASHINGS AND REGLETS

- A. Basis-of-Design Product: <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
- B. [**Available**] Manufacturers:
- 1. Castle Metal Products.
 - 2. Cheney Flashing Company.
 - 3. Fry Reglet Corporation.
 - 4. Hickman, W. P. Company.
 - 5. Keystone Flashing Company.
 - 6. Merchant & Evans, Inc.
 - 7. Metal-Era, Inc.
 - 8. MM Systems Corporation.
 - 9. <Insert manufacturer's name.>
- C. [**Available**] Products:
- 1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation.>
- D. Counterflashings: Manufactured units in lengths not exceeding [**12 feet (3.6 m)**] <Insert length> designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated:
- 1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 - 2. Aluminum: [**0.024 inch (0.6 mm)**] [**0.032 inch (0.8 mm)**] <Insert thickness> thick.
 - 3. Stainless Steel: [**0.0250 inch (0.65 mm)**] <Insert thickness> thick.
 - 4. Prepainted, Zinc-Coated Steel: [**0.028 inch (0.7 mm)**] <Insert thickness> thick.
- E. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated[**with factory-mitered and -welded corners and junctions**], from the following exposed metal in thickness indicated:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <Insert weight or thickness>.
 2. Aluminum: [**0.050 inch (1.2 mm)**] <Insert thickness> thick.
 3. Stainless Steel: [**0.0187 inch (0.5 mm)**] <Insert thickness> thick.
 4. Prepainted, Zinc-Coated Steel: [**0.028 inch (0.7 mm)**] <Insert thickness> thick.
 5. Type: Surface-mounted with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 6. Type: For stucco application, with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 7. Type: For concrete application with 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.
 8. Type: For masonry application, with offset top flange for embedment in masonry mortar joint.
 9. Type: Multiuse, for embedment in [**cast-in-place concrete**] [**masonry mortar joints**].
- F. Accessories: [**Counterflashing wind-restraint clips**] <Insert accessories>.

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: 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. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
1. Install manufactured roof specialties with provisions for thermal and structural movement.
 2. Torch cutting of manufactured roof specialties is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of [**uncoated aluminum**] [**stainless-steel**] manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties 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 by manufacturers of roof specialties for waterproof performance.
- C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of **12 feet (3.6 m)** with no unplanned joints within **18 inches (450 mm)** <Insert dimension> of corners or intersections.
- F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** for wood screws.
- G. Seal joints with [**elastomeric**] [**butyl**] sealant as required by manufacturer of roofing specialties.

3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to resist uplift and outward forces according to performance requirements.

1. Interlock face and back leg drip edges into continuous cleats anchored to substrate at [24-inch (600-mm) centers] [16-inch (400-mm) centers] [manufacturer's recommended spacing] <Insert spacing>.
2. Interlock face leg drip edge into continuous cleat anchored to substrate at [24-inch (600-mm) centers] [16-inch (400-mm) centers] [manufacturer's recommended spacing] <Insert spacing>. Anchor back leg of coping with screw fasteners and elastomeric washers at [24-inch (600-mm) centers] [16-inch (400-mm) centers] [manufacturer's recommended spacing] <Insert spacing>.

3.4 ROOF EDGE FLASHING INSTALLATION

- A. Install cleats, cant dams, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings to resist uplift and outward forces according to performance requirements.

3.5 ROOF EDGE DRAINAGE SYSTEM INSTALLATION

- A. General: Install [gutters] [downspouts] [parapet scuppers] [conductor heads] to produce a complete roof drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Gutters: Join and seal gutter lengths. Attach gutters to firmly anchored [gutter brackets] [straps] spaced not more than 36 inches (900 mm) <Insert dimension> apart. Slope gutters to downspouts.
 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.
 2. Install continuous gutter screens on gutters with noncorrosive fasteners, [removable] [hinged to swing open] for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 1. Provide elbows at base of downspout to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.
- D. 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.
 2. Loosely lock front edge of scupper with conductor head.
 3. Seal or solder exterior wall scupper flanges into back of conductor head.
- E. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch (25 mm) below [scupper] [gutter] discharge.

3.6 COUNTERFLASHING AND REGLET INSTALLATION

- A. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings **4 inches (100 mm)** over base flashings. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with [**elastomeric**] [**butyl**] sealant.
- B. Reglets: Installation of reglets is specified in Division [**3 Section "Cast-in-Place Concrete**] [**4 Section "Unit Masonry Assemblies**]."

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 manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07710

SECTION 07720 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Roof hatches.
 - 2. Hatch-type heat and smoke vents.

1.2 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated.
- B. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

1.3 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

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, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated

2.3 MISCELLANEOUS MATERIALS

- A. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
- B. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of [12

to 16 ft-lbf/in. (640 to 854 J/m)] of width when tested according to ASTM D 256, Method A (Izod).

2.4 ROOF CURBS

- A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

- a. Colony Custom Curbs.
- b. Commodity Products Company, Inc.
- c. Conn-Fab Sales, Inc.
- d. Curbs Plus Inc.
- e. Custom Curb, Inc.
- f. LM Curbs.
- g. Loren Cook Company.
- h. Metallic Products Corporation.
- i. Pate Company (The).
- j. Roof Products & Systems Corporation.
- k. Roof Products, Inc.
- l. Thaler Metal Industries Ltd.
- m. ThyCurb; Div. of Thybar Corporation.
- n. Uni-Curb, Inc.
- o. Vent Products Company, Inc.

2. Material: Galvanized steel sheet, 0.052 inch (1.32 mm) thick.

2.5 EQUIPMENT SUPPORTS

- A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

- a. Colony Custom Curbs.
- b. Commodity Products Company, Inc.
- c. Conn-Fab Sales, Inc.
- d. Curbs Plus Inc.
- e. Custom Curb, Inc.
- f. LM Curbs.
- g. Loren Cook Company.
- h. Metallic Products Corporation.

- i. Pate Company (The).
- j. Roof Products & Systems Corporation.
- k. Roof Products, Inc.
- l. Thaler Metal Industries Ltd.
- m. ThyCurb; Div. of Thybar Corporation.
- n. Uni-Curb, Inc.
- o. Vent Products Company, Inc.

2.6 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Manufacturers:

- a. Babcock-Davis; a Cierra Products Inc. Company.
- b. Bilco Company (The).
- c. Bristolite Skylights.
- d. Custom Curb, Inc.
- e. Dur-Red Products.
- f. Hi Pro International, Inc.
- g. J. L. Industries, Inc.
- h. Metallic Products Corporation.
- i. Milcor Inc.; a Gibraltar Company.
- j. Nystrom, Inc.
- k. O'Keeffe's Inc.
- l. Precision Ladders, LLC.
- m. Roof Products & Systems Corporation.
- n. ThyCurb; Div of Thybar Corporation.
- o. Wasco Products, Inc.
- p. Western Canwell.

2.7 HEAT AND SMOKE VENTS

- A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard double-leaf, hatch-type heat and smoke vents with integral double-wall insulated curbs and frame, with welded or sealed mechanical corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-wall lid, continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms, UL- fire-suppression system , and corrosion-resistant or hot-dip galvanized hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.

1. Manufacturers:

- a. Babcock-Davis; a Cierra Products Inc. Company.

- b. Bilco Company (The).
 - c. Bristolite Skylights.
 - d. Custom Curb, Inc.
 - e. Dur-Red Products.
 - f. Hi Pro International, Inc.
 - g. Milcor Inc.; a Gibraltar Company.
 - h. Naturalite Skylight Systems.
 - i. Nystrom, Inc.
 - j. O'Keeffe's Inc.
 - k. ThyCurb; Div of Thybar Corporation.
 - l. Wasco Products, Inc.
 - m. Western Canwell.
2. Heat and Smoke Vent Compliance: Provide units that have been tested and FMG approved.
 3. Fire Resistance of Lids: UL Class A rating.

END OF SECTION 07720

SECTION 07811 - SPRAYED FIRE-RESISTIVE MATERIALS (SFRM)

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 SFRM.
 - 2. Exposed SFRM.
- B. Related Sections include the following:
 - 1. Division 5 Section "Structural Steel" for surface conditions required for structural steel receiving SFRM.
 - 2. Division 7 Section "Building Insulation" for fire-safing insulation.
 - 3. Division 7 Section "Through-Penetration Firestop Systems" for fire-resistance-rated firestopping systems.

1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive material.
- B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed.
- C. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed, that are accessible through suspended ceilings, that are in elevator shafts and machine rooms, and that are in air-handling plenums.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of colored, exposed SFRM, two Samples, each **4 inches (102 mm)** square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- C. Product Certificates: For each type of SFRM, signed by product manufacturer.

- D. Qualification Data: For Installer, manufacturer, and testing agency.
- E. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:
 - 1. Materials have been tested for bond with substrates.
 - 2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
 - 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed SFRM.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. Source Limitations: Obtain SFRM through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide SFRM 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 bags containing SFRM with appropriate markings of applicable testing and inspecting agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.
 - 2. Surface-Burning Characteristics: ASTM E 84.
- D. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

- C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F (4 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 COORDINATION

- A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
 - 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
 - 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
 - 3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
 - 4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
 - 5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
 - 6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
 - 8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of SFRM from substrates.
 - b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCEALED SFRM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Carboline Co., Fireproofing Products Div.; Type 104 or approved equal.
- B. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 1. Dry Density: 60 p.c.f. for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 2. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch (6 mm).
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of SFRM is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m).
 3. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 based on laboratory testing of 0.75-inch (19-mm) minimum thickness of SFRM.
 4. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified but not less than 15 lb/cu. ft. (240 kg/cu. m).
 5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch (19 mm),

maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide SFRM 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: 10 or less.
 - b. Smoke-Developed Index: 0.

2.2 EXPOSED SFRM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Carboline Co., Fireproofing Products Div.; Type 104 or approved equal.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over concealed and exposed SFRM.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
 1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed.

- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach accessories where indicated or required for secure attachment of fabric to substrate.
- D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.
- F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.

- G. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

3.4 APPLICATION, CONCEALED SFRM

- A. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed SFRM" Article.
- B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating and where indicated.
- C. Cure concealed SFRM according to product manufacturer's written recommendations.

3.5 APPLICATION, EXPOSED SFRM

- A. Apply exposed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
- B. Apply exposed sprayed-fiber fire-resistive material to produce the following finish:
 - 1. Spray-textured finish.
- C. Cure exposed SFRM according to product manufacturer's written recommendations.

3.6 FIELD QUALITY CONTROL

- A. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
 - 1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.
 - 2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
 - 3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - 4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion

from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.

- a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.
5. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- B. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
 - C. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.7 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.
- D. Repair or replace work that has not successfully protected steel.

END OF SECTION 07811

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

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 through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 7 Section "Fire-Resistive Joint Systems."
 - 2. Division 13 Sections specifying fire-suppression piping penetrations.
 - 3. Division 15 Sections specifying duct and piping penetrations.
 - 4. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than **3.0 cfm/sq. ft** (**0.01524cu. m/s x sq. m**) at both ambient temperatures and **400 deg F** (**204 deg C**).
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding **4 inches** (**100 mm**) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.
- D. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having

the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated that are produced by one of the following manufacturers:
1. A/D Fire Protection Systems Inc.
 2. Grace, W. R. & Co. - Conn.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. NUCO Inc.
 7. RectorSeal Corporation (The).
 8. Specified Technologies Inc.
 9. 3M; Fire Protection Products Division.
 10. Tremco; Sealant/Weatherproofing Division.
 11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 07841

SECTION 07842 - FIRE-RESISTIVE JOINT SYSTEMS

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 fire-resistive joint systems for the following:
 - 1. Floor-to-floor joints.
 - 2. Floor-to-wall joints.
 - 3. Head-of-wall joints.
 - 4. Wall-to-wall joints.
 - 5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Related Sections include the following:
 - 1. Division 5 Section "Architectural Joint Systems" for fire-resistive joint systems consisting of metal frames and **[covers] [flexible seals] <Insert description>**.
 - 2. Division 7 Section "Building Insulation" for floor-to-wall joints indicated as perimeter fire-containment systems between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated exterior curtain walls.
 - 3. Division 7 Section "Roof Expansion Assemblies" for fire-resistive roof expansion assemblies.
 - 4. Division 7 Section "Through-Penetration Firestop Systems" for systems installed in openings in walls and floors with and without penetrating items.
 - 5. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, **[and with] [movement capabilities] [and] [L-ratings]** indicated as determined by UL 2079.
 - 1. Load-bearing capabilities as determined by evaluation during the time of test.
- C. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below

and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 3, as determined by [UBC Standard 26-9] [NFPA 285] and UL 2079.

1. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
 2. OPL-Listed, Perimeter Fire-Barrier Systems: F-ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
- D. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
- F. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
- B. Installation Responsibility: Assign installation of[**through-penetration firestop systems and**] fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is [UL] [OPL] <Insert name> or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Fire-Resistive Joint System Schedule at the end of Part 3.
- B. Products: Subject to compliance with requirements, provide one of the fire-resistive joint systems indicated for each application in the Fire-Resistive Joint System Schedule at the end of Part 3.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: [**Owner will engage**] [**Engage**] a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
- B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 - 1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
- B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in [UL's "Fire Resistance Directory" under Product Category XHDG] [OPL's "Directory of Listed Building Products, Materials, & Assemblies" as perimeter fire-barrier systems]:
- C. Floor-to-Floor Fire-Resistive Joint Systems[**FRJS- $\langle\#\rangle$**]:
 - 1. [Available]UL-Classified Systems: FF-[**D**] [**S**]- **\langle Insert separate four-digit number for each system selected to suit Project \rangle** .
 - 2. Assembly Rating: [1 hour] [2 hours] **\langle Insert number of hours \rangle** .
 - 3. [Nominal]Joint Width: [As indicated] **\langle Insert dimension \rangle** .
 - 4. Movement Capabilities: Class [I] [**II**] [**III**] - **\langle Insert number \rangle** percent [compression or extension] [compression, extension, or horizontal shear].
 - 5. L-Rating at Ambient: Less than **\langle Insert number \rangle** cfm/lin. ft. (**\langle Insert number \rangle** cu. m/s x sq. m).
 - 6. L-Rating at 400 deg F (204 deg C): Less than **\langle Insert number \rangle** cfm/lin. ft. (**\langle Insert number \rangle** cu. m/s x sq. m).
- D. Floor-to-Wall Fire-Resistive Joint Systems[**FRJS- $\langle\#\rangle$**]:
 - 1. [Available]UL-Classified Systems: FW-[**D**] [**S**]- **\langle Insert separate four-digit number for each system selected to suit Project \rangle** .
 - 2. Assembly Rating: [1 hour] [2 hours] **\langle Insert number of hours \rangle** .
 - 3. [Nominal]Joint Width: [As indicated] **\langle Insert dimension \rangle** .
 - 4. Movement Capabilities: Class [I] [**II**] [**III**] - **\langle Insert number \rangle** percent [compression or extension] [compression, extension, or horizontal shear].
 - 5. L-Rating at Ambient: Less than **\langle Insert number \rangle** cfm/lin. ft. (**\langle Insert number \rangle** cu. m/s x sq. m).
 - 6. L-Rating at 400 deg F (204 deg C): Less than **\langle Insert number \rangle** cfm/lin. ft. (**\langle Insert number \rangle** cu. m/s x sq. m).
- E. Head-of-Wall Fire-Resistive Joint Systems[**FRJS- $\langle\#\rangle$**]:

1. [Available]UL-Classified Systems: HW-[D] [S]-<Insert four-digit number for each system selected to suit Project>.
 2. Assembly Rating: [1 hour] [2 hours] <Insert number of hours>.
 3. [Nominal]Joint Width: [As indicated] <Insert dimension>.
 4. Movement Capabilities: Class [I] [II] [III] - <Insert number> percent[compression or extension].
 5. L-Rating at Ambient: Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
 6. L-Rating at 400 deg F (204 deg C): Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
- F. Wall-to-Wall Fire-Resistive Joint Systems[FRJS-<#>]:
1. [Available]UL-Classified Systems: WW-[D] [S]-<Insert a four-digit number for each system selected to suit Project>.
 2. Assembly Rating: [1 hour] [2 hours] <Insert number of hours>.
 3. [Nominal]Joint Width: [As indicated] <Insert dimension>.
 4. Movement Capabilities: Class [I] [II] [III] - <Insert number> percent[compression or extension].
 5. L-Rating at Ambient: Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
 6. L-Rating at 400 deg F (204 deg C): Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
- G. Perimeter Fire-Resistive Joint Systems[PFRJS-<#>]:
1. [Available]UL-Classified Perimeter Fire-Containment Systems: CW-[D-] [S-] <Insert four-digit numbers>.
 - a. Integrity Rating: [1 hour] [2 hours] <Insert number of hours>.
 - b. Insulation Rating: [0 hour] [1/4 hour] [3/4 hour] [1 hour] <Insert number of hours>.
 - c. Linear Opening Width: [2-1/2 inches (63 mm)] [8 inches (203 mm)] [As indicated] <Insert dimension>, maximum.
 - d. Movement Capabilities: Class [I] [II] [III] - <Insert number> percent[compression or extension].
 - e. L-Rating at Ambient Temperature: Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
 - f. L-Rating at 400 deg F (204 deg C): Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
 2. [Available]OPL-Classified Perimeter Fire-Barrier Systems: CEJ-<Insert three-digit number>-P.
 - a. T-Rating: [1/4 hour] <Insert number of hours>.
 - b. F-Rating: [2 hours] <Insert number of hours>.
 - c. Linear Opening Width: [2-1/2 inches (63 mm)] [8 inches (203 mm)] [As indicated] <Insert dimension>, maximum.
 - d. L-Rating at Ambient Temperature: Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).

- e. L-Rating at 400 deg F (204 deg C): Less than <Insert number> cfm/lin. ft. (<Insert number> cu. m/s x sq. m).
- f. Movement Capabilities per ASTM E 1399: <Insert number> percent.

END OF SECTION 07842

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.

1.2 SUMMARY

- A. This Section includes joint sealants for the following applications:
 - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.
 - h. Joints between different materials listed above.
 - i. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - j. Control and expansion joints in ceilings and other overhead surfaces.
 - k. Other joints as indicated.
 - 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units, including steps.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g.
 - h. 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 interior unit masonry concrete 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.
4. Interior joints in the following horizontal traffic surfaces:
- a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated.
- B. Related Sections include the following:
- 1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
 - 2. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
 - 3. Division 8 Section "Glazing" for glazing sealants.
 - 4. Division 9 Section "Gypsum Veneer Plaster" for sealing perimeter joints of gypsum veneer plaster partitions to reduce sound transmission.
 - 5. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 6. Division 9 Section "Ceramic Tile" for sealing tile joints.
 - 7. Division 9 Section "Acoustical Tile Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

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. 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.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in **1/2-inch- (13-mm-)** wide joints formed between two **6-inch- (150-mm-)** long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

- E. Field Test Report Log: For each elastomeric sealant application.
- F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. 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.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 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 (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. 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: 2 years from date of Substantial Completion.
- B. 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.
 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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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 Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Multicomponent Nonsag Polysulfide Sealant
 1. Available Products:
 - a. Pacific Polymers, Inc.; Elasto-Seal 227 Type II (Gun Grade).
 - b. Pecora Corporation; Synthacalk GC-2+.
 - c. Polymeric Systems Inc.; PSI-350.
 - d. PolySpec Corp.; T-2235-M.
 - e. PolySpec Corp.; T-2282.
 - f. PolySpec Corp.; Thiokol 2P.
 - g. Sonneborn, Division of ChemRex Inc.; Sonolastic Polysulfide Sealant.
 2. Type and Grade: M (multicomponent) and NS (nonsag).
 3. Class: 25.
 4. Uses Related to Exposure: T (traffic) and 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, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, ceramic tile, and wood.
- E. Multicomponent Nonsag Immersible Polysulfide Sealant [ES-<#>]:
1. Available Products:
 - a. Pecora Corporation; GC-2+.
 - b. PolySpec Corp.; T-2235-M.
 2. Type and Grade: M (multicomponent) and NS (nonsag).
 3. Class: 25.
 4. Uses Related to Exposure: T (traffic), NT (nontraffic), and I (immersible), Class 1
 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 galvanized steel.
- F. Single-Component Nonsag Polysulfide Sealant
1. Available Products:
 - a. Pacific Polymers, Inc.; Elastoseal 230 Type I (Gun Grade).
 - b. Polymeric Systems Inc.; PSI-7000.
 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, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel,.
- G. Single-Component Pourable Neutral-Curing Silicone Sealant [ES-<#>]:
1. Available Products:
 - a. Dow Corning Corporation; 890-SL.
 - b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
 - c. Dow Corning Corporation; SL Parking Structure Sealant.
 2. Type and Grade: S (single component) and P (pourable).
 3. Class: 100/50.
 4. Uses Related to Exposure: NT and T (traffic).
 5. Uses Related to Joint Substrates: M A and O, as applicable to joint substrates indicated.
 - a. Use O Joint Substrates: Galvanized steel and ceramic tile.

- H. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant[ES-<#>]:
1. Available Products:
 - a. Pecora Corporation; 898.
 - b. Tremco; Tremsil 600 White.
 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.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant Comply with ASTM C 834, Type P, Grade NF.
- B. Available Products:
1. Bostik Findley; Chem-Calk 600.
 2. Pecora Corporation; AC-20+.
 3. Schnee-Morehead, Inc.; SM 8200.
 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
 5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints [AS-<#>]: 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 [AS-<#>]: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Available 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. Available Products:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. GE Silicones; UltraSpan US1100.
 - c. Pecora Corporation; Sil-Span.
 - d. Tremco; Spectrem Ez Seal.
 - e. <

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 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for applications in which tape is not 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:
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 (minus 32 deg C)**. 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. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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 (10 mm)**. Hold edge of sealant bead **1/4 inch (6 mm)** 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 FIELD QUALITY CONTROL

1. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab Method B, Exposed Surface Finish Hand Pull Tab Method C, Field-Applied Sealant Joint Hand Pull Flap or Method D, Water Immersion in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

- a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 2. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION 07920