

SECTION 07 08 00

FACILITY EXTERIOR CLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 07 and Division 08.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

- A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.
- B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding commissioning processes and procedures, as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in Division 07 and Division 08 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 07 and 08, is required in cooperation with the VA and the Commissioning Agent.
- B. The Facility exterior closure systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

- A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

- A. Commissioning of the building envelope systems will require inspection of individual elements of the envelope construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule envelope inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 07 or Division 08 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

- A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00.

The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 07 and 08 Sections for additional Contractor training requirements.

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SECTION 07 13 00

SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies sheet waterproofing materials used for shower pan waterproofing in personnel showers.

1.2 QUALITY CONTROL

- A. Approval by the COR is required of products of proposed manufacturers.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Sheet waterproofing.
 - 2. Printed installation instructions.
- C. Certificates
 - 1. Sheet waterproofing manufacturer's approval of adhesive used.
 - 2. Waterproofing tests report indicating that water test as specified has been made for each shower area and that each area was found to be watertight.
- D. Samples
 - 1. Sheet waterproofing, 150 mm (6 inches) square.
 - 2. Waterproofed building paper, 150 mm² (6 inches square).
 - 3. Adhesive, 0.24 L (1/2 pint).

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to job in manufacturer's original unopened containers with brand name marked thereon.
- B. Unload and store so as to prevent injury to materials.
- C. Do not store material in areas where temperature is lower than 10°C (50°F), or where prolonged temperature is above 32°C (90°F).

1.5 WARRANTY

- A. Shower pan waterproofing is subject to the terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty period is extended to two years.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced by basic designation only.
- B. Federal Specification (Fed. Spec.)
 - UU-B-790A INT AMD Building Paper, Vegetable Fiber: (Kraft, Waterproof, Water Repellent and Fire Resistant)
- C. Uniform Plumbing Code

A118.10 American National Standard Specifications for Load Bearing,
Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and
Dimension Stone Installation.

- D. International Code Council Evaluation Service
ICC-ES Evaluation Report ESR-2467
ICC-ES PMG Product Certificate PMG 1204

PART 2 - PRODUCTS

2.1 SHOWER PAN WATERPROOFING SHEET

- A. Waterproofing 20 mil Sheet System
1. Description: 0.020" (20 mil) thick, polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the "American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).
 2. Waterproofing seaming membrane:
 - a. Provide Seams and Corners material 0.004" (4 mil) thick, polyethylene membrane, with polypropylene fleece laminated on both sides.
 3. Waterproofing Accessories:
 - a. Provide Mixing Valve seals.
 - b. Provide pipe seals.

2.2 ADHESIVES

- A. As furnished by the manufacturer of the sheet waterproofing.
- B. Compatible with adjacent materials where contact occurs.

2.3 CONCRETE PATCHING COMPOUND

- A. Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors.
- B. Have not less than the following physical properties:
1. Compressive strength - 25 mPa (3500 psi).
 2. Tensile strength - 7 mPa (1000 psi).
 3. Flexural strength - 7 mPa (1000 psi).
 4. Density - 1.9.
- C. Capable of being applied in layers up to 50 mm (two inches) thick, being brought to a feather edge, and being troweled to a smooth finish.
- D. Ready for use in 48 hours after application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installing shower pan waterproofing, adjoining surfaces shall be clean, smooth, firm and dry.
- B. Concrete surfaces shall be cured a minimum of seven days and be free from release agents, concrete curing agents, and other contaminates.

- C. Remove all high spots and loose and foreign particles and fill all voids, depressions joints and cracks with concrete patching compound.
- D. Ensure vertical surfaces have a continuous supportive back substrate for waterproofing.

3.2 INSTALLATION

- A. Coat entire surfaces to receive shower pan waterproofing with adhesive spread at rate of 1 L/m² (one gallon per 40 square feet).
- B. Butt joints and cover with a strip of the waterproofing sheeting material eight inches in width and seal with adhesive.
- C. Carry sheeting up vertical surfaces not less than 4 inches above surface of shower floor. Carry over tops of curbs.
- D. Roll entire horizontal surfaces with 23 to 45 kg (50 to 100 pounds) roller and roll corners and vertical sections with a rubber roller to insure solid anchorage.
- E. Make cut out for floor drains and fit to drain for watertight assembly, coordinating with drain installation.

3.3 PROTECTION

- A. When finish floor will not be immediately installed, protect waterproofing pan.
- B. Cover with 2 inches of sand or waterproofed building paper.
- C. Maintain protection until finished floor is placed.

3.4 WATER TEST

- A. Test in presence of COR for leaks before permanent finish is applied over shower pan waterproofing.
- B. Seal floor drain watertight and fill waterproofing pan with water to within approximately 25 mm (1 inch) of top of its vertical surfaces.
- C. When leakage occurs, repair waterproofing and repeat testing until no leakage occurs.
- D. Submit certificate to COR of test results.

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SECTION 07 13 52

MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modified bituminous sheet material used for exterior below grade waterproofing and split slab waterproofing.

1.2 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. Federal Specifications (Fed. Spec.):
 - 1. UU-B-790A Notice 2- Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).
- C. ASTM International (ASTM):
 - 1. C578-15b - Rigid, Cellular Polystyrene Thermal Insulation.
 - 2. D41/D41M-11 - Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
 - 3. D4586/D4586M-07(2012)e1 - Asphalt Roof Cement, Asbestos-Free.
 - 4. D6380/D6380M-03(2012)e1 - Asphalt Roll Roofing (Organic Felt).
- D. American Hardboard Association (AHA):
 - 1. A135.4-2012 - Basic Hardboard.

1.3 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Inspection and Testing Agency.
 - d. Contractor.
 - e. Installer.
 - f. Manufacturer's field representative.
 - g. Other installers responsible for adjacent and intersecting work, including substrate and flashing installers.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Submittal Drawings:
 - 1. Show size, configuration, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
 - 3. Warranty.
- D. Samples:
 - 1. Waterproofing and Flashing Sheet: 200 mm (8 inch) square, each type and color.
 - 2. Insulation: 200 mm (8 inch) square.
- E. Test reports: Certify products comply with specifications.
- F. Certificates: Certify products comply with specifications.
- G. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Installer with project experience list.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
 - 2. Weather Limitations: Install waterproofing only during dry current and forecasted weather conditions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant waterproofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the waterproofing system materials or workmanship of the installer.
 - 1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Waterproofing System: Modified bituminous sheet material for exterior below grade and split slab waterproofing.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Insulation Recycled Content:
 - a. Rigid Foam: 9 percent total recycled content, minimum.

2.3 BITUMINOUS SHEET

- A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior and split slab waterproofing. Sheet reinforced with fibers at manufacturer's option.
- B. Thickness: 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to 0.1 mm (4 mil) thick plastic sheet.
- C. Provide release sheet to prevent bonding of bituminous sheet to itself.

2.4 PROTECTION MATERIAL

- A. Polystyrene Insulation: ASTM C578, Type I or VIII, 13 mm (1/2 inch) minimum thickness.
- B. Hardboard: AHA A135.4, Service Type, 6 mm (1/4 inch) thick.
- C. Waterproofed Building Paper: Fed. Spec. UU-B-790A Notice 2, Type I, Grade C.
- D. Roll Roofing: ASTM D6380/D6380M, Class S (smooth), Type III with minimum net mass per unit area of roofing, 2495 g/sq. m (51 lbs./100 sq. ft.).

2.5 ACCESSORIES

- A. Patching Compound: Factory-prepared, non-shrinking, fast-setting, cementitious adhesive compound containing no ferrous metal or oxide.
- B. Primer: ASTM D41/D41M.
- C. Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Concrete surfaces cured minimum time recommended by waterproofing manufacturer.
 - 2. Substrate to be dry as recommended by waterproofing manufacturer.
- B. Protect existing construction and completed work from damage.
- C. Correct substrate deficiencies.
 - 1. Fill voids, joints, and cracks with patching compound.
- D. Clean substrates. Remove contaminants capable of preventing full adhesion.
- E. Priming:
 - 1. Prime concrete and masonry surfaces.
 - 2. Application method, amount of primer and condition of primer before installation of bituminous sheet as recommended by primer manufacturer.

3. Reprime when required according to manufacturer's instructions.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 WATERPROOFING INSTALLATION

- A. Bituminous Sheet Installation:
 1. Remove release sheet before application.
 2. Lay bituminous sheet from low point to high point so laps shed water.
 3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet minimum 200 mm (8 inches) wide, centered over joint.
 4. Lap seams minimum 50 mm (2 inches).
 5. Lay succeeding sheet with laps, and roll or press into place.
 6. Repair misaligned or inadequately lapped seams according to manufacturer's instructions.
 7. Seal seams and terminations according to sheet manufacturer's instructions.
- B. Corner Treatment:
 1. At inside and outside corners, apply double cover using an initial strip minimum 280 mm (11 inches) wide, centered along axis of corner.
 2. Cover each strip completely by the regular application of bituminous sheet.
 3. Provide a fillet or cant on inside corners.
 4. Form cants using patching compound.
 5. Do not use wood, fiber, and insulating materials for cants.
- C. Projection Treatment:
 1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
 2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.
- D. Patching:
 1. Repair tears, punctures, air blisters, and inadequately lapped seams, according to manufacturer's instructions before protection course is applied.
- E. Permanent Protection:
 1. Vertical Surfaces:
 - a. Install hardboard, polystyrene insulation, or roll roofing protection material.
 - b. Extend protection full height from footing to top of backfill.
 - c. If graded backfill is used, use roll roofing or hardboard.
- F. Horizontal Surfaces:
 1. Install roll roofing protection under concrete wearing courses.
 2. Install roll roofing, hardboard, or polystyrene insulation under earth backfill.
 3. Where no concrete wearing course occurs or when surfaces will bear heavy traffic and will not immediately be covered with a wearing course, use protection specified for vertical surfaces.
- G. Temporary Protection:
 1. When waterproofing materials are subjected to damage by sunlight and cannot be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Testing:
 - 1. Before any protection or wearing course is applied, test all horizontal applications of waterproofing with a minimum of 25 mm (1 inch) head of water above highest point and leave for 24 hours.
 - 2. Mark leaks and repair when waterproofing is dry.
 - 3. Certify, to Contracting Officer's Representative, that water tests have been made and that areas tested were found watertight.
- C. Inspection:
 - 1. Do not cover waterproofed surfaces by other materials or backfill until work is approved by Contracting Officer's Representative.

3.5 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed waterproofing surfaces. Remove contaminants and stains.

3.6 PROTECTION

- A. Protect waterproofing from construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

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SECTION 07 21 13

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermal insulation.
 - a. Board or block insulation at foundation perimeter.
 - b. Batt or blanket insulation at exterior framed and furred walls.
 - c. Board or block insulation at floor assemblies above unconditioned spaces.
 - d. Board or block insulation at masonry cavity walls.
 - 2. Acoustical insulation.
 - a. Semi-rigid insulation at interior framed partitions.
 - b. Batt and blanket insulation at interior framed partitions and ceilings.
 - c. Board insulation at interior concrete and masonry partitions.

1.2 RELATED REQUIREMENTS

- A. Adhesives VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Insulation for Cavity Face of Masonry: Section 04 20 00, UNIT MASONRY.
- C. Safing Insulation: Section 07 84 00, FIRESTOPPING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. C516-08(2013)e1 - Vermiculite Loose Fill Thermal Insulation.
 - 2. C549-06(2012) - Perlite Loose Fill Insulation.
 - 3. C552-15 - Cellular Glass Thermal Insulation.
 - 4. C553-13 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 5. C578-15 - Rigid, Cellular Polystyrene Thermal Insulation.
 - 6. C591-15 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - 7. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
 - 8. C665-12 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 9. C728-15 - Perlite Thermal Insulation Board.
 - 10. C954-15 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.
 - 11. C1002-14 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 12. D312/D312M-15 - Asphalt Used in Roofing.
 - 13. E84-15a - Surface Burning Characteristics of Building Materials.
 - 14. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show insulation type, thickness, and R-value for each location.

- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Adhesive indicating manufacturer recommendation for each application.
- D. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.
- C. Protect foam plastic insulation from UV exposure.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

- A. Insulation Thickness:
 - 1. Provide thickness required by R-value shown on drawings.
 - 2. Provide thickness indicated when R-value is not shown on drawings.
- B. Insulation Types:
 - 1. Provide one insulation type for each application.
- C. Sustainable Construction Requirements:
 - 1. Insulation Recycled Content:
 - a. Polyisocyanurate/polyurethane rigid foam: 9 percent recovered material.
 - b. Polyisocyanurate/polyurethane foam-in-place: 5 percent recovered material.
 - c. Glass fiber reinforced: 6 percent recovered material.
 - d. Phenolic rigid foam: 5 percent recovered material.
 - e. Rock wool material: 75 percent recovered material.
 - 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-Flooring Adhesives and Sealants.

2.2 THERMAL INSULATION

- A. Perimeter Insulation In Contact with Soil:
 - 1. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX.
- B. Exterior Framing or Furring Insulation:
 - 1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
 - 2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

Thermal Insulation

- C. Inside Face of Exterior Wall Insulation:
 - 1. Mineral Fiber Board: ASTM C612, Type IB or II.
- D. Floor Assemblies Above Unconditioned Spaces:
 - 1. Mineral Fiber Board: ASTM C612, Type IB or Type II.
- E. Masonry Cavity Wall Insulation:
 - 1. Mineral Fiber Board: ASTM C612, Type I,; maximum permeance 29 ng/Pa/s/sq. m (0.5 perms).

2.3 ACOUSTICAL INSULATION

- A. Semi Rigid, Batts and Blankets:
 - 1. Widths and lengths to fit tight against framing.
 - 2. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semi rigid unfaced.
 - a. Density: nominal 4.5 pound.
 - 3. Mineral Fiber Batt or Blankets: ASTM C665 unfaced.
 - 4. Maximum Surface Burning Characteristics: ASTM E84.
 - a. Flame Spread Rating: 25.
 - b. Smoke Developed Rating: 450.

2.4 ACCESSORIES

- A. Fasteners:
 - 1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
 - 2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
 - 3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
 - a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
 - b. Adhesive: Type recommended by manufacturer to suit application.
- B. Insulation Adhesive:
 - 1. Nonflammable type recommended by insulation manufacturer to suit application.
- C. Tape:
 - 1. Pressure sensitive adhesive on one face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.
- C. Install board and block insulation with joints close and flush, in regular courses, and with end joints staggered.
- D. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.

- E. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

A. Perimeter Insulation In Contact with Soil:

1. Vertical insulation:
 - a. Fill joints of insulation with same material used for bonding.
 - b. Bond polystyrene board to surfaces with adhesive.
 - c. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
2. Horizontal insulation under concrete floor slab:
 - a. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
 - b. Extend insulation from foundation walls towards center of building minimum 600 mm (24 inches).

B. Exterior Framing or Furring Insulation:

1. General:
 - a. Open voids are not acceptable.
 - b. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
 - c. Pack behind outlets, around pipes, ducts, and services encased in walls.
 - d. Hold insulation in place with pressure sensitive tape.
 - e. Lap facing flanges together over framing for continuous surface. Seal penetrations through insulation and facings.
2. Metal Studs:
 - a. Fasten insulation between metal studs, framing, and furring with pressure sensitive tape continuous along flanged edges.
3. Roof Rafters and Floor Joists:
 - a. Friction fit insulation between framing to provide minimum 50 mm (2 inch) air space between insulation and roof sheathing and subfloor.
4. Ceilings and Soffits:
 - a. Wood Framing:
 - 1) Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
 - 2) Space fastenings maximum 150 mm (6 inches) on center.
 - b. Metal Framing:
 - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
 - 2) At metal framing and ceilings suspension systems, install insulation above suspended ceilings and metal framing at right angles to main runners and framing.
 - 3) Tape insulation tightly together without gaps. Cover metal framing members with insulation.
 - c. Ceiling Transitions:
 - 1) In areas where suspended ceilings transition to structural ceiling, install blanket or batt insulation.
 - 2) Extend insulation from suspended ceiling to underside of structure above.
 - 3) Secure blanket and batt with continuous cleats to structure above.

C. Inside Face of Exterior Wall Insulation:

1. Location: On interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to face of studs to support interior wall finish where indicated.
2. Bond insulation to solid vertical surfaces with adhesive. Fill joints with adhesive cement.
3. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings maximum 300 mm (12 inches) on center. Stagger fasteners at board joints. Install fasteners at each corner.

D. Floor Assemblies Above Unconditioned Spaces:

1. Use impaling pins for attach insulation to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
 - a. Bond insulation with adhesive when separate vapor retarder is used.
- E. Masonry Cavity Wall Insulation:
 1. Install insulation on exterior faces of concrete and masonry inner wythes of cavity walls.
 2. Bond polystyrene board to surfaces with adhesive.
 3. Bond polyurethane or polyisocyanurate board, and perlite board to surfaces with adhesive.
 4. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
 5. Fill insulation joints with same material used for bonding.

3.4 ACOUSTICAL INSULATION

- A. General:
 1. Install insulation without voids.
 2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
 3. Pack behind outlets, around pipes, ducts, and services encased in walls.
 4. Hold insulation in place with pressure sensitive tape.
 5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
 6. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- B. Semi Rigid, Batts and Blankets:
 1. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedments.
 - a. Wood Framing:
 - 1) Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
 - 2) Space fastenings maximum 150 mm (6 inches) on center.
 - b. Metal Framing:
 - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
 - 2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.
 - 3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

3.5 CLEANING

- A. Remove excess adhesive before adhesive sets.

3.6 PROTECTION

- A. Protect insulation from construction operations.
- B. Repair damage.

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SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Roof and deck insulation, substrate board, vapor retarder, and cover board on new metal deck substrates ready to receive roofing or waterproofing membrane.
- C. Repairs and alteration work to existing roof insulation.

1.2 RELATED REQUIREMENTS

- A. Non-Flooring Adhesives and Sealants VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
 - 1. Standard 90.1-13 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASTM International (ASTM):
 - 1. C208-12 - Cellulosic Fiber Insulating Board.
 - 2. C552-15 - Cellular Glass Thermal Insulation.
 - 3. C726-05 - Mineral Fiber Roof Insulation Board.
 - 4. C728-15 - Perlite Thermal Insulation Board.
 - 5. C1177/C1177M-13 - Glass Mat Gypsum Substrate for Use as Sheathing.
 - 6. C1278/C1278M-07a(2015) - Fiber-Reinforced Gypsum Panel.
 - 7. C1289-15 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 8. C1396/C1396M-14a - Gypsum Board.
 - 9. D41/D41M-11 - Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - 10. D312-06 - Asphalt Used in Roofing.
 - 11. D1970/D1970M-15 - Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 12. D2178/D2178M-15 - Asphalt Glass Felt Used in Roofing and Waterproofing.
 - 13. D2822/D2822M-11 - Asphalt Roof Cement, Asbestos Containing.
 - 14. D4586/D4586M-07(2012)e1 - Asphalt Roof Cement, Asbestos-Free.
 - 15. E84-15a - Surface Burning Characteristics of Building Materials.
 - 16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.
- D. National Roofing Contractors Association (NRCA):
 - 1. Manual-15 - The NRCA Roofing Manual: Membrane Roof Systems.
- E. U.S. Department of Agriculture (USDA):
 - 1. USDA BioPreferred Program Catalog.
- F. UL LLC (UL):
 - 1. Listed - Online Certifications Directory.
- G. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
 - 1. DOC PS 1-09 - Structural Plywood.
 - 2. DOC PS 2-04 - Performance Standard for Wood-Based Structural-Use Panels.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and installation details.
 - a. Nailers, cants, and terminations.
 - b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
- D. Samples:
 - 1. Roof insulation, each type.
 - 2. Fasteners, each type.
- E. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Biobased Content:
 - a. Show type and quantity for each product.
 - 3. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
 - b. Certify each composite wood and agrifiber product contain no added urea formaldehyde.
- F. Qualifications: Substantiate qualifications meet specifications.
 - 1. Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Same installer as Division 07 roofing section installer.

1.6 DELIVERY

- A. Comply with recommendations of NRCA Manual.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Comply with recommendations of NRCA Manual.
- B. Store products indoors in dry, weathertight facility.
- C. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Insulation Thermal Performance:
 - 1. Any Location R-Value: RSI-5.28 (R-30), minimum.
- B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.
- C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:
 - 1. UL Listed.
 - 2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
 - a. Flame Spread Rating: 75 maximum.
 - b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Insulation Recycled Content:
 - a. Mineral Fiber: 75 percent total recycled content, minimum.
 - b. Fiberglass: 20 percent total recycled content, minimum.
 - c. Cellulose: 75 percent post-consumer recycled content, minimum.
 - d. Perlite Composite Board: 23 percent post-consumer recycled content, minimum.
 - e. Rigid Foam: 9 percent total recycled content, minimum.
 - f. Glass Fiber Reinforced Rigid Foam: 6 percent total recycled content, minimum.
 - 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-flooring adhesives and sealants.
 - b. Composite wood and agrifiber.
 - 3. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

2.3 ADHESIVES

- A. Primer: ASTM D41/D41M.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to adhere roof insulation to substrate or to another insulation layer.
- D. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.
- E. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.
- F. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.
- C. Tapered Roof Insulation System:
 - 1. Fabricate of mineral , polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
 - 2. Cut to provide high and low points with crickets and slopes as shown.
 - 3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
 - 4. Minimum slope 1/48 (1/4 inch per 12 inches).
- D. Composite Nail Base Insulated Roof Sheathing:
 - 1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Polyisocyanurate thermal insulation ASTM C1289, Type V, insulation thickness as shown, with oriented strand board laminated to top surface.
 - 2. Vented Air Space of 1 inch (25.4mm) thick wood spacers.
 - a. Air space shall provide a minimum of 92 percent overall free air movement through the panel.
 - 1) Lateral free air movement of 55 percent
 - 3. Oriented Strand Board: NIST DOC PS 1, Exposure 1, 16 mm (5/8 inch) thick.
 - 4. Bottom surface faced with felt facers.
 - 5. System thickness:
 - a. Thickness: 5.1 inches (130 mm), R Value 20.5, flute spanability 4-3/8 inches (111.13 mm)

2.5 INSULATION ACCESSORIES

- A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
 - 1. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 - 2. Tapered Edge Strips: 1/12 (1 inch per 12 inches), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
 - a. Mineral Fiberboard: ASTM C726.
- C. Vapor Retarder:
 - 1. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).
- D. Substrate Board:
 - 1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, Type X, 16 mm (5/8 inch) thick, factory primed.
- E. Cover Board:
 - 1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 6 mm (1/4 inch) thick, factory primed.

2.6 ACCESSORIES

- A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.
- B. Nails: ASTM F1667; type to suit application.
- C. Fasteners shall be FM Approved SIP/SD Panel Fasteners for steel deck application. Fasteners have a 3/16 inch (5 mm) shank, and are corrosion resistant with oversized heads. Length of fasteners shall be as recommended by Hunter Panels. Use of 2 inch (51 mm) round plates are not required. See the Hunter Panels application guide for instructions.
 - 1. Fasteners shall penetrate the top flute of steel deck a minimum of 1 inch (25 mm).

2. Penetration of fastener into bottom flute is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Comply with requirements of UL for insulated steel roof deck.
- C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.4 SUBSTRATE BOARD INSTALLATION

- A. Fasten substrate board to top flanges of steel decking to resist uplift pressures according requirements for specified roofing system.
 1. Locate the long dimension edge joints solidly bearing on top of decking ribs.

3.5 VAPOR RETARDER INSTALLATION

- A. Vapor Retarder Installation, General:
 1. Install continuous vapor retarder on roof decks where indicated.
 2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
 3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.
- B. Cast in Place Concrete Decks, Except Insulating Concrete:
 1. Prime deck as specified.
 2. Apply two plies of asphalt saturated felt mopped down to deck.

3.6 INSULATION INSTALLATION

- A. Insulation Installation, General:
 1. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate before installation of insulation.
 2. Cant Strips: Install preformed insulation cant strips at junctures of roofing system with vertical construction.
- B. Insulation Thickness:
 1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
 2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
 3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
 4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
 - a. Low Point Thickness: Minimum 152.4 mm (6 inches).

5. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.
- C. Lay insulating units with close joints, in regular courses and with end joints staggered.
 1. Stagger joints between layers minimum 150 mm (6 inches).
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tightly against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
- H. Installation Method:
 1. Adhered Insulation:
 - a. Prime substrate as required.
 - b. Set each layer of insulation firmly in solid mopping of hot asphalt.
 - c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
 - d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.

3.7 COVER BOARD INSTALLATION

- A. Install cover boards over insulation with long joints in continuous straight lines with staggered end joints.
- B. Offset cover board joints from insulation joints 150 mm (6 inches), minimum.
- C. Secure cover boards according to "Adhered Insulation" requirements.

3.8 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING INSTALLATION

- A. Install panels with the wood (OSB/Plywood) side face up. Place panels in the manufacturers recommended pattern. Only factory assembled panels will be accepted. Fasten panels through the top nailable surface and also through the wood block panel spacers using Hunter Panels approved threaded fasteners.
- B. For multiple layered installations, install the base layer of panels loose-laid, and stagger the joints of subsequent layers in accordance with good roofing practice.
- C. For roof slopes up to 7/12 pitch, 7 inches (178 mm) rise in 12 inches (304 mm), the minimum number of fasteners shall be 18 per 4 foot by 8 foot (1220 mm by 2440 mm) panel.
- D. For roof slopes over 7/12 pitch, 7 inches (178 mm) rise in 12 inches (304 mm), the minimum number of fasteners shall be 24 per 4 foot by 8 foot (1220 mm by 2440 mm) panel.

3.9 PROTECTION

- A. Protect installed products until completion of project.
- B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
- C. Do not leave panels exposed to moisture. Wet panels shall be removed or allowed to completely dry prior to application of vapor barrier and/or roof covering.
- D. Apply only enough insulation panels per day that can be covered the same day by a completed roof covering material.

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SECTION 07 27 27

FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR RETARDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fluid-applied vapor-retarding air barrier at exterior above grade wall assemblies.
 - 2. Connection to adjacent air barrier components providing a durable, continuous, full building air barrier.

1.2 RELATED REQUIREMENTS

- A. General Quality Assurance and Quality Control Requirements: Section 01 45 29 TESTING LABORATORY SERVICES.
- B. General Sustainable Construction Requirements: Section 01 81 13 SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- C. Commissioning of Building Envelope Components: Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- D. Masonry Unit Air Barrier Substrates: Section 04 20 00 UNIT MASONRY.
- E. Flashing Components of Factory Finished Roofing and Wall Systems Air Barriers Requiring Air Barrier Transitions: Division 07 roofing and wall system sections.
- F. Metal Flashing Requiring Air Barrier Transitions: Section 07 60 00 FLASHING AND SHEET METAL.
- G. Joint Sealants: Section 07 92 00 JOINT SEALANTS.
- H. Exterior Wall Openings Requiring Air Barrier Transitions: Division 08 sections for aluminum-framed entrances and storefronts; aluminum windows; louvers and vents; Hollow Metal Door and Frames.
- I. Wall Sheathings Air Barrier Substrates: Section 09 29 00 GYPSUM BOARD.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. Air Barrier Association of America (ABAA):
 - 1. Quality Assurance Program.
- C. ASTM International (ASTM):
 - 1. C920-14a - Elastomeric Joint Sealants.
 - 2. C1193-13 - Use of Joint Sealants.
 - 3. D412-06a(2013) - Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - 4. E84-15a - Surface Burning Characteristics of Building Materials.
 - 5. E96/E96M-15 - Water Vapor Transmission of Materials.
 - 6. E162-15a - Surface Flammability of Materials Using a Radiant Heat Energy Source.
 - 7. E783-02(2010) - Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - 8. E1186-03(2009) - Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - 9. E2178-13 - Air Permeance of Building Materials.
 - 10. E2357-11 - Determining Air Leakage of Air Barrier Assemblies.
- D. U.S. Environmental Protection Agency (EPA):

Fluid-Applied Membrane Air Barrier, Vapor Retarding

1. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 1. Indicate size, configuration, and fabrication and installation details.
- B. Manufacturer's Literature and Data:
 1. Description of each product.
 2. Installation instructions.
- C. Sustainable Construction Submittals:
 1. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
- D. Test reports:
 1. Submit field inspection and test reports.
- E. Certificates: Certify each product complies with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
 1. Manufacturer with project experience list.
 2. Installer with project experience list.
 - a. Certify installer approval by air barrier manufacturer.
- G. Installation Audit:
 1. Submit audit report.

1.5 QUALITY ASSURANCE

- A. Coordinate work with adjacent and related work to provide continuous, unbroken, durable air barrier system.
- B. Manufacturer Qualifications:
 1. Regularly and presently manufactures specified products.
 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
 3. Accreditation by ABAA.
- C. Installer Qualifications:
 1. Regularly and presently installs specified products.
 2. Approved by manufacturer.
 3. Accredited by ABAA.
 4. Applicators certified according to ABAA Quality Assurance Program.
 5. Applicators trained and certified by manufacturer of air barrier system.
 6. Full time on-site field supervisor has completed three projects of similar scope within last year.
 7. Field Supervisor: Holds Sealant, Waterproofing, and Restoration Institute (SWRI) Wall Coating Validation Program Certificate, or similar qualification acceptable to Contracting Officer's Representative.
 8. Field supervisor accredited by ABAA as Level 3 Accredited Installer.
- D. Testing Agency Qualifications:
 1. Accredited by International Accreditation Service, Inc. or American Association for Laboratory Accreditation.
 2. Certified perform ABAA Quality Assurance Program installer audits.
 3. Staff experienced in installation of specified system and qualified to perform observation and inspection specified and determine compliance with project requirements.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight, conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Work Area Ambient Temperature Range: 4 to 32 degrees C (40 to 90 degrees F) continuously, beginning 48 hours before installation.
- B. Surface Requirements: visibly dry, and complying with manufacturer's instructions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Air-Barrier Assembly Air Leakage: Maximum 0.2 L/s/sq. m (0.04 cfm/sq. ft.) of surface area at 75 Pa (1.57 psf) differential pressure when tested according to ASTM E2357.
- B. Full Building Air Leakage: Refer to Section 01 45 29 TESTING LABORATORY SERVICES.
- C. Provide full system of compatible materials under conditions of service and application required. Compatibility based on testing by material manufacturer.
- D. Perform as continuous vapor retarding air barrier and moisture drainage plane.
- E. Transition to adjacent flashings and discharge water to building exterior.
- F. Accommodate substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without moisture deterioration and air leakage exceeding performance requirements.

2.2 PRODUCTS - GENERAL

- A. Provide air barrier system components from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-Flooring Adhesives and Sealants.

2.3 AIR BARRIER

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier:
 - 1. Elastomeric, modified bituminous or synthetic polymer membrane.
 - 2. Air Permeance: ASTM E2178: 0.2 L/s/sq. m (0.04 cfm/sq. ft.) of surface area at 75 Pa (1.57 psf) differential pressure.
 - 3. Vapor Permeance: ASTM E96/E96M: Maximum 5.8 ng/Pa/s/sq. m (0.1 perms).
 - 4. Elongation: Ultimate, ASTM D412, Die C: 500 percent, minimum.

Fluid-Applied Membrane Air Barrier, Vapor Retarding

5. Thickness: Minimum 1.0 mm (40 mils) dry film thickness, applied in single continuous coat.
6. Surface Burning Characteristics: When tested according to ASTM E84S.
 - a. Flame Spread Rating: 25 maximum.
 - b. Smoke Developed Rating: 450 maximum.

2.4 ACCESSORIES

- A. Primer: Waterborne primer complying with VOC requirements, recommended air barrier manufacturer to suit application.
- B. Counterflashing Sheet: Modified bituminous, minimum 1.0 mm (40 mils) thick, self-adhering composite sheet consisting of minimum 0.8 mm (33 mils) of rubberized asphalt laminated to polyethylene film.
- C. Substrate Patching Material: Manufacturer's standard trowel-grade filler material.
- D. Sprayed Polyurethane Foam Sealant: Foamed-in-place, 24 to 32 kg/cu. m (1.5 to 2.0 pcf) density, with maximum flame-spread index of 25 when tested according to ASTM E84.
- E. Flexible Opening Transition: Cured low-modulus silicone extrusion with reinforcing ribs, sized to fit opening widths, designed for adhesion to or insertion into aluminum framing extrusions, and compatible with air barrier system materials and accessories.
- F. Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, approved by membrane air barrier manufacturer for adhesion and compatibility with membrane air barrier and accessories.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Correct substrate deficiencies:
 1. Remove projections and excess materials and fill voids with substrate patching material.
 2. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Prepare and treat substrate joints and cracks according to ASTM C1193 and membrane air barrier manufacturer's instructions.

3.2 INSTALLATION - AIR BARRIER

- A. Install products according to manufacturer's instructions and approved submittals drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install air barrier components according to requirements of ABAA Quality Assurance Program.
- C. Apply primer.
- D. Install transition strips and accessory materials.
- E. Seal air barrier to adjacent components of building air barrier system.
- F. Install flexible opening transition at each opening perimeter. Extend transition onto each substrate minimum 75 mm (3 inches).
 1. Fill gaps at perimeter of openings with foam sealant.
- G. At penetrations, seal transition strips around penetrating objects with termination mastic.
 1. Fill gaps at perimeter of penetrations with sprayed polyurethane foam sealant.

- H. At top of through-wall flashings, seal with continuous transition strip of manufacturer's recommended material to suit application.
- I. Apply air barrier in full contact with substrate to produce continuous seal with transitions.
- J. Apply fluid membrane in thickness recommended by manufacturer, and minimum specified thickness.
- K. Leave air barrier exposed until tested and inspected and tested by Contracting Officer's Representative.

3.3 FIELD QUALITY CONTROL

- A. Field Inspections and Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
 - 1. Perform inspections and tests before concealing air barrier with subsequent work.
- B. Inspections:
 - 1. Compatibility of materials within air barrier system and adjacent materials.
 - 2. Suitability of substrate and support for air barrier.
 - 3. Suitability of conditions under which air barrier is applied.
 - 4. Adequacy of substrate priming.
 - 5. Application and treatment of joints and edges of transition strips, flexible opening transitions, and accessory materials.
 - 6. Continuity and gap-free installation of air barrier, transition strips, and accessory materials.
- C. Field Tests:
 - 1. Qualitative air-leakage testing according to ASTM E1186.
 - 2. Quantitative air-leakage testing according to ASTM E783.
- D. Inspection and Test Frequency: Determined by installed air barrier surface area.
 - 1. Up to 900 sq. m (10,000 sq. ft.): One inspection.
 - 2. 901 - 3,300 sq. m (10,001 - 35,000 sq. ft.): Two inspections.
 - 3. 3,300 - 7,000 sq. m (35,001 - 75,000 sq. ft.): Three inspections.
 - 4. 7,001 - 11,600 sq. m (75,001 - 125,000 sq. ft.): Four inspections.
 - 5. 11,601 - 19,000 sq. m (125,001 - 200,000 sq. ft.): Five inspections.
 - 6. Over 19,000 sq. m (200,000 sq. ft.): Six inspections.
- E. Submit inspection and test reports to Contracting Officer's Representative within seven calendar days of completing inspection and test.
- F. Audit:
 - 1. Provide installer and site inspection audit by ABAA.
 - 2. Coordinate scheduling of work and associated audit inspections.
 - 3. Cooperate with ABAA's testing agency. Allow access to work and staging areas.
 - 4. Notify ABAA in writing of schedule for Work of this Section to allow sufficient time for testing and inspection.
 - 5. Pay for site inspections by ABAA to verify conformance with the ABAA Quality Assurance Program.
- G. Defective Work:
 - 1. Correct deficiencies, make necessary repairs, and retest as required to demonstrate compliance with specified requirements.

3.4 CLEANING

- A. Remove masking materials.
- B. Clean spills and overspray using cleaning agents recommended by manufacturers of affected construction.

3.5 PROTECTION

- A. Protect air barrier from construction operations.
- B. Protect air barrier from exposure to UV light exposure exceeding manufacturer's recommendation.
- C. Replace overexposed materials and retest.

-- E N D --

SECTION 07 31 13

ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass asphalt shingles over underlayment nailed to roof sheathing.

1.2 RELATED REQUIREMENTS

- A. Counterflashing and Flashing of Roof Projections: Section 07 60 00, FLASHING AND SHEET METAL.
- B. Roof Hatches (Scuttles) and Roof Vents: Section 07 71 00, ROOF SPECIALTIES.
- C. Shingle Color: See Construction documents..

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. D226/D226M-09 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 2. D1970/D1970M-15a - Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 3. D3018/D3018M-11 - Class A Asphalt Shingles Surfaced with Mineral Granules.
 - 4. D3161/D3161M-15 - Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method).
 - 5. D3462/D3462M-10a - Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
 - 6. F1667-05(2011) - Driven Fasteners: Nails, Spikes, and Staples.
- C. UL LLC (UL):
 - 1. 790-14 - Fire Tests of Roof Coverings.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
 - 3. Warranty.
- C. Samples:
 - 1. Shingles: Full size each type, color and texture.
- D. Sustainable Construction Submittals:
 - 1. Solar Reflectance Index (SRI) for asphalt shingles.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, manufacture date, and the label of Underwriters Laboratories.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

- A. Store shingles according to manufacturer's instructions. Store roll goods on end in upright position.
- B. Protect products from damage during handling and construction operations.
- C. Keep materials dry, covered completely and protected from weather.

1.7 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant asphalt shingles against material and manufacturing defects.
 - 1. Material Warranty Period: 50 years.
 - 2. Wind-Speed Warranty Period: Resist wind speeds up to 180 km/h (110 mph) 15 years.
 - 3. Algae-Resistance Warranty Period: No discoloration for 15 years.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer.
 - 1. Provide each product exposed to view from one production run.
- B. Sustainable Construction Requirements:
 - 1. Asphalt Shingle Recycled Content: 50 percent post-consumer recycled content, minimum.
 - 2. Solar Reflectance Index: 29, minimum.

2.2 ASPHALT SHINGLES

- A. Asphalt Shingles: Fiberglass reinforced, laminated type, square butt.
 - 1. ASTM D3462/D3462M and ASTM D3018/D3018M, Type I, self-sealing.
 - 2. ASTM D3161/D3161M, Class F wind-resistant.
 - 3. UL 790 Class A fire resistance.
 - 4. Minimum Weight: 10.3 kg/sq. m (210 lbs./100 sq. ft.).

2.3 ROOFING NAILS

- A. ASTM F1667, Type I, Style 20, galvanized steel, deformed shanks, heads 10 mm to 11 mm (3/8 inch to 7/16 inch) diameter.
 - 1. Nails for Shingles: 32 mm (1-1/4 inches) long.
 - 2. Nails for Felt: 19 mm (3/4 inch) long.

2.4 ROOFING UNDERLAYMENT

- A. Organic Felt: ASTM D226/D226M, Type I.
- B. Self-Adhering Modified Bituminous Underlayment: ASTMD1970/D1970M.

2.5 METAL FLASHING

- A. Provide metal roof flashings, including apron flashings, step flashings, valley flashings, drip edges, and vent pipe flashings specified in Section 07 60 00, FLASHING AND SHEET METAL.

2.6 RIDGE VENTS

- A. Ridge Vents: Manufacturer's standard ridge vent for use under asphalt shingles.
 - 1. Provide ridge vents with internal filters, internal baffles, or external baffles, for weather protection.
 - 2. Free Area: Minimum 25400 sq. mm per m (12 sq. inches per foot).

2.7 SNOW GUARDS

- A. Snow Guards: Stainless steel or aluminum individual snow guards designed for use with asphalt shingles.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for roofing installation.
 - 1. Verify roof substrates are sound, within manufacturer's tolerances, and free from defects which would interfere with roofing installation.
 - 2. Verify roof accessories, vent pipes and other projections through roof are in place and roof flashing is installed, or ready for installation, before installing shingles.
- B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 METAL DRIP EDGE INSTALLATION

- A. At eaves and rakes, install stainless steel drip edges specified in Section 07 60 00, FLASHING AND SHEET METAL.
 - 1. Eaves: Install metal drip edge before underlayment.
 - 2. Rakes: Install metal drip edge after underlayment.
- B. Secure metal drip edges with compatible nails spaced maximum 250 mm (10 inches) on center along inner edges.

3.4 FLASHING INSTALLATION

- A. Install metal flashings specified in Section 07 60 00, FLASHING AND SHEET METAL at intersections of roofs, adjoining walls, or projections through deck such as chimneys and vent stacks.
- B. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.
 - 1. Secure valley flashing according to shingle manufacturer's instructions.
 - 2. Expose flashing in open portion of valley 125 mm (5 inches) minimum, and lap shingles over flashing 125 mm (5 inches) minimum.

3.5 UNDERLAYMENT INSTALLATION

- A. Install self-adhering sheet underlayment, working from low point to high point. Lap sides 90 mm (3-1/2 inches) minimum, and lap ends 150 mm (6 inches) minimum. Install at the following locations:
 - 1. Eaves and Rakes: From edge of eave and rake to 600 mm (24 inches) minimum beyond inside face of exterior wall.
 - a. Lap underlayment over eave metal drip edge.
 - 2. Valleys, Hips and Roof Slope Transitions: Centered over change in slope, and extended 450 mm (18 inches) minimum on both sides.
 - 3. Ridges: Centered on ridge, and extended 900 mm (36 inches) minimum on both sides. Do not cover ridge vent opening.
 - 4. Sidewalls and Projections through Roof: Extended 450 mm (18 inches) from projection, and extended up projection 100 mm (4 inches) minimum.
 - 5. Firmly roll underlayment to ensure adhesion to roof deck and metal flashings.

- B. Install organic felt underlayment on roof deck not covered by self-adhering sheet underlayment, with 100 mm (4 inches) minimum end laps, 50 mm (2 inches) minimum head laps, and 300 mm (12 inches) minimum ridge laps. Nail felt 125 mm (5 inches) on centers along laps.

3.6 ROOF ACCESSORY INSTALLATION

- A. Install roof hatches (scuttles), and roof vents, specified in Section 07 71 00, ROOF SPECIALTIES before installing shingles.
- B. Lap underlayment and asphalt shingles over upslope base flanges of roof accessory flashings.
- C. Install underlayment and asphalt shingles over sideslope base flanges of roof accessory flashings.
- D. Install downslope base flanges of roof accessories over asphalt shingles.

3.7 ASPHALT SHINGLE INSTALLATION

- A. Install shingles aligned parallel to roof eave, nailed to roof sheathing.
 - 1. Exposure: 125 mm (5 inches) maximum.
 - 2. Headlap: 50 mm (2 inches) minimum.
- B. Install asphalt-shingle starter strip with tabs removed, and overhanging lower edge of roof 13 mm (1/2 inch).
- C. Valleys: Open.

3.8 RIDGE VENT INSTALLATION

- A. Install ridge vents over shingles.
 - 1. Extent: Continuous along ridges extending as shown in contract documents.

3.9 HIP AND RIDGE SHINGLE INSTALLATION

- A. Bend each shingle lengthwise down center to provide equal exposure on both sides of hip and ridge.
 - 1. Begin ridge installation at leeward end of ridge. Cover ridge vents with shingles.
 - 2. Begin hip installation at eave.
- B. Install shingles with maximum 125 mm (5 inches) exposure.
- C. Secure each shingle with one nail on both sides of hip and ridge, 215 mm (8-1/2 inches) back from exposed end and one inch up from edge.

3.10 SNOW GUARD INSTALLATION

- A. Install snow guards in layout recommended by manufacturer.
 - 1. Fasten snow guards with fasteners concealed by shingles.

-- E N D --

SECTION 07 42 10.21

CONTINUOUS INSULATION (CI) WITH COMPOSITE FRAMING SUPPORT (CFS) SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Continuous insulation (CI) composite framing support (CFS) system integrated with brick veneer, fiber cement panels exterior wall cladding.
 - 1. Substrate: Exterior sheathing over metal stud framing.

1.2 RELATED REQUIREMENTS

- A. Section 04 20 00 – Unit Masonry: Concrete masonry unit (CMU) wall substrate
- B. Section 05 40 00 – Cold-Formed Metal Framing: Metal stud substrate support framing
- C. Section 06 10 00 – Rough Carpentry: Exterior sheathing and wood stud substrate support framing
- D. Section 07 21 13 – Thermal Insulation
- E. Section 07 27 27 – Fluid-Applied Membrane Air Barrier: Weather Barriers: Air, water, vapor barrier over exterior sheathing
- F. Section 07 46 46 – Fiber-Cement Siding
- G. Section 07 92 00 – Joint Sealants: Perimeter sealant
- H. Section 09 29 00 – Gypsum Board Assemblies: Exterior sheathing

1.3 REFERENCE STANDARDS

- A. ASCE American Society of Civil Engineers (www.asce.org)
 - 1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2010 with Supplements and Errata
 - 2. ASCE – Structural Plastics Design Manual
- B. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.org)
 - 1. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013
 - 2. ASHRAE 189.1 – Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings; 2014
- C. ASTM International (American Society for Testing and Materials; www.astm.org)
 - 1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015
 - 2. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2015
 - 3. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015
 - 4. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015
 - 5. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013
 - 6. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2015
 - 7. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2011

Continuous Insulation (CI) with Composite Framing Support (CFS) System

8. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2014a
9. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010e1
10. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 2010e1
11. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014
12. ASTM D638 – Standard Test Method for Tensile Properties of Plastics; 2014
13. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between minus 30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer; 2008e1
14. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics; 2015
15. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010
16. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013
17. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2010
18. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2015
19. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a
20. ASTM D4385 - Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2013
21. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
22. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
23. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2015
- D. IBC – International Building Code (International Code Council); 2018
- E. IECC – International Energy Conservation Code; 2018
- F. IgCC – International Green Construction Code; 2018
- G. NFPA – National Fire Protection Association (www.nfpa.org)
 1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019
- H. Voluntary Product Standard; National Institute of Standards and Technology (NIST)
 1. PS 1 – Structural Plywood; 2009

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate construction of wall cladding support system over substrate indicated for proper drainage, flashing, trim, back-up support, soffits, and other related Work.
 1. Review and finalize construction schedule.
 2. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
 3. Review means and methods related to installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment and attachment to structural support system.
 5. Review flashings, wall cladding details, wall penetrations, openings, and condition of other construction that affects this Work.
 6. Review temporary protection requirements for during and after installation of this Work.

Continuous Insulation (CI) with Composite Framing Support (CFS) System

1.5 SUBMITTALS

- A. See Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- B. Product Data: Submit for each type of product indicated; include construction details, material descriptions, dimensions of individual components and profiles, and accessories as necessary for complete fully functioning and assembled system.
- C. Test and Inspection Reports: Submit test and inspection reports on each type of wall cladding/veneer system based on evaluation of comprehensive tests performed by nationally recognized testing agency.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.
 - 1. System Review: Manufacturer to provide engineering assessment based on CFS and cladding system design.
- B. Installer: Company specializing in performing work of this section and the following:
 - 1. Install system in strict compliance with manufacturer's installation instructions.
 - 2. Have not less than three years of documented experience.
- C. Source Limitations: Obtain CI and CFS system from single source and single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original unopened containers and packaging with labels clearly identifying product name and manufacturer.
- B. Deliver components and other manufactured items or accessories without damage or deformation.
- C. Storage: Store materials in clean, dry, and level interior areas or outdoor areas for limited duration in accordance with manufacturer's written instructions.
- D. Protect components and auxiliary accessories during transportation, handling, and installation from moisture, excessive temperatures and other construction operations in accordance with manufacturer's written instructions.
- E. Handle components in strict compliance with manufacturer's written instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface, edge or corner damage.

1.8 SITE CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work in accordance with manufacturer's written installation instructions and warranty requirements.

1.9 WARRANTY

- A. See Section 01 00 00 - Warranty, for additional warranty requirements.
- B. CI and CFS System Warranty: Provide written warranty by manufacturer and installer agreeing to correct defects in manufacturing within five year or period after Date of or Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Advanced Architectural Products (A2P): SMARTci 2-in-1 System
 - 1. Address: 959 Industrial Drive, Allegan, Michigan 49010.
 - 2. Phone: (269) 355-1818; Fax: (866) 858-5568; Website: www.smartcisystems.com
 - 3. Other products shall be pre-submitted and approved products that meet materials and performance requirements with specified and validated third party testing.

2.2 DESCRIPTION

- A. CFS system components anchored to exterior sheathing over metal stud framing or.
 - 1. Refer to Section 05 40 00 for metal stud framing.
- B. Install CI panels and CFS system components **horizontally on substrate system** as indicated on drawings in compliance with specified requirements.

2.3 PERFORMANCE REQUIREMENTS

- A. Structural: Measure the performance of the factory formed joints using a minimum of 30 psf (ASTM E72)
- B. System Thermal Design: Ensure installed CI and CFS system, opening trim, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to interior face of insulation.
 - 1. System thermal design shall meet or exceed thermal design requirements in compliance with ASHRAE 90.1 energy code.
 - 2. Thermal Resistance: Wall assembly R Value of **15**.
 - 3. Thermal Performance Test: Provide thermal resistance (R-value) indicated, in compliance with ASTM C1363, corrected to 15 mph outside and still air inside, with installed conditions including trim for openings, fastening and joints.
 - a. Provide efficiency of no less than 93 to 98 percent or , with a maximum temperature differential of 18 degrees F from interior wall surface to interior wall cavity and node locations with a 70 degrees F exterior to interior wall temperature delta.
 - b. Provide test unit with at least one insulation panel horizontal and vertical joint length and height of test chamber area.
 - c. Provide finite element analysis of three-dimensional simulation of described wall assembly sealed by professional engineer in compliance with performance requirements and exceeding it by at least 3 percent.
- C. Temperature: Comply with structural loading requirements within temperature range of minus 55 degrees F to 180 degrees F.
- D. Fire-Test-Response Characteristics: Provide composite framing support system with fire-test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: In compliance with ASTM E84, for foam insulation, steel fiber reinforced polymer (SFRP) and interior surfaces as follows:
 - a. Flame Spread Index (FSI): 25 or less.
 - b. Smoke Developed Index (SDI): 450 or less.
 - 2. Intermediate Scale Multistory Fire Test: Comply with NFPA 285 and/or IBC acceptance criteria for wall height above grade and fire separation distances, when wall type and other noted conditions require such testing or compliance with requirements as indicated.

2.4 COMPOSITE FRAMING SUPPORT (CFS) SYSTEM

- A. CFS System: Provide CFS system consisting of polyester and vinyl ester bioresin matrix (FRP) with recycled materials, fire retardant additives and integral continuous metal inserts the length of profile. Reinforce CFS system with glass strand rovings used internally for longitudinal Continuous Insulation (CI) with Composite Framing Support (CFS) System

(lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.

1. Depth of GreenGirt: 3 inch or 3-1/2 inch deep.
2. On Center Spacing: 16 inch or .
3. Provide continuous non-corrosive steel insert for engagement of fasteners, 16 gage, minimum thickness, with G90 galvanized coating designation in compliance with ASTM A653/A653M.
 - a. Fully engage steel insert with adjacent CFS at ends.
 - b. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of CFS.
 - c. Provide screw pullout testing that meets or exceeds **513 lbs**.
4. Provide integral 3-point compression seal in CFS sections to ensure insulation panel will not dislodge.
5. Provide integral anti-siphon grooves on exterior and interior flanges of CFS.
6. Provide force distribution zones integrally designed into profile of CFS.
7. Provide spline seals for adjacent insulation units into profile of CFS.
8. Surface Burning Characteristics:
 - a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
9. Flammability: Comply with ASTM E84.
10. Self-Extinguishing: Comply with ASTM D635.
11. Profile Visual Requirements: Comply with ASTM D4385.
12. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
13. Compressive Stress: Provide engineered lengthwise and crosswise compressive stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D695.
14. Flexural Stress: Provide engineered lengthwise and crosswise flexural stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D790.
15. Modulus of Elasticity: Engineered to meet performance loading criteria and specified safety factors.
16. Barcol Hardness: 45, in accordance with ASTM D2583.
17. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
18. Density: Within range of 0.062 to 0.070 lbs/cubic inch, in accordance with ASTM D792.
19. Lengthwise Coefficient of Thermal Expansion: 7.0×10^{-6} inch/inch/degrees F, in accordance with ASTM D696.
20. Notched Izod Impact, Lengthwise: 24 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.
21. Notched Izod Impact, Crosswise: 4 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.

2.5 INSULATION

- A. Provide Insulation per Section 07 21 13

2.6 CONTINUOUS INSULATION SYSTEM ASSEMBLY

- A. Assemble CI with CFS and trim system using manufacturer's standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.
 1. Comply with CFS system and dimensional and structural requirements as indicated on drawings.

Continuous Insulation (CI) with Composite Framing Support (CFS) System

2. Erect CFS system in sequence in accordance with manufacturer's standard installation procedures.
3. Provide spray foam sealant on backside of cantilevered fasteners that completely puncture the insulation layer.

2.7 ACCESSORIES

- A. Provide accessories necessary for complete CFS system including **metal closure trim, transition angle, strapping, tie-in brackets**, and similar items.
- B. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by CFS system manufacturer for project application.
 1. Cladding to CFS System: Use standard self-tapping metal screws.
 2. CFS System to Metal Stud Wall Framing: Use standard self-tapping metal screws.
 3. CFS System to Concrete/CMU: Use standard masonry or concrete screw anchors in predrilled hole.
 4. CFS System to Wood Framing: Use standard wood screw anchors.
 5. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the CFS.
- C. Tape: Pressure sensitive adhesive coated polypropylene woven fabric. Must be mold, water, tear and UV resistant. Must be applicable in a wide temperature range (-20 degrees F).
- D. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, square long edges, Type X fire-resistant.
 1. Refer to Drawings for thickness and **Section 09 29 00** for additional requirements.
- E. Weather Resistant Barrier (WRB): Refer to Section 07 27 27 for requirements.
- F. Sealants: Provide sealants as recommended by CFS manufacturer for openings within CFS system and perimeter conditions.
 1. Refer to Section 07 92 00 for sealant information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, CFS system conditions, and other conditions affecting performance of this Work.
- B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by CFS system manufacturer.
- C. Examine rough-in for components and systems penetrating CFS system to coordinate actual locations of penetrations relative to CFS systems joint locations prior to installation.
- D. Verify that mechanical and electrical services for exterior walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.
- E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by CFS manufacturer for achieving best result for substrate under project conditions.

- C. Prepare sub-framing, base angles, sills, furring, and other CFS system members and provide anchorage in accordance with ASTM C754 for substrate type and wall cladding type in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

- A. Install CFS system in accordance with manufacturer's installation instructions.
- B. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.
- C. Trim insulation neatly to fit spaces, and insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.
- E. Seal gaps, voids or penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.
- F. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.
- G. Exposed insulation must be protected from open flame and kept dry at all times.
- H. Exterior wall insulation panels are not intended to be left exposed for periods of time in excess of 60 days without adequate protection.
 - 1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, window and door openings with a compatible waterproof tape.
- I. Install CFS system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.4 TOLERANCES

- A. Shim and align CFS system within installed tolerances of 1/4 inch in 20 feet, non-cumulative, level, plumb, and on location lines as indicated.

3.5 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Ensure that insulation panels are not exposed to moisture.
 - 1. Remove wet insulation panels or allow them to completely dry prior to installation of CFS system.
- C. Replace damaged insulation panels prior to Date of Substantial Completion.

END OF SECTION

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SECTION 07 46 46

FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiber cement lap siding, panels, trim, fascia, and accessories
- B. Factory-finished fiber cement lap siding, panels, trim, fascia, and accessories.

1.2 RELATED SECTIONS

- A. Section 05 40 00 - Cold-Formed Metal Framing.
- B. Section 06 10 00 - Rough Carpentry.
- C. Section 07 21 13 – Thermal Insulation.
- D. Section 07 42 10.21 – Continuous Insulation (CI) with Composite Framing Support (CFS) System.

1.3 REFERENCES

- A. ASTM
 - C1186-08(2016) Standard Specification for Flat Fiber-Cement Sheets
 - E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.
 - D3359 Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.
- D. Selection Samples:
 - 1. For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples:
 - 1. For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by COR.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by COR.
3. Remodel mock-up area as required to produce acceptable work.

DELIVERY, STORAGE, AND HANDLING

- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty.
 1. Lap siding for 30 years.
 2. Vertical siding for 30 years.
 3. Panels for 30 years.
 4. Siding for 30 years.
 5. Boards for 15 years.
 6. Artisan lap siding for 30 years.
- B. Finish Warranty: Limited product warranty against manufacturing finish defects.
 1. When used for its intended purpose, properly installed and maintained according to published installation instructions, factory finish, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.
- C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 - PRODUCTS

2.1 SIDING AND TRIM

- A. Lap siding, , Soffit panels and Shingle siding requirement for materials:
 1. Fiber-cement siding - complies with ASTM C 1186 Type A Grade II.
 2. Fiber-cement siding - complies with ASTM E 136 as a noncombustible material.
 3. Fiber-cement siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
 4. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
 5. ICC-ES evaluation reports ESR-2290, ESR-1844, and ESR-2273 (IBC, IRC, CBC, CRC)
 6. City of Los Angeles, Research Report No. 24862.
 7. Miami Dade County, -Notice of Acceptance -15-0122.04.
 8. US Department of Housing and Urban Development Materials Release -1263f.
 9. California DSA PA-019.
 10. City of New York M EA 223-93-M.
 11. Florida State Product Approval -FL13192, FL13223, and FL13265
 12. Texas Department of Insurance Product Evaluation EC-23.
- B. Lap Siding: HardiePlank HZ10 Lap as manufactured by James Hardie Building Products, Inc.

Fiber-Cement Siding

1. Type: Smooth 7-1/4 inches (184 mm) with 6 inches (152 mm) exposure.
- C. Shingle Siding: HardieShingle HZ10 siding as manufactured by James Hardie Building Products, Inc.
 1. Type: HardiShingle Individual Shingles 6 inches (152 mm) wide by 18 inches (457 mm) high with 8 inches (203 mm) exposure.
- D. Soffit Panels: Non-Vented Soffit Panel, as manufactured by James Hardie Building Products, Inc.
 1. Factory sealed on 5 sides.
 2. Thickness: 1/4 inch (6 mm).
 3. Type: Smooth, 12 inches (305 mm) by 12 feet (3658 mm).
 4. Type: Smooth, 16 inches (406 mm) by 12 feet (3658 mm).
 5. Type: Smooth, 24 inches (610 mm) by 8 feet (2438 mm).
- E. 2X Smooth Trim:
 1. 2X Smooth Trim
 2. Overall Thickness: 1-1/2 in (38 mm).
 3. Width: 5-1/2 inch (140 mm).
 4. Width: 9-1/4 inch (235 mm).
 5. Width: 11-1/4 inch (286 mm).
 6. Texture: Smooth.

2.2 FASTENERS

- A. Metal Framing:
 1. Metal Framing: 1-1/4 inches (32 mm) No. 8-18 by 0.375 inch (9.5 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
 2. Metal Framing: 1-5/8 inches (41 mm) No. 8-18 by 0.323 inch (8.2 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
 3. Metal Framing: 1 inch (25 mm) No. 8-18 by 0.323 inch (8.2 mm) head self-drilling, corrosion resistant ribbed buglehead screws.
 4. Metal Framing: 1 inch (25 mm) No. 8-18 by 0.311 inch (7.9 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
 5. Metal Framing: 1.5 inch (38mm) AGS-100 .100 inches by 25 inches (2540 mm by 635 mm) ET&F Pin or equivalent pneumatic fastener.

2.3 FINISHES

- A. Factory Primer: Provide factory applied universal primer.
 1. Primer: Recommend Factory primed by Fiber Cement Siding Manufacture.
 2. Topcoat: Refer to Section 09 91 00 - Painting and Coating and Exterior Finish Schedule.
- B. Factory Finish: Refer to Exterior Finish Schedule.
 1. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
 2. Process:
 - a. Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.
 - b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by third party.
 3. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed
 4. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.
- C. Factory Finish Color for Trim, Soffit and Siding Colors:

1. Color Names and Number Basis of Design:
 - a. ColorPlus Technology by James Hardie
2. Arctic White JH10-20.
3. Crisp White
4. Summer White
5. White Picket Fence

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install a water-resistive barrier is required in accordance with contract documents requirements.
- D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with contract documents requirements.

3.3 INSTALLATION - LAP SIDING, ARTISAN LAP SIDING, AND ARTISAN LAP SIDING WITH LOCK JOINT SYSTEM

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Align vertical joints of the planks over framing members.
- E. Butt joints must not fall within 4 inches (102 mm) of a stud. Do not nail within 2 inches (51 mm) of the end of planks.
- F. Maintain clearance between siding and adjacent finished grade.
- G. Locate splices at least one stud cavity away from window and door openings.
- H. For proper fastener selection and fastening schedules for various wind load requirements and framing options, refer to the Technical Data Sheet at www.aspyredesign.com.
- I. Face nail to CFS system.
- J. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION - SOFFIT AND VENTED PANELS

- A. Install materials in strict accordance with manufacturer's installation instructions.
 1. Panels may be installed as soffit or ceiling over wood or steel framing; 20 gauge (33 mils) minimum to 16 gauge (54 mils), complying with local building code. Install soffits to nominal 2 x 4 framing members spaced a maximum of 24 inches (610 mm) on center with the long dimension perpendicular to the rafter or joist framing.
 2. Support edges by framing.

3. Install water barriers and air barriers as required by local building codes.
4. Ensure gutters have end caps. Maintain a minimum 1 inch (25 mm) gap between end caps and siding and trim.
5. Install kickout flashing at roof-wall junctions per manufacturer's instructions.
6. Additional framing may be needed to ensure proper fastening.
7. Position vent holes toward outside of eave for optimal airflow.
8. Vents can be installed into non-vented soffit.
9. Insect screen can be installed using construction adhesive.
10. Fastener Positioning: Position fasteners 3/8 inches (9.5 mm) from panel edges and no closer than 2 inches (51 mm) away from corners when using soffit greater than 12 inch (305 mm) wide and no closer than 1 inch (25 mm) away from corners when using soffit that is less than or equal to 12 inch (305 mm) wide.
11. Jointing Methods: Install panels in moderate contact at ends, provide PVC or metal jointers, battens or leave appropriate gap and caulk.
12. Drive fasteners perpendicular to siding and framing.
13. Fastener heads should fit snug against siding; no air space.

3.5 INSTALLATION — HARDIE HZ10 SHINGLE SIDE CLADDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
 1. Substrate: Install a minimum 7/16 inch (11 mm) thick OSB wall sheathing or equivalent braced walls complying with applicable building codes.
 2. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall.
 3. Maintain clearance between siding and adjacent finished grade.
 4. Apply starter course of 10 inches (254 mm) shingles or 9-1/2 inches (241 mm) lap siding overlapping the starter strip.
 5. Apply subsequent courses horizontally with a minimum 10 inch overlap at the top and a minimum 2 inch (51 mm) side lap. The bottom edge of the first two courses overlaps the starter strip.
 6. Fasten between 1/2 inch (13 mm) and 1 inch (25 mm) in from the side edge and between 8-1/2 inches (216 mm) and 9 inches (229 mm) up from the shingle bottom edge.
 7. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
 8. Ensure vertical joints of overlapping shingle course do not align.
 9. Wind Resistance: Where a specified level of wind resistance is required, Hardie Shingle siding is installed to substrate and secured with a minimum two fasteners described in Table No. 6, 7 and 8 in National Evaluation Service Report No. NER-405.

3.6 INSTALLATION - TRIM BOARDS

- A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.
- E. Trim inside corner with a single board trim both side of corner.
- F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.

- G. Allow 1/8 inch gap between trim and siding.
 - H. Seal gap with high quality, paint-able caulk.
 - I. Shim frieze board as required to align with corner trim.
 - J. Fasten through overlapping boards. Do not nail between lap joints.
 - K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Trim boards to Trim boards.
 - L. Shim frieze board as required to align with corner trim.
 - M. Install Trim Fascia boards to rafter tails or to sub fascia.
- 3.7 PROTECTION**
- A. Protect installed products until completion of project.
 - B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED REQUIREMENTS

- A. Non-Flooring Adhesives and Sealants VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
 - 1. FX-1-01(R2006) - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
 - 1. 7-10 - Minimum Design Loads for Buildings and Other Structures.
- D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
 - 1. 90.1-13 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- E. ASTM International (ASTM):
 - 1. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
 - 2. C140/C140M-15 - Sampling and Testing Concrete Masonry Units and Related Units.
 - 3. C1371-15 - Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
 - 4. C1549-09(2014) - Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 5. D1876-08(2015)e1 - Peel Resistance of Adhesives (T-Peel Test).
 - 6. D4263-83(2012) - Indicating Moisture in Concrete by the Plastic Sheet Method.
 - 7. D4434/D4434M-15 - Poly(Vinyl Chloride) Sheet Roofing.
 - 8. D6878/D6878M-13 - Thermoplastic Polyolefin Based Sheet Roofing.
 - 9. E408-13 - Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
 - 10. E1918-06(2015) - Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
 - 11. E1980-11 - Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- F. Cool Roof Rating Council (CRRRC):
 - 1. 1-15 - Product Rating Program.
- G. National Roofing Contractors Association (NRCA):
 - 1. Manual-15 - The NRCA Roofing Manual: Membrane Roofing Systems.
- H. U.S. Department of Agriculture (USDA):
 - 1. BioPreferred® Program Catalog.
- I. UL LLC (UL):
 - 1. 580-06 - Tests for Uplift Resistance of Roof Assemblies.
 - 2. 1897-15 - Uplift Tests for Roof Covering Systems.

Thermoplastic Polyolefin (TPO) Roofing

- J. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
 - 1. DOC PS 1-09 - Structural Plywood.
 - 2. DOC PS 2-04 - Performance Standard for Wood-Based Structural-Use Panels.
- K. U.S. Environmental Protection Agency (EPA):
 - 1. Energy Star - ENERGY STAR Program Requirements for Roof Products Version 3.0.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Inspection and Testing Agency.
 - d. Contractor.
 - e. Installer.
 - f. Manufacturer's field representative.
 - g. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof penetrations, roof accessories, utility penetrations, rooftop curbs and equipment.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
 - j. Pullout test of fasteners.
 - k. Material storage, including roof deck load limitations.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Roof membrane layout.
 - 2. Roofing membrane seaming and joint details.
 - 3. Roof membrane penetration details.
 - 4. Base flashing and termination details.
 - 5. Paver layout.
 - 6. Paver anchoring locations and details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Minimum fastener pullout resistance.
 - 3. Installation instructions.
 - 4. Warranty.
- D. Samples:
 - 1. Roofing Membrane: 150 mm (6 inch) square.
 - 2. Base Flashing: 150 mm (6 inch) square.
 - 3. Fasteners: Each type.

4. Roofing Membrane Seam: 300 mm (12 inches) square.
- E. Sustainable Construction Submittals:
 1. Solar Reflectance Index (SRI) for roofing membrane.
 2. Biobased Content:
 - a. Show type and quantity for each product.
 3. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
 4. Energy Star label for roofing membrane.
- F. Certificates: Certify products comply with specifications.
 1. Fire and windstorm classification.
 2. High wind zone design requirements.
 3. Energy performance requirements.
- G. Qualifications: Substantiate qualifications comply with specifications.
 1. Installer, including supervisors with project experience list.
 2. Manufacturer's field representative with project experience list.
- H. Field quality control reports.
- I. Temporary protection plan. Include list of proposed temporary materials.
- J. Operation and Maintenance Data:
 1. Maintenance instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
 2. Regularly installs specified products.
 3. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
 4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.
- B. Manufacturer's Field Representative:
 1. Manufacturer's full-time technical employee or independent roofing inspector.
 2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Comply with NRCA Manual storage and handling requirements.
- B. Store products indoors in dry, weathertight facility.
- C. Store adhesives according to manufacturer's instructions.
- D. Protect products from damage during handling and construction operations.
- E. Products stored on the roof deck must not cause permanent deck deflection.

1.9 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
 - 2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.
 - 1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Roofing System: Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

2.2 SYSTEM PERFORMANCE

- A. Design roofing system complying with specified performance:
 - 1. Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.
 - a. Uplift Pressures:
 - 1) Corner Uplift Pressure: -2.28 kPa/sq. m (-47.67 psf).
 - 2) Perimeter Uplift Pressure: -1.52 kPa/sq. m (-31.71 psf).
 - 3) Field-of-Roof Uplift Pressure: 0.91 kPa/sq. m (-18.90 psf).
 - 2. Energy Performance:
 - a. EPA Energy Star Listed for low-slope roof products.
 - b. ASTM E1980; Minimum 78 Solar Reflectance Index (SRI).
 - c. CRR-1; Minimum 0.70 initial solar reflectance and minimum 0.75 emissivity.
 - d. Three-Year Aged Performance: Minimum 0.55 solar reflectance tested in according to ASTM C1549 or ASTM E1918, and minimum 0.75 thermal emittance tested in according to ASTM C1371 or ASTM E408.
 - 1) Where tested aged values are not available:
 - a) Calculate compliance adjusting initial solar reflectance according to ASHRAE 90.1.
 - b) Provide roofing system with minimum 64 three-year aged Solar Reflectance Index calculated according to ASTM E1980 with 12 W/sq. m/degree K (2.1 BTU/h/sq. ft.) convection coefficient.

2.3 PRODUCTS - GENERAL

- A. Provide roof system components from one manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Solar Reflectance Index: 78 minimum.
 - 2. Biobased Content: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.
 - 3. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
 - a. Non-flooring adhesives and sealants.

2.4 TPO ROOFING MEMBRANE

1. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.

2.5 MEMBRANE ACCESSORY MATERIALS

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Metal Termination Bars: Manufacturer's standard, stainless-steel or aluminum, 25 mm wide by 3 mm thick (1 inch wide by 1/8 inch thick) factory drilled for fasteners.
- E. Battens: Manufacturer's standard, galvanized or galvanized steel sheet, 25 mm wide by 1.3 mm thick (1 inch wide by 0.05 inch thick), factory punched for fasteners.
- F. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.
- G. Primers, Sealers, T-Joint Covers, Lap Sealants, and Termination Reglets: As specified by roof membrane manufacturer.
- H. Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

2.6 WALKWAY PADS

- A. Manufacturer's standard, slip-resistant rolls, minimum 900 mm (3 feet) wide by 5 mm (3/16 inch) thick.

2.7 ACCESSORIES

- A. Temporary Protection Materials:
 1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
 2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
 3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine and verify substrate suitability with roofing Installer and roofing inspector present.
 1. Verify roof penetrations are complete, secured against movement, and firestopped.
 2. Verify roof deck is adequately secured to resist wind uplift.
 3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.
- B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

- A. Complete roof deck construction before beginning roofing work:
 1. Curbs, blocking, edge strips, nailers, cants, and other components to which insulation, roofing, and base flashing is attached in place ready to receive insulation and roofing.
 2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
 3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

- B. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.
- C. Broom clean roof decks. Remove dust, dirt and debris.
- D. Remove projections capable of damaging roofing materials.
- E. Concrete Decks, except Insulating Concrete:
 - 1. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.
 - 2. Prime concrete decks. Keep primer back 100 mm (4 inches) from precast concrete deck joints.
 - 3. Allow primer to dry before application of bitumen.
- F. Poured Gypsum Decks: Dry out poured gypsum according to manufacturer's instructions before installing roofing materials.

3.3 TEMPORARY PROTECTION

- A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.
- B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Temporarily seal exposed insulation surfaces within roofing membrane.
 - 1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
 - 2. Direct water away from work. Provide drainage, preventing water accumulation.
 - 3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.
- D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.
 - 1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.
- E. Remove sandbags and store for reuse.

3.4 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Comply with NRCA Manual installation requirements.
- C. Comply with UL 580 or UL 1897 for uplift resistance.
- D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with TPO.

3.5 ROOFING INSTALLATION

- A. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- B. Begin installation at the low point of the roof and work towards the high point. Lap membrane shingled in water flow direction.

- C. Position the membrane free of buckles and wrinkles.
- D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:
 - 1. Lap edges and ends of sheets 50 mm (2 inches) or more as recommended by the manufacturer.
 - 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434/D4434M.
 - 3. Check seams to ensure continuous adhesion and correct defects.
 - 4. Finish seam edges with beveled bead of lap sealant.
 - 5. Finish seams same day as membrane is installed.
 - 6. Anchor membrane perimeter to roof deck or parapet wall as indicated on drawings.
 - 7. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
 - 8. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.
- E. Membrane Perimeter Anchorage:
 - 1. Install batten at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.
 - 2. Mechanically Fastening:
 - a. Space fasteners maximum 300 mm (12 inches) on center, starting 25 mm (1 inch) from ends.
 - b. When battens are cut, round edges and corners before installing.
 - c. After mechanically fastening strip cover and seal strip with a 150 mm (6 inch) wide roof membrane strip; heat weld to roof membrane and seal edges.
 - d. At gravel stops and fascia-cants turn roofing membrane down over front edge of the blocking, cant, or nailer. Secure roofing membrane to vertical portion of nailer; or, if required by the membrane manufacturer, with fasteners spaced maximum 150 mm (6 inches) on centers.
 - e. At parapet walls intersecting building walls and curbs, secure roofing membrane to structural deck with fasteners 150 mm (6 inches) on centers or as shown in NRCA manual.
- F. Adhered System:
 - 1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
 - 2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
 - 3. After adhesive has set according to adhesive manufacturer's instruction, roll roofing membrane into adhesive minimizing voids and wrinkles.
 - 4. Repeat for other half of sheet.

3.6 FLASHING INSTALLATION

- A. Install flashings same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.
- B. Flashing Roof Drains:
 - 1. Install roof drain flashing as recommended by roofing membrane manufacturer.
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with TPO roofing membrane.
 - c. Adhere roofing membrane to metal flashing with bonding adhesive.
 - 2. Turn down the metal drain flashing and roofing membrane into drain body. Install clamping ring and strainer.
- C. Installing Base Flashing and Pipe Flashing:

1. Install flashing sheet to pipes, wall or curbs to minimum 200 mm (8 inches) above roof surfaces and extending roofing manufacturer's standard lap dimension onto roofing membranes.
 - a. Adhere flashing with bonding adhesive.
 - b. Form inside and outside corners of flashing sheet according to NRCA manual. Form pipe flashing according to NRCA manual.
 - c. Lap ends roofing manufacturer's standard dimension.
 - d. Heat weld flashing membranes together and flashing membranes to roofing membranes. Finish exposed edges with lap sealant.
 - e. Install flashing membranes according to NRCA manual.
 2. Anchor top of flashing to walls and curbs with fasteners spaced maximum 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
 3. Apply sealant to top edge of flashing.
- D. Repairs to Membrane and Flashings:
1. Remove sections of roofing membrane or flashing that are creased, wrinkled, or fishmouthed.
 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Heat weld to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.7 WALKWAY PAD INSTALLATION

- A. Heat weld walkway sheet to roofing membrane at edges. Weld area 50 mm (2 inches) wide by the entire length of the walkway sheet.
- B. Finish edges of laps with lap sealant.

3.8 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
 1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 sq. m (2,500 sq. ft.) of deck. Perform tests for each combination of fastener type and roof deck type before installing roof insulation.
 - a. Test at locations selected by Contracting Officer's Representative.
 - b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.
 - c. Test Results:
 - 1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.
 - 2) Patch cementitious deck to repair areas of fastener tests holes.
 2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.
 3. Probe seams to detect marginal bonds, voids, skips, and fishmouths.
 4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
 5. Cut one sample for every 450 m (1500 feet) of seams.
 6. Cut samples perpendicular to seams.
 7. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.
 8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.
 9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.
- B. Manufacturer Services:
 1. Inspect initial installation, installation in progress, and completed work.

2. Issue supplemental installation instructions necessitated by field conditions.
3. Prepare and submit inspection reports.
4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.9 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed roofing surfaces. Remove contaminants and stains to comply with specified solar reflectance performance.

3.10 PROTECTION

- A. Protect roofing system from traffic and construction operations.
 1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
 2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.
- B. Loose lay temporary insulation board overlaid with plywood or OSB.
 1. Weight boards to secure against wind uplift.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

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SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

- A. Manufactured flashing, copings, roof edge metal, and fasciae: Section 07 71 00 ROOF SPECIALTIES.
- B. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- C. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- D. Color of factory coated exterior architectural metal and anodized aluminum items: See Construction documents..
- E. Integral flashing components of manufactured roof specialties and accessories or equipment: Section 07 71 00, ROOF SPECIALTIES; Section 07 72 00, ROOF ACCESSORIES, Division 22, PLUMBING sections and Division 23 HVAC sections.
- F. Paint materials and application: Section 09 91 00, PAINTING.
- G. Flashing of Roof Drains: Section 22 14 00, FACILITY STORM DRAINAGE .

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. Aluminum Association (AA):
 - AA-C22A41Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
 - AA-C22A42Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
 - AA-C22A44Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish
- C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):
 - 4435/ES-1-11 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- D. American Architectural Manufacturers Association (AAMA):
 - AAMA 620-02 Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum
 - AAMA 621-02 Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
- E. ASTM International (ASTM):

Flashing and Sheet Metal

- A240/A240M-15 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
- A653/A653M-15 Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
- B32-14..... Solder Metal
- B209-14..... Aluminum and Aluminum-Alloy Sheet and Plate
- B370-12..... Copper Sheet and Strip for Building Construction
- D173-03(R2011) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
- D412-15..... Vulcanized Rubber and Thermoplastic Elastomers-Tension
- D1187-97(R2011) Asphalt Base Emulsions for Use as Protective Coatings for Metal
- D1784-11..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- D3656-13..... Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- D4586-12..... Asphalt Roof Cement, Asbestos Free
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.
- G. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 Metal Finishes Manual
- H. Federal Specification (Fed. Spec):
A-A-1925A..... Shield, Expansion; (Nail Anchors)
UU-B-790A Building Paper, Vegetable Fiber
- I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:
 1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
 2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
 3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
 4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.
- B. Wind Design Standard: Fabricate and install roof-edge flashings tested per ANSI/SPRI/FM ES-1 to resist design pressure indicated on Drawings.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Shop Drawings: For all specified items, including:
 - 1. Flashings
 - 2. Copings
 - 3. Gravel Stop-Fascia
 - 4. Gutter and Conductors
 - 5. Expansion joints
 - 6. Fascia-cant
- C. Manufacturer's Literature and Data: For all specified items, including:
 - 1. Two-piece counterflashing
 - 2. Thru wall flashing
 - 3. Expansion joint cover, each type
 - 4. Nonreinforced, elastomeric sheeting
 - 5. Copper clad stainless steel
 - 6. Polyethylene coated copper
 - 7. Bituminous coated copper
 - 8. Copper covered paper
 - 9. Fascia-cant
- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

- A. Stainless Steel: ASTM A240, Type 302B, dead soft temper.
- B. Copper ASTM B370, cold-rolled temper.
- C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.
- D. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.
- E. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- F. Aluminum Sheet: ASTM B209, alloy 3003-H14 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
- G. Galvanized Sheet: ASTM, A653.
- H. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
 - 1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
 - 2. Nails:
 - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
 - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
 - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
 - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
 - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
 - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
 - 1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
 - 2. Stainless steel: 0.25 mm (0.010 inch) thick.
 - 3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
 - 4. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
 - 1. Copper: 0.4 Kg (16 oz).
 - 2. Stainless steel: 0.4 mm (0.015 inch).
 - 3. Copper clad stainless steel: 0.4 mm (0.015 inch).
- D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

- A. Jointing:
 - 1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
 - 2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
 - 3. Joints shall conform to following requirements:
 - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
 - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
 - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
 - 4. Flat and lap joints shall be made in direction of flow.
 - 5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100

mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.

6. Soldering:
 - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
 - b. Wire brush to produce a bright surface before soldering lead coated copper.
 - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
 - d. Completely remove acid and flux after soldering is completed.
- B. Expansion and Contraction Joints:
 1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
 2. Space joints as shown or as specified.
 3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
 4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
 5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
 6. Fabricate joint covers of same thickness material as sheet metal served.
- C. Cleats:
 1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
 2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
 3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
 4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.
- D. Edge Strips or Continuous Cleats:
 1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
 2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
 3. Use material compatible with sheet metal to be secured by the edge strip.
 4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
 5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
 6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.
- E. Drips:
 1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
 2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.
- F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
 1. Copper: Mill finish.
 2. Stainless Steel: Finish No. 2B or 2D.
 3. Aluminum:
 - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
 - b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
 - c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
 - d. Mill finish.
 4. Steel and Galvanized Steel:
 - a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
 - b. Manufacturer's finish:
 - 1) Baked on prime coat over a phosphate coating.
 - 2) Baked-on prime and finish coat over a phosphate coating.
 - 3) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
 1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
 2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
 1. Either copper, stainless steel, or copper clad stainless steel.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
 1. Use same metal and thickness as counter flashing.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.

3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.
 1. Use plan flat sheet of stainless steel.
 2. Form exposed portions with drip as specified or receiver.
- E. Window Sill Flashing and Lintel Flashing:
 1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
 2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
 3. Turn up back edge as shown.
 4. Form exposed portion with drip as specified or receiver.
- F. Door Sill Flashing:
 1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
 2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
 3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 BASE FLASHING

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
 1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
 2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
 3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
 4. Use either copper, or stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
 1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
 2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
 3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
 - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
 - b. Allow for loose fit around and into the pipe.
 4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
 - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
 - b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Either copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

Flashing and Sheet Metal

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
 2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
 3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
 4. Manufactured assemblies may be used.
 5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
 6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:
1. Back edge turned up and fabricate to lock into reglet in concrete.
 2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
- D. Two-Piece Counterflashing:
1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
 2. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
 2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
 3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.
- F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
 2. Fabricate 100 mm (4 inch) over lap at end.
 3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
 4. Use stainless steel bolt on draw band tightening assembly.
 5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.
- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 GRAVEL STOPS

- A. General:
1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
 2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
 3. Fabricate roof flange not less than 100 mm (4 inches) wide.
 4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.

5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
 - a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
 - b. Fabricate bottom edge of formed fascia to receive edge strip.
 - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).
- B. Formed Flat Sheet Metal Gravel Stops and Fascia:
 1. Fabricate as shown of 1.25 mm (0.050 inch) thick aluminum.
 2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
 3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
 4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
 5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.
- C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
 1. Fabricate as shown of 0.8 mm (0.032 inch) thick aluminum.
 2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
 3. Factory fabricate prepackaged system, complete with fastenings.
 4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
 5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

2.10 BITUMEN STOPS

- A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.
- B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.
- C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.11 HANGING GUTTERS

- A. Fabricate gutters of not less than the following:
 1. 1.3mm (0.051 inch) thick aluminum..
- B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
- C. Building side of gutter shall be not less than 38 mm (1 1/2 inches) higher than exterior side.
- D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.
- E. Gutter Spacers:
 1. Fabricate of same material and thickness as gutter.
 2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
 3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
 4. Rivet and solder to gutter except rivet and seal to aluminum.
- F. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Lock and solder longitudinal seam except use sealant in lieu of solder with aluminum.
3. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:

1. Fabricate of same metal as gutter. Use the following:
 - a. 6 by 25 mm (1/4 by 1 inch) aluminum.
2. Fabricate to gutter profile.
3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.12 CONDUCTORS (DOWNSPOUTS)

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long with 19 mm (3/4 inch) wide flat locked seams.
 1. Fabricate open face channel shape with hemmed longitudinal edges.
- B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.
- C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.
- D. Conductor Heads:
 1. Fabricate of same material as conductor.
 2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
 3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
 4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
 5. Extend wall edge not less than 25 mm (one inch) above front edge.
 6. Solder joints for water tight assembly.
 7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.13 REGLETS

- A. Fabricate reglets of one of the following materials:
 1. 0.4 Kg (16 ounce) copper.
 2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
 3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
 4. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

- F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.14 INSULATED EXPANSION JOINT COVERS

- A. Either type optional, use only one type throughout.
- B. Types:
1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
 2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.
- C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.
- D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.15 GOOSENECK ROOF VENTILATORS

- A. Form of 1.3 mm (0.0508 inch) thick sheet aluminum, reinforce as necessary for rigidity, stiffness, and connection to curb, and to be watertight.
1. Form lower-edge to sleeve to curb.
 2. Curb:
 - a. Form for 100 mm (4 inch) high sleeve to ventilator.
 - b. Form for concealed anchorage to structural curb and to bear on structural curb.
 - c. Form bottom edge of curb as counterflashing to lap base flashing.
- B. Provide open end with 1.6 mm (16 gage), stainless steel wire guard of 13 mm (1/2 inch) square mesh.
1. Construct suitable aluminum angle frame to retain wire guard.
 2. Rivet angle frame to end of gooseneck.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
 2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
 3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
 4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
 5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
 6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.

7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
 - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
 - b. Paint dissimilar metal with a coat of bituminous paint.
 - c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
 - a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
 - b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.

10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
 11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
 12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
 13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
 14. Continue flashing around columns:
 - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
 - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).
- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.
- C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.
- E. Flashing at Veneer Walls:
1. Install near line of finish floors over shelf angles or where shown.
 2. Turn up against sheathing.
 3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
 4. At concrete backing, extend flashing into reglet as specified.
 5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- F. Lintel Flashing when not part of shelf angle flashing:
1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
 2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
 3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- G. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
 2. Turn back edge up to terminate under window frame.
 3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- H. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
 2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
 3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

- I. Flashing at Masonry, Stone, or Precast Concrete Copings:
 - 1. Install flashing with drips on both wall faces unless shown otherwise.
 - 2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

- A. Install where roof membrane type base flashing is not used and where shown.
 - 1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
 - 2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
 - 3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
 - 4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. General:
 - 1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
 - 2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
 - 3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
 - 4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
 - 5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
 - 6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
 - 1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
 - 2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
 - 3. Where flashing is surface mounted on flat surfaces.
 - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
 - 1) Locate fasteners in masonry mortar joints.
 - 2) Use screws to sheet metal or wood.
 - b. Fill joint at top with sealant.
 - 4. Where flashing or hood is mounted on pipe.
 - a. Secure with draw band tight against pipe.

- b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
 - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
 - 1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
 - 2. Surface applied type receiver:
 - a. Secure to face construction in accordance, with manufacturers instructions.
 - b. Completely fill space at the top edge of receiver with sealant.
 - 3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints on each section of reglet and securely hold in position until concrete or mortar are hardened:
 - 1. Coordinate reglets for anchorage into concrete with formwork construction.
 - 2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 GRAVEL STOPS

- A. General:
 - 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
 - 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
 - 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
 - 4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
 - 5. Set flange in roof cement when installed over built-up roofing.
 - 6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI/FM ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal gravel stops and fascia:
 - 1. Install with end joints of splice plates sheets lapped three inches.
 - 2. Hook the lower edge of fascia into a continuous edge strip.
 - 3. Lock top section to bottom section for two piece fascia.
- C. Corrugated sheet gravel stops and fascia:
 - 1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
 - 2. Hook lower edge of fascia into a continuous edge strip.

3.7 COPINGS

- A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
 2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
 3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.
- B. Aluminum Coping:
1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
 2. Install joint covers, centered at each joint, and securely lock in place.

3.8 EXPANSION JOINT COVERS, INSULATED

- A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.
- B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.
- C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

3.9 HANGING GUTTERS

- A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.
 1. For copper or copper clad stainless steel gutters use brass or bronze brackets.
 2. For stainless steel gutters use stainless steel brackets.
 3. For aluminum gutters use aluminum brackets or stainless steel brackets.
 4. Use brass or stainless steel screws.
- D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.
- E. Gutter Expansion Joint:
 1. Locate expansion joints midway between outlet tubes.
 2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
 3. Install a cover plate over the space at expansion joint.
 4. Fasten cover plates to gutter section on one side of expansion joint only.
 5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.
- F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

3.10 CONDUCTORS (DOWNSPOUTS)

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout,

intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.

- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

3.11 SPLASH PANS

- A. Install where downspouts discharge on low slope roofs unless shown otherwise.
- B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

3.12 GOOSENECK ROOF VENTILATORS

- A. Install on structural curb not less than 200 mm (8 inch) high above roof surface.
- B. Securely anchor ventilator curb to structural curb with fasteners spaced not over 300 mm (12 inch) on center.
- C. Anchor gooseneck to curb with screws having nonprene washers at 150 mm (6 inch) on center.

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SECTION 07 71 00

ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies copings, gravel stops, fascias, and expansion joints.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Color and Texture of Finish: See Construction documents.
- C. Sealant Material and Installation: Section 07 92 00, JOINT SEALANTS.
- D. General Insulation: Section 07 21 13, THERMAL INSULATION.
- E. Rigid Insulations for Roofing: Section 07 22 00, ROOF AND DECK INSULATION.

1.3 QUALITY CONTROL:

- A. Provide roof accessories that products of manufacturers regularly engaged in producing the kinds of products specified.
- B. For each accessory type provide products made by the same manufacturer.
- C. Assemble each accessory to the greatest extent possible before delivery to the site.
- D. Provide each accessory with FM approval listing for class specified.

1.4 PERFORMANCE REQUIREMENTS:

- A. Provide roof accessories that withstand exposure to weather and resist thermal movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, or installation.
- B. Provide roof accessories listed in FM Approvals "RoofNav" and approved for windstorm classification Class 1-90. Identify materials with FM Approval markings.
- C. Manufacture and install roof accessories to allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
 - 1. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.
 - 2. For design purposes, base provisions for thermal movement on assumed ambient temperature (range) from minus 18 degrees C (0 degrees F), ambient to 82 degrees C (180 degrees F).

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
- C. Samples: Representative sample panel of color-anodized aluminum not less than 101 x 101 mm (4 x 4 inches), except extrusions are to be of a width not less than section to be used. Submit sample that shows coating with integral color and texture. Include manufacturer's identifying label.

- D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- E. Manufacturer's Literature and Data: Each item specified.
- F. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
 - A240/A240M-14 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - A653/A653M-13 Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - A666-10..... Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - B209-14..... Aluminum and Aluminum Alloy-Sheet and Plate
 - B209M-14..... Aluminum and Aluminum Alloy-Sheet and Plate (Metric)
 - B221-14..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - B221M-13..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
 - B32-08(R2014)..... Solder Metal
 - B370-12..... Copper Sheet and Strip for Building Construction
 - B882-10..... Pre-Patinated Copper for Architectural Applications
 - C612-14..... Mineral Fiber Block and Board Thermal Insulation
 - D1187/D1187M-97 (R2011) .. Asphalt-Base Emulsions for Use as Protective Coatings for Metal
 - D1970/D1970M-14..... Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - D226/D226M-09..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - D4869/D4969M-05(R2011) ... Asphalt-Saturated Organic Felt Underlayment Used In Steep Slope Roofing
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06 Metal Finishes Manual
- D. American Architectural Manufacturers Association (AAMA):
 - 2605-11 High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 611-14 Anodized Architectural Aluminum
- E. FM Global (FM):
 - RoofNav Approved Roofing Assemblies and Products

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Aluminum, Extruded: ASTM B221M (B221).
- B. Aluminum Sheet: ASTM B209M (B209).
- C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.
- D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
- F. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- G. Insulation: ASTM C612, Class 1 or 2.
- H. Asphalt Coating: ASTM D1187, Type I, quick setting.

2.2 UNDERLAYMENT:

- A. Self-Adhering Modified Bitumen Underlayment:
 - 1. Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal copings and fascias.
 - 2. Provide membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions (stable after testing at 116 degrees C (240 degrees F)).
 - 3. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.
 - 4. Provide primer.
- B. Felt Underlayment: Provide No. 30 asphalt saturated organic, non-perforated felt underlayment in compliance with ASTM D226/D226M, Type II, or ASTM D4869/D4869M.
- C. Slip Sheet: Provide 0.24 kg per square meter (5 pounds per 100 sf) rosin sized unsaturated building paper for slip sheet.

2.3 SOLDER:

- A. Copper Solder conforming to ASTM B32, lead-free solder.

2.4 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS:

- A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.
- B. Turn fascia down face of wall and up above roof as shown in construction documents.
- C. Maximum lengths of 3.05 M (10-feet).
- D. Shop fabricate external and internal corners as one (1)-piece assemblies with not less than 305 mm (12 inch) leg lengths.

2.5 VENTED ALUMINUM FASCIAS, RIGID VENTS:

- A. Fascia: Two component, pre-slotted holes aluminum fascia
 - 1. Perforated, 24 gauge galvanized steel closures providing 54 percent net free area
 - a. Net free Area:
 - 1) 3" wide vent 18 Square inches per linear foot of NFA
 - 2) Color: Bone White
 - 2. Factory installed Vertical Z brackets 12 inches on center.
 - 3. 24 gauge galvanized steel backer
 - 4. Aluminum Fascia Cover:

- a. 0.063" (1.60mm) Aluminum
 - 5. Accessories
 - a. Cover Splice Plats
 - b. Miter Backer Assembly
 - 1) Eave to Eave Outside Miter
 - 2) Eave to Rake Outside Miter
 - c. Miter Fascia Cover
 - 1) Eave to Eave Outside Miter
 - 2) Eave to Rake Outside Miter
 - d. End Caps
 - e. Closure Plates
 - B. Ridge Vent: Slope to High Wall
 - 1. Continuous Z Bracket
 - a. 20 gauge galv steel
 - 2. Continuous 0.050 inch Expanded Metal Support Screen
 - a. 3" wide vent 18 Square inches per linear foot of NFA
 - 3. Cover
 - a. Concealed Splice Plate
 - 4. Accessories
 - a. Miters
 - b. End Caps
 - C. Ridge Vent: Slope to Slop
 - 1. Continuous Z Bracket
 - a. 20 gauge galv steel
 - 2. Continuous 0.050 inch Expanded Metal Support Screen
 - a. 3" wide vent 18 Square inches per linear foot of NFA
 - 3. Stainless Steel Springs 6 inches wide at 4 feet on center
 - 4. Cover
 - a. Concealed Splice Plate
 - 5. Accessories
 - a. Miters
 - b. End Caps
 - D. Ridge Vent: Slope to Vertical Wall
 - 1. Continuous Z Bracket
 - a. 20 gauge galv steel
 - 2. Continuous 0.050 inch Expanded Metal Support Screen
 - a. 3" wide vent 18 Square inches per linear foot of NFA
 - 3. Stainless Steel Springs 6 inches wide at 4 feet on center
 - 4. Cover
 - a. Concealed Splice Plate
 - 5. Accessories
 - a. Miters
 - b. End Caps
 - E. Maximum lengths of 3.65 M (12-feet).
 - F. Shop fabricate external and internal corners as one (1)-piece assemblies with not less than 305 mm (12 inch) leg lengths.
 - G. Finish: Two-coat fluoropolymer Color as specified.
- 2.6 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS:**
- A. Fabricate in 3.0 M (10 foot) lengths with fastener openings slotting for expansion not over 610 mm (24 inch) centers.

- B. Provide four-way expansion, for joint widths shown on construction documents.
- C. Finish: Two-coat fluoropolymer Color as specified.
- D. Form waterstop or moisture seals of continuous sheets of neoprene, not less than 0.81 mm (0.032 inch) thick.
- E. Fabricate corners as one (1) piece assembly with mitered and welded joint and least dimension legs not less than 300 mm (12 inches) long.
- F. Factory fabricate end caps and transitions to insure waterproof assembly.
- G. Five (5) piece assembly:
 - 1. Roof expansion joint cover system consists of an extruded aluminum cover, extruded frame or curb vertical section, galvanized steel cant, and aluminum compression clamp counter flashing, complete with moisture seals. Form cover and vertical section from extruded aluminum, 2 mm (0.080 inch) minimum thickness with spring stainless steel tension or pivot bar.
 - 2. Form cant from galvanized steel not less than 0.8 mm (0.029 inch) thick formed to profile shown on construction documents.
 - 3. Form splice plates of not less than 0.81 mm (0.032 inch) thick aluminum sheet.
 - 4. Form counter flashing member of 1.3 mm (0.050 inch) thick sheet aluminum, secured with screws to the top edge of the vertical section and providing compression clamp over base flashing.
 - 5. Provide compression gasket separating cover from curb bearing.
- H. Two (2) piece assembly:
 - 1. Roof expansion joint system consists of an extruded aluminum cover combination extruded aluminum frame or curb with integral adjustable counter flashing flange, and moisture seals.
 - 2. Form cover from extruded aluminum 2 mm (0.078 inch) minimum thickness.
 - 3. Form cover anchor system of stainless steel pivot bar.
 - 4. Form frame assembly of not less than 2 mm (0.076 inch) aluminum except for flashing portion.
 - 5. Provide compression gasket separating cover from curb at bearing.

2.7 ALUMINUM SOFFIT PANELS:

- A. Soffit Panels:
 - 1. Minimum 0.4826 mm (0.019 inches) sheet stock.
 - 2. 305 mm (12 inches) Triple 102 mm (four inch) U-groove soffit soild.
 - 3. Color: White
 - 4. Trim: Same sheet stock as Panels

2.8 FINISH:

- A. In accordance with NAAMM AMP 500-505.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Fluoropolymer Finishes: High performance organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Examine substrates, areas, and conditions, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- C. Install soffit and related complements in accordance with manufacturer's instructions.
 - 1. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint.
 - 2. Permanently fasten soffit system to structure; align, level, and plumb with specified tolerances
- D. Underlayment Installation:
 - 1. Self-Adhering Sheet Underlayment:
 - a. Apply primer as required by manufacturer.
 - b. Comply with temperature restrictions of underlayment manufacturer for installation.
 - c. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 152 mm (6 inches) staggered 610 mm (24 inches) between courses.
 - d. Overlap side edges not less than 89 mm (3-1/2 inches). Roll laps with roller.
 - e. Cover underlayment within 14 days.
 - f. Apply continuously under copings and roof-edge fascias and gravel stops.
 - g. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
 - 2. Felt Underlayment:
 - a. Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.
 - b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).
 - 3. Slip Sheet:
 - a. Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.
 - b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).
- E. Install roof accessories where indicated in construction documents.
- F. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise. Provide fasteners suitable for application, for metal types being secured and designed to meet performance requirements.
- G. Where soldered joints are required, clean surfaces to be soldered, removing oils and foreign matter.
 - 1. Pre-tin edges of sheets to be soldered to a width of 38 mm (1-1/2 inches).
 - 2. Reduce pre-tinning where pre-tinned surface would show in completed work.
 - 3. Tin edges of uncoated copper sheets using solder for copper.
 - 4. Do not use torches for soldering.
 - 5. Heat surfaces to receive solder and flow solder into joint.
 - 6. Fill joint completely.
 - 7. Completely remove flux and spatter from exposed surfaces.
- H. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- I. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions.
- J. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- K. Gravel Stops and Fascias:
 - 1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.

2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
 3. Provide lap cover plates and concealed flashing over the gravel stop and fascia not less than 101 mm (4 inches).
 4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.
- L. Aluminum Coping:
1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
 2. Center joint gutter bar and covers at joints and lock in place.
 3. When snap-on system is installed ensure front and back edges are locked in place.
- M. Fascia-Cant System:
1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown in construction documents.
 2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
 3. Offset joints in extruded aluminum members from galvanized steel cant joints.
- N. Expansion Joint Covers:
1. Install to terminate base flashing 203 mm (8 inches) above roof.
 2. Install moisture seals to drain water to outlets that do not permit water to enter building.
 3. Provide stainless steel screws when exposed.
 4. Three piece assembly:
 - a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
 - b. Install cant to wood blocking by nailing along horizontal flange every 152 mm (6 inches), with galvanized roofing nails 25 mm (1 inch) long.
 - c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 457 mm (18 inches) on center.
 - d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
 - e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than 101 mm (4 inches).
 5. Two piece assembly:
 - a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
 - b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
 - c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
 - d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

3.2 TOLERANCES

- A. Maximum offset from true alignment between adjacent members butting or in-line 1.6 mm (1/16 inch)
- B. Maximum variation from plane or location indicated on drawings: 3.175 mm in 3048 mm (1/8 inch in 10 feet).

3.3 PROTECTION OF ALUMINUM:

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one (1) side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two (2) coats of asphalt coating.

3.4 ADJUSTING:

- A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.5 PROTECTION:

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies roof hatches; equipment supports; gravity ventilators; and metal grating roof walkway system.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Color and texture of finish: See Construction documents..
- C. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- D. General insulation: Section 07 21 13, THERMAL INSULATION. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

1.3 QUALITY ASSURANCE:

- A. Provide roof accessories that are the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. For each accessory type provide the same product made by the same manufacturer.
- C. Assemble each accessory to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
- C. Samples: Submit representative sample panel of color anodized aluminum not less than 101 x 101 mm (4 x 4 inches). For extrusions, submit width not less than section to be installed. Show coating with integral color and texture and include manufacturer's identifying label.
- D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- E. Manufacturer's Literature and Data: Each item specified.
- F. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - RR-G-1602DGrating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)
- C. ASTM International (ASTM):
 - A653/A653M-10Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
 - B209-14.....Aluminum and Aluminum Alloy-Sheet and Plate

- B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
- B221-14.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
- C726-12.....Mineral Wool Roof Insulation Board
- C1289-14a.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- D1187/D1187M-97(R2011)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 SeriesMetal Finishes Manual
- E. American Architectural Manufacturers Association (AAMA):
2603-13Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
2605-13High Performance Organic Coatings on Architectural Extrusions and Panels.
611-14Anodized Architectural Aluminum
621-02High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
- F. American Society of Civil Engineers (ASCE):
ASCE 7-10Minimum Design Loads for Buildings and Other Structures
- G. U.S. National Archives and Records Administration (NARA):
29 CFR 1910.23.....Guarding Floor and Wall Openings and Holes

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Aluminum, Extruded: ASTM B221M (B221).
- B. Aluminum Sheet: ASTM B209M (B209).
- C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.
- D. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.
- E. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- F. Asphalt Coating: ASTM D1187/D1187M, Type I, quick setting.

2.2 ROOF HATCH (SCUTTLE):

- A. Performance Characteristics:
 1. Cover to be reinforced to support a minimum live load of 195 kg per sq. m (40 lb. per sq. ft.) with a maximum deflection of 1/150th of the span or 97 kg per sq. m (20 lb. per sq. ft.) wind uplift.
 2. Operation of the Cover: Smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. Operation of the Cover: Not affected by temperature.
 4. Entire Hatch: Weathertight with fully welded corner joints on cover and curb.
- B. Shop fabricate from aluminum with mill finish.

- C. Curb and Cover:
1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum with mill finish.
 2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
 3. Minimum of 50 mm (2 inch) thick polyisocyanurate insulation (ASTM C1289) with a U-value = 0.47 W/m² K (R-value = 12) between facings of cover and over exterior face of curb.
 4. Form exterior curb facing with an integral 76 mm (3 inch) wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
 5. Make curb 305 mm (12 inches) above finish roof surface.
 6. Form cover to lap curb and cap flashing.
 7. Size opening as shown on construction documents.
 8. Finish: Mill Aluminum; color Mill.
- D. Hardware:
1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long. Bolt hardware into heavy gauge channel reinforcement welded to the underside of the cover and concealed within the insulation space.
 2. Provide heavy duty pintle hinges.
 3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
 4. Latch Strike: Stamped component bolted or welded to the curb assembly.
 5. Automatically lock in the open position at not less than 70 degrees.
 6. Provide weatherstripping at cover closure.
 7. Galvanize all hardware items.
- E. Assembly:
1. Shop assemble roof scuttle.
 2. Weld joints exposed to the weather and built into the roofing.
 3. Finish weld smooth where exposed.
- F. Safety Accessories:
1. Ladder Assist Post: Provide a telescoping tubular section that locks automatically when fully extended. Control upward and downward movement by a stainless steel spring balancing mechanism. Provide unit completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.
 2. Safety Railing: Provide a fixed, attached to the roof hatch railing assembly including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; complying with 29 CFR 1910.23 requirements.

2.3 LOW SILHOUETTE GRAVITY VENTILATORS

- A. Fabricate base of 1 mm (0.04 inch) thick aluminum, and vent of 0.8 mm (0.032 inch) thick aluminum.
1. 1. Height not to exceed 305 mm (12 inches) above top of roof curb.
 2. 2. Design ventilators to withstand 137 Km (85 miles) per hour wind velocity.
 3. 3. Provide ventilators with a removable 18 by 18 mesh by 0.28 mm (0.11 inch) diameter aluminum wire cloth insect screen.
- B. Construct damper of the same material as the ventilator and design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 305 mm (12 inches) below and engage catch when damper is closed.
- C. Finish: Aluminum; color to match shingle color.

2.4 FINISH:

- A. In accordance with NAAMM AMP 500 Series.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.

- C. Fluoropolymer Finish: High performance organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - 1. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install roof specialties where indicated on construction documents.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
 - 1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
 - 2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
 - 3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).
- F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

3.2 PROTECTION OF ALUMINUM:

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING:

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

3.4 PROTECTION:

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

--- E N D ---

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- D. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS; Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
 - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Installer qualifications.
- D. Inspector qualifications.
- E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- F. List of FM, UL, or WH classification number of systems installed.
- G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE:

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE:

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.
- B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

Firestopping

- C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
- E84-14..... Surface Burning Characteristics of Building Materials
 - E699-09..... Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
 - E814-13a..... Fire Tests of Through-Penetration Fire Stops
 - E2174-14..... Standard Practice for On-Site Inspection of Installed Firestops
 - E2393-10a..... Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- C. FM Global (FM):
- 1. Annual Issue Approval Guide Building Materials
 - 4991-13 Approval of Firestop Contractors
- D. Underwriters Laboratories, Inc. (UL):
- 1. Annual Issue Building Materials Directory
 - 2. Annual Issue Fire Resistance Directory
 - 723-10(2008)..... Standard for Test for Surface Burning Characteristics of Building Materials
 - 1479-04(R2014) Fire Tests of Through-Penetration Firestops
- E. Intertek Testing Services - Warnock Hersey (ITS-WH):
- 1. Annual Issue Certification Listings
- F. Environmental Protection Agency (EPA):
- 40 CFR 59(2014) National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS:

- A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) in overall cross sectional area.
- C. Firestop sealants used for firestopping or smoke sealing to have the following properties:
- 1. Contain no flammable or toxic solvents.
 - 2. Release no dangerous or flammable out gassing during the drying or curing of products.

3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
 5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
- D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
1. Classified for use with the particular type of penetrating material used.
 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
- E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.
- F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
- H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
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 101 mm (4 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS:

- A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Provide mineral fiber filler and bond breaker behind sealant.
- C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
- B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance

of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
- C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION:

- A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP:

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Clean up spills of liquid type materials.
- C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK:

- A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).
- B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.
- D. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Glazed Aluminum-Framed Entrance and Storefronts: Section 08 41 13, GLAZED ALUMINUM CURTAIN WALLS.
- G. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.
- H. Mechanical Work: Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS; Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING; Section 23 05 11, COMMON WORK RESULTS FOR HVAC;.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
- B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
 - 1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.

2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

1.4 CERTIFICATION:

- A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.
- F. Cured samples of exposed sealants for each color.
- G. Manufacturer's Literature and Data:
1. Primers
 2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

- A. Environmental Limitations:
1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Backing Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):
 - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material
 - C612-14.....Mineral Fiber Block and Board Thermal Insulation
 - C717-14a.....Standard Terminology of Building Seals and Sealants
 - C734-06(R2012)Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering
 - C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
 - C919-12.....Use of Sealants in Acoustical Applications.
 - C920-14a.....Elastomeric Joint Sealants.
 - C1021-08(R2014)Laboratories Engaged in Testing of Building Sealants
 - C1193-13.....Standard Guide for Use of Joint Sealants.
 - C1248-08(R2012)Test Method for Staining of Porous Substrate by Joint Sealants
 - C1330-02(R2013)Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
 - C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

- D217-10..... Test Methods for Cone Penetration of Lubricating Grease
D1056-14..... Specification for Flexible Cellular Materials—Sponge or
Expanded Rubber
E84-09..... Surface Burning Characteristics of Building Materials
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
D. The Professionals' Guide
E. Environmental Protection Agency (EPA):
40 CFR 59(2014) National Volatile Organic Compound Emission Standards for
Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

- A. Exterior Sealants:
1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25,
 2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
 3. Provide location(s) of exterior sealant as follows:
 - a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
 - b. Metal to metal.
 - c. Masonry to masonry or stone.
 - d. Stone to stone.
 - e. Cast stone to cast stone.
 - f. Masonry expansion and control joints.
 - g. Wood to masonry.
 - h. Masonry joints where shelf angles occur.
 - i. Voids where items penetrate exterior walls.
 - j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.
- B. Floor Joint Sealant:
1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
 2. Provide location(s) of floor joint sealant as follows.
 - a. Seats of metal thresholds exterior doors.
 - b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.
- C. Interior Sealants:
1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
 2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
 3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
 4. Provide location(s) of interior sealant as follows:
 - a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
 - b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
 - c. Interior surfaces of exterior wall penetrations.

Joint Sealants

- d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
- e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
- f. Exposed isolation joints at top of full height walls.
- g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
- h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
- i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:

- 1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
- 2. Provide location(s) of acoustical sealant as follows:
 - a. Exposed acoustical joint at sound rated partitions.
 - b. Concealed acoustic joints at sound rated partitions.
 - c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent concrete.
- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 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 C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and 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.

2.4 WEEPS:

- A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.
 - 1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

2.5 FILLER:

- A. Mineral fiberboard: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

Joint Sealants

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

- A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. 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.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to 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 surfaces include but are not limited to the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 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. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

- A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.
- D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
 - 2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
 - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 - 9. Apply compounds with nozzle size to fit joint width.
 - 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
 - 11. Replace sealant which is damaged during construction process.
- B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
 - 1. Use round plastic tubing to form weep holes.
 - 2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
 - 3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.

- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
 - 1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
 - 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
 - 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
 - 4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
 - 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. 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.
- C. Inspect tested joints and report on following:
 - 1. 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.
 - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 3. Whether sealants filled joint cavities and are free from voids.
 - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. 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.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. 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.

3.7 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
- B. Leave adjacent surfaces in a clean and unstained condition.

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SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Prefabricated floor, wall, and ceiling; seismic and building expansion joint assemblies.
 - a. Metal plate covers at floor; wall and ceiling joints.
 - b. Elastomeric joint covers at wall and ceiling joints.
 - c. Preformed elastomeric sealant joint at interior floor and wall control joints.
 - d. Exterior wall joints.

1.2 RELATED REQUIREMENTS

- A. Steel Plate Expansion Joint Covers: Section 05 50 00, METAL FABRICATIONS.
- B. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.
- C. Roof Expansion Joint Cover Assemblies: Section 07 71 00, ROOF SPECIALTIES.
- D. Color of Elastomer Inserts, Filler Strips, Exterior Wall Seals and Metal Finishes: See Construction documents.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this Section.
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE/SEI 7-10 - Minimum Design Loads For Buildings and Other Structures.
- C. ASTM International (ASTM):
 - 1. A36/A36M-14 - Structural Steel.
 - 2. A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
 - 3. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 4. A786/A786M-05(2009) - Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
 - 5. B36/B36M-13 - Brass, Plate, Sheet, Strip, and Rolled Bar.
 - 6. B121/B121M-11 - Lead Brass Plate, Sheet, Strip and Rolled Bar.
 - 7. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 8. B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - 9. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 10. B221M 13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
 - 11. B455-10 - Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.
 - 12. C864-05(2011) - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 13. D1187/D1187M-97(2011)e1 - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - 14. E1399/E1399M-97(2013)e1 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
 - 15. E1966-15 - Standard Test Method for Fire-Resistive Joint Systems.
- D. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. AMP 500-06 - Metal Finishes Manual.

- E. UL LLC (UL):
 - 1. 2079-15 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this Section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Architect/Engineer.
 - c. Inspection and Testing Agency.
 - d. Contractor.
 - e. Installer.
 - f. Manufacturer's field representative.
 - g. Other installers responsible for adjacent and intersecting work.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Include large-scale details indicating profiles of each type of expansion joint cover, splice joints between joint sections, transitions to other assemblies, terminations, anchorages, fasteners, and relationship to adjoining work and finishes.
 - 2. Show size, configuration, and fabrication and installation details.
 - 3. Include composite drawings showing work specified in other Sections coordinated with expansion joints.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product specified.
 - 2. Show movement capability of each cover assembly and suitability of material used in exterior seals for ultraviolet exposure.
 - 3. Description of materials and finishes.
 - 4. Installation instructions.
- D. Samples: Submit 300 mm (12 inch) long samples.
 - 1. Each type and color of metal finish for each required thickness and alloy.
 - 2. Each type and color of flexible seal.
- E. Sustainable Construction Submittals:
 - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 - 2. Low Pollutant-Emitting Materials:
 - a. Identify volatile organic compound types and quantities.
- F. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Installer with project experience list.

- G. Certificates: Indicate products comply with specifications.
 - 1. Fire rated expansion joint cover assemblies.
- H. Operation and Maintenance Data:
 - 1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.

1.7 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify field conditions affecting expansion joint cover assembly fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Provide joint cover assemblies that permit unrestrained movement of joint without disengagement of cover, and, where applicable, maintain moisture, watertight and fire-rated protection.
- B. Provide templates to related trades for location of support and anchorage items.

2.2 SYSTEM PERFORMANCE

- A. Design expansion joint cover assemblies complying with specified performance.
- B. Joint Movement: ASTM E1399.
 - 1. Joint at Building 6
 - a. Nominal Joint Width: 25.4 mm (2 inches).
 - b. Minimum Movement Capability: 50 percent.
 - c. Movement Type: Thermal and wind.
 - 2. Joint at Building 6
 - a. Nominal Joint Width: 50.8 mm (2 inches).
 - b. Minimum Movement Capability: 50 percent.
 - c. Movement Type: Thermal and wind.

Expansion Joint Cover Assemblies

- C. Floor Joints: Live loads, including rolling loads.
 - 1. Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.
 - 2. Maximum Deflection: 1/360 of span, maximum.
- D. Fire Rated Joints: ASTM E1399, ASTM E1966, or UL 2079, including hose stream test at full-rated period.
 - 1. Fire rating: Match adjacent floor, wall, and ceiling construction.
 - 2. System: Capable of anticipated movement while maintaining fire rating.
 - 3. Coverless Applications: Maintain fire rating without joint cover system.

2.3 MATERIALS

- A. Stainless Steel: ASTM A240/A240M, Type 302 or 304.
- B. Structural Steel Shapes: ASTM A36/A36M.
- C. Steel Plate: ASTM A283/A283M, Grade C.
- D. Rolled Steel Floor Plate: ASTM A786/A786M.
- E. Aluminum:
 - 1. Extruded: ASTM B221M (ASTM B221), alloy 6063-T5, 6063-T6, or 6061-T6.
 - 2. Plate and Sheet: ASTM B209M (ASTM B209), alloy 6061-T6.
- F. Bronze: Manufacturer's standard alloy.
 - 1. Extruded: ASTM B455.
 - 2. Plate: ASTM B121.
- G. Brass: ASTM B36/B36M.
- H. Elastomeric Sealant: As specified in Section 07 92 00, JOINT SEALANTS.
- I. Elastomeric Seals:
 - 1. Flexible extruded polyvinyl chloride, meeting a Shore A hardness of 75 with UV stabilizer. Manufacturer's standard colors.
- J. Thermoplastic Rubber:
 - 1. ASTM C864.
 - 2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.
- K. Compression Seals: Pre-compressed secondary sealant using preformed expanding foam sealant; open-cell polyurethane foam impregnated with polymer-modified acrylic adhesive.
- L. Water Barrier Sheets: Neoprene or EPDM flexible sheet materials minimum 45 mils thick.
 - 1. Provide with drain tubes for horizontal applications.
- M. Vinyl Invertor Sealant Waterstops: Manufacturer's standard shapes and grade.
- N. Moisture Barrier: Fabric reinforced clear vinyl sheet material sized to accommodate opening.
- O. Flexible Membrane: 1.5 mm (60 mil) EPDM sheet, with manufacturer's standard support foam.
- P. Fire Barrier: Labeled by an approved independent testing laboratory for fire resistance rating indicated for maximum joint width.
 - a. Thermal Insulation: Manufacturer's standard with factory cut miters and transitions.
 - b. Fire Barrier Lengths:
 - 1) Joint widths up to and including 150 mm (6 inches): Maximum 15 m (50 feet) to minimize field splicing.
 - 2) Other Joint widths: 3 m (10 foot) with overlapping ends for field splicing.
- Q. Ceramic Blanket: Manufacturer's standard joint filler to achieve fire rating indicated.
- R. Butyl Caulk Tape: Self adhering double sided butyl rubber sealant tape with easy-release silicone coated paper.

Expansion Joint Cover Assemblies

2.4 PRODUCTS - GENERAL

- A. Basis of Design: See Construction documents..
- B. Provide each product from one manufacturer.
 - 1. Provide ceiling and wall expansion joint cover assemblies design matching floor to wall and floor to floor expansion joint cover design.
 - 2. Provide expansion joint cover assembly designs, profiles, materials and configuration indicated, as required to accommodate joint size variations in adjacent surfaces, and anticipated movement.
- C. Sustainable Construction Requirements:
 - 1. Steel Recycled Content: 30 percent total recycled content, minimum.
 - 2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.
 - 3. Aluminum Recycled Content: 80 percent total recycled content, minimum.
 - 4. Low Pollutant-Emitting Materials: Maximum VOC content by weight.
 - a. Non-Flooring Adhesives and Sealants.

2.5 FABRICATION

- A. Fabricate Expansion Joint Cover Assemblies:
 - 1. As complete assembly ready for installation.
 - 2. In longest practicable lengths to minimize number of end joints.
 - 3. With factory mitered corners where joint changes directions or abuts other materials.
 - a. With closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
 - 4. Joints within enclosed spaces such as chase walls, include 1 mm (0.04 inch) thick galvanized steel cover where conventional expansion joint cover is not used.
 - 5. Where floor slab is fire rated provide ceramic blanket at joints.
 - 6. Seal Strip: Factory-formed and bonded to metal frames and anchor members.
 - 7. Compression Seals: Fabricate from expanding foam as secondary seal and elastomeric sealant to sizes and profiles shown.
- B. Floor-to-Floor Metal Plate Joints:
 - 1. Frames: Metal, continuous on both sides of joint designed to support cover plate.
 - a. Flush Design: Seating surface and raised floor rim to accommodate adjacent flooring.
 - b. Anchorage: Concealed bolt and steel anchors for embedment in concrete.
 - 2. Cover Plate: Metal, matching frames where exposed.
 - a. Supported Load: 19.2 MPa (400 psf), minimum.
 - b. Rattle-free due to traffic.
 - 3. Fillers: Resilient material between raised rim of frame and edge of cover plate, where shown.
 - a. No gaps or bulges over full design range joint movement.
 - 4. Fire Barrier: As required for fire resistance rating.
 - 5. Water Stop: Manufacturer's standard, continuous, full length of joint.
 - 6. Seismic: As required by Code.
 - 7. Finishes: See Construction documents.
- C. Floor-to-Wall Metal Plate Joints:
 - 1. Frames: Metal, continuous on floor side of joint only.
 - a. Provide wall side frame where required by manufacturer's design.
 - 2. Cover Plates: Angle cover plates with countersunk flat-head exposed fasteners for securing cover plate to wall unless shown otherwise.
 - a. Fastener Spacing: As recommended by manufacturer.
 - 3. Joint Design: Match adjacent floor to floor design.
 - 4. Fire Barrier: As required for fire resistance rating.
 - 5. Water Stop: Manufacturer's standard, continuous, full length of joint.

6. Seismic: As required by Code.
 7. Finishes: As specified in See Construction documents.
- D. Interior Wall Joint Cover Assemblies:
1. Frame: Metal, surface mounted, concealed fastening to wall on one sides of joint.
 2. Cover Plate: Metal, smooth surface, lap both sides of joint and permitting free movement on one side.
 - a. Fabricate with concealed attachment of cover to frame when cover is in close contact with adjacent wall surface finish.
 - b. Use angle cover plates at intersecting walls.
 3. Joint Design: Match adjacent floor to floor design.
 4. Fire Barrier: As required for fire resistance rating.
 5. Seismic: As required by Code.
 6. Finishes: As specified in See Construction documents.
- E. Exterior Wall Joint Assemblies:
1. Design seal for variable movement and prevention of water and air infiltration.
 2. Frame: Metal, concealed, for fastening to wall on one side of joint.
 3. Cover Plate: Metal, surface mounted, lap both sides of joint, permitting free movement on one side.
 - a. Fabricate with concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
 - b. Use angle cover plate at intersecting walls.
 4. Water Seal: Vinyl seal strip as secondary seal behind primary seal.
 5. Seismic: As required by Code.
 6. Finish: As specified in See Construction documents.
- F. Extruded Thermoplastic Rubber Joint Assemblies:
1. Frames: Aluminum, both sides of joint.
 2. Primary Seal: Flexible rubber on exposed face after frame installation with factory welded watertight miters and transitions.
 - a. Anchor spaced at ends and not over 600 mm (24 inches).
 - 1) Variable movement extruded rubber primary seal designed to remain in aluminum frame, throughout movement of joint.
 - b.
 - c. Recessed front face seal minimum 3 mm (0.12 inch) thick with no movement grooves, designed for plus or minus 50 percent movement of joint width.
 - d. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12 inches) wide and greater.
 3. Secondary Seal: Continuous vinyl sheet seal.
 4. Finishes: As specified See Construction documents..
- G. Ceiling and Soffit Assemblies:
1. Frames: Metal, continuous on both sides of joint, flush mounted with no exposed fasteners.
 2. Flexible Insert: Variable movement semi-rigid vinyl locked into frame.
 - a. Face Style: Flush or accordion, as shown, to span joint width without sagging.
 3. Seismic: As required by Code.
 4. Finishes: As specified in See Construction documents.
- H. Preformed Sealant Joint: Factory installed elastomeric sealant between extruded aluminum angle frame both sides.
1. Frames: Extruded aluminum angle on both sides of joint.
 2. Filler: Elastomeric sealant.
 3. Anticipated movement: 25 percent maximum.
 4. Finishes: As specified in See Construction documents.

2.6 EXPANSION JOINTS TYPES SPECIFIED ELSEWHERE

- A. Expansion Joints at Roofing:
 - 1. Specified in Section 07 71 00 and applicable roofing sections.

2.7 FINISHES

- A. Carbon Steel: NAAMM AMP 500, Galvanized G90.
- B. Stainless Steel: NAAMM AMP 500, No. 2B bright finish.
- C. Aluminum Anodized Finish: NAAMM AMP 500.
 - 1. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.
- D. Aluminum Paint Finish:
 - 1. Fluorocarbon Finish: AAMA 2605; 70 percent fluoropolymer resin, 2-coat system.
- E. Bronze Finish: NAAMM-AMP 500, M32 mechanical finish, directional textured, natural medium satin.

2.8 ACCESSORIES

- A. General: Manufacturer's standard anchors, fasteners, set screws, spaces, protective coating, and filler materials, adhesive and other accessories required for installation.
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.
- D. Fasteners: Type and size recommended by expansion joint cover assembly manufacturer.
 - 1. Exterior Applications: Stainless steel.
 - 2. Fasteners for Aluminum: Stainless steel.
 - 3. Other Applications: Galvanized steel or stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Provide items embedded in concrete and masonry in time for building into work without delaying work.
- B. Protect existing construction and completed work from damage.
- C. Apply barrier coating to aluminum and steel surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install anchorage devices and fasteners for securing expansion joint assemblies to in-place construction where anchors are not embedded in concrete and masonry.
 - 1. Secure with metal fasteners, type and size to suit application.
- C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
- D. Install joint cover assemblies aligned and positioned in correct relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
 - 1. Allow for thermal expansion and contraction of metal to avoid buckling.

2. Accommodate joint opening size at time of installation.
- E. Set floor covers at elevations flush with adjacent finished flooring, unless shown otherwise.
- F. Grout floor frames set in prepared recesses.
- G. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Secure with required accessories.
- H. Locate anchors at interval recommended by manufacturer, but minimum 75 mm (3 inches) from each end, and, maximum 600 mm (24 inches) on centers.
- I. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
- J. Cut and fit ends to accommodate thermal expansion and contraction of metal to avoid buckling of frames and cover plates.
- K. Flush Metal Cover Plates:
 1. Secure flexible filler between frames to allow compression and expansion.
 2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- L. Waterstops:
 1. Install in conjunction with floor joints, and where shown.
 2. Install continuously to prevent water damage to finish spaces.
 3. Seal waterstop to frames to prevent water leakage.
 4. Install drainage tubes from waterstops to discharge collected water in nearest plumbing air gap drain.
- M. Fire Barriers:
 1. Install in compliance with tested assembly.
 2. Install at joints in floors and in fire rated walls.
 3. Use fire barrier sealant furnished with expansion joint assembly.
- N. Apply sealant where required to prevent water and air infiltration.
- O. Vertical Exterior Extruded Thermoplastic Rubber.
 1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with secondary seal.
 2. Install primary seals retained in extruded aluminum side frames.
- P. Extruded Thermoplastic Rubber or Seals:
 1. For straight sections, install preformed seals in continuous lengths.
 2. Vulcanize or heat-seal field spliced joints to provide watertight joints as recommended by manufacturer.
- Q. Preformed Elastomeric Sealant Joint:
 1. Locate joint directly over joints in wall and floor substrates.
 2. Fasten full length to substrate using construction adhesive.
 3. Install flush or slightly below finish material.

3.3 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed metal surfaces. Remove contaminants and stains.

3.4 PROTECTION

- A. Cover floor joints with plywood where wheel traffic occurs before Substantial completion.
- B. Remove protective covering when adjacent work areas are completed. Clean exposed surfaces in compliance with manufacture's printed instructions.

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