

## **SECTION 07 11 13 BITUMINOUS DAMPPROOFING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.

#### **1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Product description.
  - 2. Application instructions.

#### **1.3 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. American Society for Testing and Materials (ASTM):
  - D226-09 ..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
  - D449-03(R2008)..... Asphalt Used in Dampproofing and Waterproofing
  - D1227-95(R2007)..... Emulsified Asphalt Used as a Protective Coating for Roofing

### **PART 2 - PRODUCTS**

#### **2.1 ASPHALT (HOT APPLIED)**

- A. ASTM D449, Type I.

#### **2.2 ASPHALT SATURATED FELT**

- A. ASTM D226, Type I, 7 kg (# 15).

#### **2.3 ASPHALT EMULSION (COLD APPLIED)**

- A. ASTM D1227, Type III (spray grade)

### **PART 3 - EXECUTION**

#### **3.1 SURFACE PREPARATION**

- A. Surfaces to receive dampproofing shall be clean and smooth.
- B. Remove foreign matter, loose particles of mortar or other cementitious droppings.
- C. Clean and wash soil or dirt particles from surface.
- D. Remove free water; surfaces may remain damp.

### **3.2 APPLICATION**

- A. Comply with Manufacturer's written instructions for methods and rates of dampproofing application, cleaning and installation of any protection course.
- B. Apply each coat at the rate of not less than  $1 \text{ L/m}^2$  (2-1/2 gallons per 100 square feet) and allow not less than 24 hours drying time after application.

### **3.3 LOCATION**

- A. Apply to surfaces where shown.
- B. Apply to exterior surface of inner wythe of masonry cavity walls where shown.  
Coordinate application with masonry work.

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## **SECTION 07 21 13 THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

#### **1.2 RELATED WORK**

- A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing Insulation: Section 07 84 00, FIRESTOPPING.

#### **1.3 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

#### **1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT**

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
  - 1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserve/tools/cpg/products/>.
  - 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
  - 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN

REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

## **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used.
  - 2. Adhesive, each type used.
  - 3. Tape.
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

## **1.6 SUSTAINABLE DESIGN CERTIFICATION**

- A. Provide third party certified product in accordance with ULE GREENGUARD, SCS Global Indoor Advantage Certification or equal; certification must be current and performed annually.
- B. Provide documentation to demonstrate fiberglass insulation does not contain urea-formaldehyde.

## **1.7 STORAGE AND HANDLING**

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

## **1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):

C270	Mortar for Unit Masonry
C553-11	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C578-12b	Rigid, Cellular Polystyrene Thermal Insulation

C591-12b	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
C665-12	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
D312-00(R2006)	Asphalt Used in Roofing
F1667-11ae1	Driven Fasteners: Nails, Spikes and Staples

- C. Scientific Certification Systems (SCS Global): SCS Indoor Advantage certification.
- D. UL Environment, GREENGUARD (ULE GREENGUARD): The GREENGUARD Product Guide (online)

## **PART 2 - PRODUCTS**

### **2.1 INSULATION – GENERAL**

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Polyisocyanurate/polyurethane/polystyrene	9 percent recovered material
Glass fiber reinforced	6 percent recovered material

- D. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

### **2.2 POLYISOCYANURATE BOARD INSULATION**

- A. ASTM C591, Type I, faced with a vapor retarder having a perm rating of not more than 0.5.

### **2.3 POLYSTYRENE BOARD**

- A. ASTM C578, Type X for cavity walls.
- B. ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

### **2.4 GLASS FIBER AND STONE WOOL INSULATION**

- A. Unfaced Insulation: ASTM C665, Type I or ASTM C533.
- B. Faced Insulation: ASTM C665, Type III, Faced.

- C. Acoustical Insulation: Preformed, friction-fit type, unfaced; insulation type conforming to ASTM C665 or C553.

## **2.5 FASTENERS**

- A. Staples or Nails: ASTM F1667, zinc coated, size and type best suited for purpose.

## **2.6 ADHESIVE**

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

## **2.7 TAPE**

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

## **2.8 BLOCKING AROUND HEAT PRODUCING DEVICES**

- A. Provide non-combustible blocking around heat producing devices to provide the following clearances:
  - 1. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm 24 inches above fixture.
  - 2. Vents and vent connectors used for venting products of combustion, flues, and chimneys: minimum clearances as required by NFPA 211.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.
- E. Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

- F. Place insulation to the outside of pipes.
- G. Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

### **3.2 POLYISO BOARD**

- A. Bond polyisocyanurate board, to surfaces with adhesive as recommended by insulation manufacturer.

### **3.3 POLYSTYRENE BOARD**

- A. Vertical Insulation:
  - 1. Fill joints of insulation with same material used for bonding.
  - 2. Bond polystyrene board to surfaces with adhesive and applied in accordance with recommendations of insulation manufacturer.

### **3.4 GLASS FIBER BATT**

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Roof Rafter Insulation or Floor Joist Insulation: Place mineral fiber blankets between framing to provide not less than a 50 mm (two inch) air space between insulation and roof sheathing or subfloor.
- E. Ceiling Insulation and Soffit Insulation:
  - 1. Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
  - 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. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
  - 3. In areas where suspended ceilings adjoin areas without suspended ceilings, install blanket, batt, or mineral fiberboard extending from the suspended ceiling to

underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

### **3.5 ACOUSTICAL INSULATION**

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.

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## **SECTION 07 21 29 SPRAY FOAM INSULATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies spray foam thermal insulation for buildings.

#### **1.2 RELATED WORK**

- A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing Insulation: Section 07 84 00, FIRESTOPPING.

#### **1.3 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

#### **1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT**

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conservation/cpg/products/>.
  2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
  3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material

selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

### **1.5 PERFORMANCE REQUIREMENTS**

- A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

### **1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: For each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed and meet or exceed specified requirements.

### **1.7 SUSTAINABLE DESIGN CERTIFICATION**

- A. Provide third party certified product in accordance with ULE GREENGUARD, SCS Global Indoor Advantage Certification or equal; certification must be current and performed annually.
- B. Provide documentation to demonstrate fiberglass insulation does not contain urea-formaldehyde.

### **1.8 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Manufacturer with a minimum of ten years of experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years of experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish area designated for mock-up.
  - 2. Do not proceed with remaining work until workmanship is approved.
  - 3. Refinish mock-up area as required to produce acceptable work.
  - 4. Approved mock-up may remain as part of completed work.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging clearly labeled with manufacturer's product information.
- B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).
- C. Handling: Handle Materials to avoid damage of packaging and contents.

## 1.10 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
  - C117 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
  - C270 Mortar for Unit Masonry
  - C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - C553-11 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - C578-12b Rigid, Cellular Polystyrene Thermal Insulation
  - C591-12b Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - C665-12 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  - C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
  - D312-00(R2006) Asphalt Used in Roofing
- C. Scientific Certification Systems (SCS Global): SCS Indoor Advantage certification.

- D. UL Environment, GREENGUARD (ULE GREENGUARD): The GREENGUARD Product Guide (online)

## **PART 2 - PRODUCTS**

### **2.1 BASIS OF DESIGN**

- A. Basis of Design: CertainTeed Corp., Insulation Group, 750 E. Swedesford Road, Valley Forge, PA. 19482; phone 800-233-8990; [www.certainteed.com/products/insulation](http://www.certainteed.com/products/insulation).

### **2.2 SPRAY FOAM INSULATION**

- A. Basis of Design Insulation: HFC-blown type Closed Cell Foam: CertainTeed CertaSpray Closed Cell Foam of medium density, MDI-based polyurethane thermoset rigid foam with an in-place core density of 1.9 – 2.2 pcf.
- B. Physical and Mechanical Properties:
1. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
  2. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft<sup>2</sup>- degrees F)/Btu.
  3. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft<sup>2</sup>- degrees F)/Btu.
  4. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
  5. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
  6. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
  7. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
  8. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 1626 at 75 degrees F/95 percent RH, 28 Day.
  9. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
  10. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m<sup>2</sup>.
  11. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.

C. Fire Performance:

1. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
2. Smoke: Less than 450 when tested in accordance with ASTM E 84.

D. Thermal Performance (aged): Tested in accordance with ASTM C 518 and/or ASTM C 177 at 75 degrees F (24 degrees C) mean temperature.

1. Thickness 2 inches (51 mm) minimum, R-Value 11.6 (h-ft<sup>2</sup>-degreesF)/Btu (2.0(m<sup>2</sup>-degreesC)/W).

## **2.8 BLOCKING AROUND HEAT PRODUCING DEVICES**

- A. Provide non-combustible blocking around heat producing devices to provide the clearances as recommended by spray foam material manufacturer or as listed below.
1. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm 24 inches above fixture.
  2. Vents and vent connectors used for venting products of combustion, flues, and chimneys: minimum clearances as required by NFPA 211.

## **PART 3 - EXECUTION**

### **3.1 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.
- B. Do not apply insulations when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.
- C. Surfaces must be dry prior to application of spray foam insulation. Excess humidity may cause poor adhesion, and result in product failure.
- D. to avoid overspray, product should not be applied when conditions are windy.

### **3.2 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.

- D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulations.
- E. If substrate preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

### **3.3 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. Mask and protect adjacent surfaces from overspray or dusting.

### **3.4 INSTALLATION**

- A. Install spray foam insulation in accordance with manufacturer's printed instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
- B. Apply spray foam insulation by spray method, to uniform monolithic density without voids.
- C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled in this section.
- D. Apply to a minimum cured thickness of 2 inches.
- E. Apply spray foam insulation to seal voids at truss ends to prevent wind scouring of ceiling insulation where applicable.
- F. Apply to seal voids around plumbing stacks, electrical wiring and other penetrations to control air leakage.
- G. Apply to seal voids around doors and windows. Apply to fill voids around accessible service and equipment penetrations.
- H. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.
- I. Where building is designed to meet the specific air tightness standards of the Energy Star Program, apply spray foam insulation as recommended by manufacturer to provide airtight construction. Apply sealant to joints between structural assemblies as specified in Division 7.
- J. Patch damaged areas as required.

### **3.5 FIELD QUALITY CONTROL**

- A. Inspection will include verification of insulation and density.

### **3.6 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion at no additional expense to Owner.

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## **SECTION 07 22 00 ROOF AND DECK INSULATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Installation of roof and deck insulation, and vapor retarder on new construction ready to receive roofing or waterproof membrane.
- B. Repairs and alteration work to existing roof insulation.

#### **1.2 RELATED WORK**

- A. Wood blocking and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Perimeter, rigid, and batt or blanket insulation: Section 07 21 13, THERMAL INSULATION.
- C. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

#### **1.3 QUALITY CONTROL**

- A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisor's qualification.
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Asphalt materials, each type
  - 2. Roofing cement, each type
  - 3. Roof insulation, each type
  - 4. Fastening requirements
  - 5. Insulation span data for flutes of metal decks
- C. Samples:
  - 1. Roof insulation, each type
  - 2. Nails and fasteners, each type
- D. Certificates:
  - 1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).

2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

- E. Laboratory Test Reports: Thermal values of insulation products.
- F. Layout of tapered roof system showing units required.
- G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

### **1.5 DELIVERY, STORAGE AND MARKING**

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weather tight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.
  1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.
  2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.
- C. Protect from damage from handling, weather and construction operations before, during, and after installation.

### **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. American Society for Testing and Materials (ASTM):

C1289-10 .....	Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
D41-11 .....	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D312-00(R2006).....	Asphalt Used in Roofing
D2178-04 .....	Asphalt Glass Felt Used in Roofing and Waterproofing
D2822-05(R2011).....	Asphalt Roof Cement
D4897-01(2009) .....	Asphalt Coated Glass Fiber Venting Base Sheet
- C. Factory Mutual Global (FM):

4450-89 .....	Approved Standard for Class 1 Insulated Steel Deck Roofs
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D. National Roofing Contractors Association (NRCA):

The NRCA Roofing and Waterproofing Manual - Fifth Edition (2009).

E. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2009)

**1.7 QUALITY ASSURANCE:**

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.
  - 1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.
  - 2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."
  - 3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

**PART 2 - PRODUCTS**

**2.1 ASPHALT MATERIALS**

- A. Primer: ASTM D41.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Glass (Felt): ASTM D2178, Type IV, heavy duty ply sheet.
- D. Venting Asphalt Base Sheet: ASTM D4897, Type I or Type II.
- E. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

**2.2 INSULATION**

- A. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.
- B. Tapered Roof Insulation System Segments:
  - 1. Fabricate of mineral fiberboard, isocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections.

2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

## 2.3 FASTENERS

- A. Fasteners for securing insulation to steel decks:
1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
  2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.
  3. Antibackout thread design.
  4. Have a pullout resistance of 14 kg (30 pounds) minimum.

## 2.4 RECOVERED MATERIALS

- A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Rock wool material	75 percent recovered material

- B. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.
- B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.
- C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

- D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.
- E. Do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 ☒C (50 ☐F) or less. ~~Do not apply materials to substrate having temperature of 10~~
- F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

### 3.2 SURFACE PREPARATION

- A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- B. Remove projections that might damage materials.

### 3.3 INSULATION THICKNESS

- 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than specified.
- 2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.
- 3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the NCA.
- 4. Tapered insulation shall be preformed and fabricated to the slopes indicated.
- 5. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

### 3.5 INSTALLATION OF INSULATION

- A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.
- B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- C. Cover all insulation installed on the same day by either:

1. The roofing membrane as specified.
  2. Temporary protection as specified.
- D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- E. Cut to fit tight against blocking or penetrations.
- F. Over Vapor Retarder: Lay insulation in hot bitumen as specified.
- G. Steel Deck:
1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
  2. Mechanically anchor first layer of insulation to steel deck to conform to FM Class 1-60, Insulated Steel Roof Deck.
  3. Locate the long dimension edge joints to have solid bearing on top of deck ribs; do not cantilever over deck rib openings or flutes.

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**SECTION 07 31 26**  
**POLYMERIC SLATE TILE ROOFING SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies polymeric slate tile roofing system secured to wood or plywood sheathing.

**1.2 RELATED WORK**

- A. Flashing at projections through roof and other flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- B. Slate color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY ASSURANCE**

- A. Basis of Design roofing system requires the use of manufacturer supplied products where available for use with the specified roofing system.
- B. There must be no deviations made from the manufacturer's written specifications, manufacturer approved shop drawings and submittals without the prior written approval of roofing system manufacturer.
- C. Upon completion of roofing system installation, the authorized roofing contractor must contact roofing system manufacturer's warranty coordinator to arrange for an inspection to be conducted by the manufacturer's Field Service Representative to ascertain that the roofing system has been installed according to the manufacturer's published specifications and details applicable at the time of installation. This inspection is for the benefit of the manufacturer to determine whether a warranty shall be issued.
- D. It is the authorized roofing contractor's responsibility to adhere to all applicable building codes (local and national) and to have or acquire the appropriate licenses and permits for the roofing system installation requirements and limitations in their local areas applicable at the time of installation.
- E. Authorized roofing contractor to submit a manufacturer Pre-Project Survey to manufacturer technical department for approval prior to project bid and the job start to enable the technical department to approve and assign a job number to the project.
  - 1. The manufacturer's Pre-Project Survey form must be filled out completely and accurately to include and prior deviations approved from this specification, including a roof drawing showing all dimensions, all penetrations and roof slope.

2. Authorized roofing contractor to comply with all manufacturer requirements for acquiring manufacturer material and roofing system warranty coverage.

### **1.3 INSTALLERS QUALIFICATIONS**

The Roofing Contractor shall be experienced in the installation of specified roofing system and be an authorized roofing contractor as recognized by the roofing system manufacturer. The Roofing Contractor upon request shall provide the names and addresses of three successfully completed projects of comparable size and scope.

### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Slate, not less than two, 300 mm (12 inches) square. Submit enough samples to show the range and extremes of color and texture.
- C. Certification: Certify that the roofer is experienced in polymeric slate tile roofing work. When required by the Resident Engineer, provide project names as specified in Paragraph, INSTALLERS QUALIFICATIONS.

### **1.5 WARRANTY**

- A. Warranty materials and workmanship are to be free from defects and leaks for two years in accordance with requirements of Article "Warranty of Construction", FAR clause 52.246-21.

### **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. American Society for Testing and Materials (ASTM):
  - C406-10 ..... Roofing Slate
  - D226-09 ..... Asphalt Saturated Organic Felt Used in Roofing and  
Waterproofing
  - F1667-11 ..... Driven Fasteners: Nails, Spikes and Staples
- C. Underwriters Laboratory (UL):
  - Class A and C Fire Resistance – UL 790 Test Standard
  - Class 4 Impact Resistance – UL 2218 Test Standard
  - Wind Driven Rain – PA100-95 Test Standard
  - Wind Uplift – UL 1897 Test Standard or UL 580



## **1.7 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in original unopened packages.
- B. Packages shall be labeled with manufacturer's name, brand name and identification of various items.
- C. Specified product may not be installed if the tiles have been stored in temperatures lower than 45 degree Fahrenheit. If tiles have been stored in temperatures below 45 degrees Fahrenheit, tiles must be brought back to a material temperature of 45 degrees Fahrenheit. As the temperature rises, specified tiles will expand beyond the designated installation pattern if the product is installed while cold or frozen.
- D. Store all materials in a dry protected area. Damaged materials must not be used. Installed materials found to be damaged shall be replaced at authorized roofing contractor's expense.

## **1.8 JOB CONDITIONS**

- A. Authorized roofing contractor to contact tile roofing system manufacturer's technical department for procedures when installing slate tile roofing system during temperatures lower than 45 degrees Fahrenheit.
- B. Roofing surface must be free of ice, water, or snow prior to and during roofing project.
- C. Decking materials must be dimensionally stable prior to installing slate tile roofing system. If the materials are not dry, manufacturer recommends installing the underlayment and allowing the roof to dry out before installing slate roofing tiles.
- E. It is the authorized roofing contractor's responsibility to ensure the proper blending and bending of slate tiles occurs. When improper bending occurs, the aesthetic appearance of the roof can be affected negatively. All materials required for project completion should be on site to blend from. Contact slate roof tile manufacturer customer service for available factory-blended options.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Polymeric Slate Tile Roofing System
  - 1. Basis of Design: Majestic Slate Polymeric Slate Tile Roofing System as manufactured by EcoStar, LLC, 42 Edgewood Drive, Holland, NY 14080. (phone) 1-800-211-7170, (fax) 1-888-780-9870, [www.ecostarllc.com](http://www.ecostarllc.com).
  - 2. Polymeric slate tile roofing system is a rubber and plastic-based roof tile designed to provide the look of natural stone slate. Polymeric slate tile is manufactured with a state of the art formulation using recycled polyolefin polymers. Polymeric slate tile to

be supplied in either 10 inch or 12 inch wide by 18 inch long by nominal 1/4 thickness.

- B. Tile Design: Traditional.
- C. Fasteners: Fasteners for Glacier Guard underlayment to be corrosive resistant, plastic capped roofing nails with a minimum plastic cap diameter of 1 inch. Fasteners shall be 90 degree to the roof deck and shall not be under or over driven. Fasteners for slate roofing tile to be ring shank stainless steel with a 3/8 inch diameter head and a minimum of 1-1/2 inch long shank. Nails can be supplied in a hand-drive style or in coils for use in pneumatic tools.
- D. Substrate: Minimum 1/2 inch plywood or 7/16 inch OSB decking properly gapped for expansion, or 3/4 inch tongue and groove decking with end caps not exceeding 1/4 inch, and board widths not exceeding 6 inches.
- E. Slope: Polymeric slate tile roofing system is not recommended for slopes less than 3/12. On roofs less than 6/12 and greater than 3/12, tile roofing system must be installed with a maximum exposure of 6 inches. On roofs 6/12 or greater, tile roofing system may be installed with either a 6 inch, 6-1/2 or 7 inch exposure.
- F. Underlayment: Prior to installation, Glacier Guard underlayment to be applied to all rakes, valleys, ridges, hips, eaves and any protrusions. Aqua Guard is then applied over the remaining deck surface. Glacier Guard ice and water underlayment is a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer or coated with a granular surface providing maximum skid resistance. The slate tile roofing system manufacturer is to recommend the appropriate type of Glacier Guard material for use on this project.
- G. Roofers Plastic Cement and Sealing Materials: As manufactured for the purpose and approved by the polymeric slate tile roofing system manufacturer to be compatible with specified slate tile roofing system. Color shall match slate tile. If local codes require the use of shingle sealant, the only material approved for use with specified slate tile roofing assembly is Dow Corning 790 silicone sealant.
- H. Copper Snow Guards: As manufactured and supplied by slate tile roofing system manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. The authorized roofing system contractor to examine roof structure for suitable framing conditions and proper installation of roof decking underlayment.

1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the polymeric slate tile roofing system installation.
2. Proceed with the installation only after unsatisfactory conditions have been corrected. Start of installation indicates full acceptance of existing conditions.

### **3.2 ROOFING SYSTEM UNDERLAYMENT**

- A. Follow polymeric slate tile roofing system manufacturer's published installation instructions for placement of roofing system underlayment. Place underlayment on a dry, sound deck substrate. Lap underlayment in direction of water flow. Authorized roofing contractor to field verify appropriate clearance on underside of decking or sheathing for proper penetration of all fasteners.
- B. Glacier Guard Underlayment:
  1. Lap end joints 6 inches and side joints 3-1/2 inches.
  2. Apply continuous 36 inch wide sheet in valley centered over valley.
  3. Apply rows of 36 inch sheets along and around all dormers and roof protrusions.
  4. When applicable, install as far up as it can be installed on any head walls or vertical walls a minimum of 12 inches where possible.
  5. Do not leave Glacier Guard Granular Surface (100) exposed to weather more than 30 days after beginning of installation. Do not leave Glacier Guard Smooth Surface High Temp (300) exposed to the weather more than 60 days after beginning of installation.
  6. Installing of Glacier Guard at temperatures below 40 degrees Fahrenheit may require nailing or priming to hold membrane in place while adhesion develops.

### **3.3 INSTALLING SLATE TILE**

- A. Follow polymeric slate tile roofing system manufacturer's published installation instructions for starting and placement of slate tile roofing.
- B. Using measurement lines integral to slate tiles, begin installing tiles per specified pattern.
- C. After installing underlayment and before installing slate tile roofing system, clean the surface of debris and dirt.
- D. Care must be taken to place tiles so shade variations are evenly distributed over the entire roof area. Shade variation will occur differently from pallet to pallet of tile material and within pallets. Tiles between bundles and pallets must be blended to ensure even distribution of shade variations. Shade "mapping" or "blotching" in appearance is not acceptable and the authorized roofing contractor will be required to correct. It is recommended that work not begin until all materials have been delivered to the job site

so that all the material may be blended together. Periodic ground inspections should be conducted to ensure a random shade pattern to the installation. Authorized roofing contractor to contact the tile manufacturer for correct blending procedures or available factory-blended options.

- E. Minimum Fastening: No less than two (2) ring shank fasteners per tile shall be used with a minimum length of 1-1/2 inches. Fasteners should be installed at the designated “nail here” marks on the tile. Failure to fasten the tile at these locations may result in a “lifted” tile. Caution should be used with pneumatic nailer to ensure that nails are not over driven causing the tiles to curl upward. If tiles have been installed with over driven nails causing ends of the tile to curve upward, tiles will never lay flat. Tiles with overdriven nails must be removed and renailed properly. Never hold tiles from behind while nailing, as this will cause upward curl of the tile.
- F. Do not install tiles against each other. A minimum gap of 3/8 inch must be maintained between installed tiles. A minimum 3/8 inch gap must be maintained between installed tiles and any sidewalls or roof protrusion.
- G. Beginning at the eave, install a starter row of slate roofing tiles gapped a minimum of 3/8 inch between tiles and any protrusions while achieving a 3/4 inch overhang with two ring shank fasteners per tile (in location shown on tiles). This layer of tiles will become the starter row. The final tile at the roof edges must be a minimum of 3 inches wide. This may involve cutting the tile to fit. To cut the tile to correct width simply score the back of the tile with a straight edge and utility knife and snap tile at the score. Install first course of tiles in the same manner as the starter row. The first course of tiles should be installed flush with the starter row with no exposure.
- H. After the initial starter and first row of tiles has been installed, it is recommended that a chalk line be placed parallel to the roof edge running perpendicular to the first row of tiles. This chalk line will ensure that the tiles stay true and plumb to the roof edge throughout installation. Never use red chalk as this will permanently stain the roof tiles.
- I. Continue installing tile courses up the roof slope now achieving the correct chosen exposure. It is recommended that chalk lines be placed horizontally up the roof slope for every tile course. This will ensure that each course is installed straight across the roof surface.
- J. It is the responsibility of the authorized roofing contractor to ensure that each tile has been flexed to provide a downward curve prior to tile fastening. Do not install tiles with upward curve.

- K. Valley Areas: Either an open or closed valley design may be used.
  - 1. With an open valley design leave a minimum of 2 inches on each side of the center of the valley exposed and uncovered by the roof tiles. A V-style, W-style, or double W-style valley metal should be used.
  - 2. With a closed valley design cut the tiles in a straight line to fit no closer than 3/8 inches against tile of adjoining roof slopes or standing seam metal roofing system of adjoining roof slopes. A closed valley design to be used at valleys that are shared with standing seam metal roofing system of adjoining roof slopes with a minimum separation of 4 inches between different roofing materials centered on valley.
- L. Install slate tile roofing system universal hip and ridge tiles at all hip locations. Manufacturer recommends a chalk line be snapped up the hip line to ensure a straight application up the roof surface. Universal hip and ridge tiles are always installed at a 6 inch exposure.
- M. Care must be taken to minimize foot traffic over completed areas of the roof. Tiles will show mud and dirt causing appearance problems. The removal of dirt and debris is the responsibility of the authorized roofing contractor. Never use chemical cleaning agents not approved by the manufacturer to wash a slate roofing tile assembly.
- N. Slate roofing tiles can be slippery when wet; caution should be exhibited with early morning dew and after rain. Manufacturer recommends the use of tow boards and OSHA approved harnesses and safety equipment at all times.

### **3.4 INSTALLING FLASHING AND SHEET METAL**

- A. Install sheet metal and flashing metal in all valleys and where required. Manufacturer recommends a V-type, W-type, or Double W-type metal valley flashing. Where required, install metal edging at all eaves and roof edges.

### **3.5 INSTALLING COPPER SNOW GUARDS**

- A. Slate tile roofing system manufacturer approved nails must be used with the manufacturer supplied snow guards to ensure proper attachment of the snow guard bracket.
- B. Ensure the snow guard bracket is low enough on the roof tile to accommodate the next row of tiles above it. The bottom edge of the next row of tiles must be no closer than 1/2 inch to the top of the vertical bracket surface.
- C. Place the snow guard bracket so as not to be directly in line with the space between the tiles above.

- D. Copper snow guards to be spaced a maximum of 24 inches on center horizontal. Snow guards to be provided for a total of 5 horizontal rows across the entire slate tile roofing surfaces. Start first row of snow guards a minimum of 5 courses above the lower roof edge and place subsequent rows at every other horizontal slate tile course for a total of five rows of copper snow guards.
- E. Attach copper snow guards with four (4) 2 inch stainless steel ring shank nails in compliance with tile manufacturers published installation details. Ensure nails are properly seated to avoid protrusion under the upper tile.

### **3.6 FIELD QUALITY CONTROL**

- A. Ensure that polymeric slate tile roofing system manufacturer has been contacted and roofing system installation has been inspected as required for compliance with manufacturer's warranty requirements.

### **3.7 ADJUSTING AND CLEANING**

- A. Remove temporary protective coverings and strippable films, if any, as required by tile roofing system manufacturer.
- B. Adjust and or repair all items and conditions found to be non-compliant with manufacturers published installation instructions or field inspection.
- C. On completion of tile roofing system installation, clean all exposed surfaces as recommended by tile roofing system manufacturer. Remove and properly dispose of all trash and debris from project site.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturer.
- E. Replace any items or components found to be damaged or in non-compliance with tile roofing system manufacturer's published installation instructions at no additional expense to owner to maintain tile roofing system manufacturer's warranty compliance.
- F. Phased roofing – The weathering process of the specified slate tile roofing system will begin immediately upon installation and exposure to the elements. Therefore, every effort should be made to ensure that the roof assembly is installed at a continuous rate to completion. Lengthy delays in installation may result in appearance differences when installation is resumed and tiles that have not been exposed to the elements are installed adjacent to tiles that have been on the roof for an extended period of time and will not be acceptable to owner.

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## **SECTION 07 41 13 STANDING SEAM METAL ROOFING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies the installation of pre-formed standing seam roofing panels with double roll formed field seam.

#### **1.2 RELATED WORK**

- A. Sealant: Section 07 92 00, JOINT SEALANTS.
- B. Fascia and Trim: 07 60 00, FLASHING AND SHEET METAL.

#### **1.3 DESIGN REQUIREMENTS**

- A. Provide panels in continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets must be in continuous contact from eave to ridge.
- B. There cannot be exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners into steel must be stainless steel, zinc cast head, or cadmium plated steel screws inserted into predrilled holes.
- C. Field-formed seam type system must be mechanically locked closed by the manufacturer's locking tool.
- D. Roof panel anchor clips must be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Provide for lateral thermal movement in panel configuration or with clips designed for lateral and longitudinal movement.
- E. Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 1. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E1592.
  - 2. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class; design and size components to withstand positive and negative wind loads, including increased loads at building corners as calculated according to local jurisdiction and ASCE 7.

3. Deflection: Provide panels capable of supporting design loads between unsupported spans with deflection of not greater than  $L/180$  of the span.
- F. Single Source: Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; be the latest design by the manufacturer; and have been designed by the manufacturer to operate as a complete system for the intended use.
- G. Energy Performance, Energy Star: Provide roofing finish system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" or listed on Cool Roof Rating Council (CRRC) product list.

#### **1.4 INSTALLATION REQUIREMENTS**

- A. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.
- B. Install in accordance with SMACNA Architectural Sheet Metal Manual except as otherwise shown or specified.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, details of construction, flashing, and fastenings.
- C. Provide design calculations prepared by a professional engineer specializing in structural engineering verifying that system supplied and any additional framing meets design load criteria indicated. Coordinate calculations with manufacturer's test results. Include calculations for:
  1. Wind load uplift design pressure at roof locations.
  2. Clip spacing and allowable load per clip.
  3. Fastening of clips to structure or intermediate supports.
  4. Intermediate support spacing and framing and fastening to structure when required.
  5. Allowable panel span at anchorage spacing indicated.
  6. Safety factor used in design loading.
  7. Governing code requirements or criteria.



8. Edge and termination details.

- D. Installer Qualifications: Document installer is factory-trained, approved by the metal roofing system manufacturer to install the system, and has a minimum of three years' experience as an approved applicator with that manufacturer. The applicator must have applied five installations of similar size and scope as this project within the previous 3 years.

## **1.6 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content requirements.

## **1.7 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT**

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conservation/tools/cpg/products/>.
  2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
  3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

## **1.8 WARRANTY**

- A. Roofing work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

## **1.9 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable

provisions and recommendations of the following, except as otherwise shown or specified.

B. American Architectural Manufacturer Association (AAMA):

AAMA 621-02	High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
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C. American Society for Testing and Materials (ASTM):

A463/A463M-09	Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
C920-11	Elastomeric Joint Sealants
E1514-98(2011)	Structural Standing Seam Steel Roof Panel Systems
E1592	Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

D. American Society of Civil Engineers (ASCE):

ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
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E. Cool Roof Rating Council (CRRRC):

CRRRC-1-10	Product Rating Program, <a href="http://www.coolroofs.org">www.coolroofs.org</a>
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F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

Architectural Sheet Metal Manual 2012

G. Underwriters Laboratory (UL):

UL 580, 2006 Edition	Tests for Uplift Resistance of Roof Assemblies
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H. U.S. Department of Energy (DoE):

Roof Products Qualified Product List, [www.energystar.gov](http://www.energystar.gov)

## **PART 2 - PRODUCTS**

### **2.1 METAL ROOF PANEL**

- A. Aluminum-Zinc Alloy Coated Sheet Steel conforming to ASTM A463 and coated on both sides with 0.5 ounce of aluminum per square foot (0.15 Kg/sm); minimum 0.6 mm (24 gage) base metal thickness.
- B. Conform to ASTM E1514.
- C. Factory formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated, and

mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for a weathertight installation.

D. Panel Coverage: 406 mm (16 inches).

E. Seam Height: Minimum 44 mm (1-3/4 inch).

## **2.2 SEALANTS**

A. Field-applied: ASTM C920.

B. Type, Grade, and Class as recommended in writing by the manufacturer.

## **2.3 SEALANT TAPE**

A. Pressure sensitive, 100 percent solids, Gray Polyisobutylene compound with release-paper backing.

B. 12 mm (1/2 inch) wide x 3 mm (1/8 inch) thick.

## **2.4 UNDERLAYMENT**

A. Self-Adhering with reinforcing scrim, High-Temperature Sheet: Minimum 50 thick minimum, consisting of slip-resisting top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

## **2.5 FASTENERS**

A. Self-drilling, or self-tapping zinc plated hex head carbon-steel screws with EPDM washer or stainless steel cap.

B. Concealed Standard Anchor Clips: Clips base must be minimum 1.2 mm (18 gauge) galvanized steel with 0.7 mm (22 gage) galvanized or stainless steel sliding top. Clips must be two (2) piece design; one-piece clips are not acceptable.

## **2.6 FINISHES**

A. Factory finished complying with SMACNA's recommendations for applying and designating finishes.

B. Exterior Finish:

1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

2. Coating system must provide nominal 0.025 mm (1.0 mil) dry film thickness, consisting of primer and color coat.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.0125 mm (0.5 mil).

C. Color: As indicated.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.
  - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Install fascia and trim.

### **3.3 METAL ROOF PANEL INSTALLATION, GENERAL**

- A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cutting of metal roof panels by torch is not permitted.
  - 2. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction; predrill panels.
  - 3. Provide metal closures at peaks, rake walls and each side of ridge and hip caps.
  - 4. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
  - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 6. Install ridge and hip caps as metal roof panel work proceeds.
  - 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

**B. Fasteners:**

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

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

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

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

### **3.4 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION**

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

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer.

### **3.5 ACCESSORY INSTALLATION**

**A. General:** Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Details of installation which are not indicated must be in accordance with the SMACNA, panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

- B. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

### **3.6 ERECTION TOLERANCES**

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

### **3.7 CLEANING AND PROTECTION**

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures at no additional expense to owner.

- - - E N D - - -

**SECTION 07 52 16**  
**STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies modified bituminous sheet roofing and base flashing installed using hot-applied asphalt on new construction with solar reflective granular coating.
- B. Repairs and alteration work, including temporary roofs.

**1.2 RELATED WORK**

- A. Wood cants, blocking and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Roof Insulation under Membrane: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Vapor barrier: Section 07 22 00, ROOF AND DECK INSULATION.
- D. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Miscellaneous items: Section 07 72 00, ROOF ACCESSORIES.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03                      Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):  
ASCE/SEI-7-10                      Minimum Design Loads for Buildings and Other Structures
- D. Asphalt Roofing Manufacturers Association/National Roofing Contractors Association (ARMA/NRCA):  
Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing
- E. ASTM International (ASTM):  
C67-12                      Sampling and Testing Brick and Structural Clay Tile  
C140-13                      Sampling and Testing Concrete Masonry Units and Related Units

C1371-04a(2010)e1	Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
C1549-09	Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
D146/D146M-04(2012)e1	Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
D312-00(2006)	Asphalt Used in Roofing
D1644-01(2012)	Nonvolatile Content of Varnishes
D2823/D2823M-05(2011)e1	Asphalt Roof Coatings, Asbestos Containing
D3960-05	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
D4073-06(2013)	Tensile-Tear Strength of Bituminous Roofing Membranes
D4263-83(2012)	Indicating Moisture in Concrete by the Plastic Sheet Method
D4586/D4586M-07(2012)e1	Asphalt Roof Cement, Asbestos Free
D4601/D4601M-04(2012)e1	Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
D4897/D4897M-01(2009)	Asphalt Coated Glass Fiber Venting Base Sheet Used in Roofing
D5147/D5147M-11a	Sampling and Testing Modified Bituminous Sheet Material
D6162-00a(2008)	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
D6163-00(2008)	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
D6164/D6164M-11	Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
D6511/D6511M-06(2011)e1	Solvent Bearing Bituminous Compounds
E108-11	Fire Tests of Roof Coverings
E408-71(2008)	Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
E1918-06	Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field



- E1980-11                      Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- WK29032                      Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
- F. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):  
ASHRAE 90.1-2010                      Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix f.
- G. Cool Roof Rating Council:  
CRRC-1                      Product Rating Program, [www.coolroofs.org](http://www.coolroofs.org)
- H. FM Approvals: RoofNav Approved Roofing Assemblies and Products:  
4450-89                      Approved Standard for Class 1 Insulated Steel Deck Roofs  
4470-10                      Approved Standard for Class 1 Roof Coverings  
1-28-09                      Loss Prevention Data Sheet: Design Wind Loads.  
1-29-09                      Loss Prevention Data Sheet: Above-Deck Roof Components  
1-49-09                      Loss Prevention Data Sheet: Perimeter Flashing
- I. National Roofing Contractors Association: Roofing and Waterproofing Manual
- J. U.S. Environmental Protection Agency (EPA):  
EPA 600/R13/116-02                      Method for the Determination of Asbestos in Bulk Building Materials
- K. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog, [www.biopreferred.gov](http://www.biopreferred.gov)
- L. U.S. Department of Energy (DoE): Roof Products Qualified Product List, [www.energystar.gov](http://www.energystar.gov)

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
3. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.
  - a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to demonstrate compliance as indicated in ASHRAE 90.1-2010 Addendum f.
  - b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft<sup>2</sup> (12 W/m<sup>2</sup>K).

## **1.5 QUALITY CONTROL**

### **A. Installer Qualifications:**

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

### **B. Inspector Qualifications:** Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector must be one of the following:

1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

### **C. Product/Material Requirements:**

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
2. Provide manufacturer's label on each container or certification with each load of bulk bitumen, indicating Flash Point (FP), Finished Blowing Temperature (FBT), Softening Point (SP), Equiviscous Temperature (EVT).
3. Provide manufacturer's certification that field applied bituminous coatings and mastics, and field applied roof coatings comply with limits for Volatile Organic Compounds (VOC) per the National Volatile Organic Compound Emission Standards for Architectural Coatings pursuant to Section 183(e) of the Clean Air Act with limits as follows:
  - a. Bituminous Coatings and Mastics: 500 g/l (4.2 lb/gal.).
  - b. Roof Coatings: 250 g/l (2.1 lb/gal.).

D. Roofing System Design Standard Requirements:

1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
3. Recommendations of ANSI/SPRI ES-1 for roof edge design.
4. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
  - a. Corner Uplift Pressure: 1.44 kPa/sq. m (30 lbf/sq. ft.).
  - b. Perimeter Uplift Pressure: 5.74 kPa/sq. m (90 lbf/sq. ft.).
  - c. Field-of-Roof Uplift Pressure: 0.96 kPa/sq. m (20 lbf/sq. ft.).
5. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
  - a. Fire/Windstorm Classification: Class 1A-60.
  - b. Hail Resistance: MH

E. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and COTR.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
3. Inspect roof deck at this time to:
  - a. Verify that work of other trades which penetrates roof deck is completed.
  - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
  - c. Examine samples and installation instructions of manufacturer.

## **1.6 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, and certified wood requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

## **1.7 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
  1. Asphalt and adhesive materials.
  2. Modified bituminous sheet roofing and flashing membrane.
  3. Roofing cement.
  4. Roof walkway.
  5. Fastening requirements.
  6. Application instructions.

- C. Samples:
  - 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Base flashings and terminations.
- E. Certificates:
  - 1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
  - 2. Indicating compliance with load/strain properties requirement.
  - 3. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.
- G. Documentation of supervisors' and inspectors' qualifications.
- H. Field reports of roofing inspector.
- I. Contract Close-out Submittals:
  - 1. Maintenance Manuals.
  - 2. Warranty signed by installer and manufacturer.

## **1.8 PRE-INSTALLATION CONFERENCE**

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

## **1.9 DELIVERY, STORAGE AND MARKING**

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation.

## **1.10 ENVIRONMENTAL REQUIREMENTS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

## **1.11 WARRANTY**

- A. Roofing work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend warranty period to 25 years from acceptance of facility by the NCA.

## **PART 2 - PRODUCTS**

### **2.1 ADHESIVE AND ASPHALT MATERIALS**

- A. General: 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.
  - 1. Liquid-type auxiliary materials must comply with VOC limits of authorities having jurisdiction.
  - 2. Adhesives and sealants that are not on the exterior side of weather barrier must comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Multipurpose Construction Adhesives: 70 g/L.
    - b. Contact Adhesives: 80 g/L.
    - c. Other Adhesives: 250 g/L.
    - d. Non-membrane Roof Sealants: 300 g/L.
    - e. Sealant Primers for Nonporous Substrates: 250 g/L.
    - f. Sealant Primers for Porous Substrates: 775 g/L.
- B. Water-Based Asphalt Primer: Water-based, polymer modified, asphalt primer with the following physical properties:
  - 1. Asbestos Content, EPA 600/R13/116: None.
  - 2. Non-Volatile Content, minimum, ASTM D2823: 30 percent.
  - 3. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 65 g/L.
- C. Asphalt: ASTM D312, Type III or IV for roof membrane.
- D. Cold-Applied Adhesive for Membrane Flashing: One-part, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
  - 1. Asbestos Content, EPA 600 R13/116: None.
  - 2. Volatile Organic Compounds (VOC), maximum, ASTM D6511: <250 g/L.
  - 3. Nonvolatile Content, minimum, ASTM D6511: 75 percent.
  - 4. Uniformity and Consistency, ASTM D6511: Pass.
- E. Roof Cement: ASTM D4586, Type II.

## 2.2 MEMBRANE AND SHEET MATERIALS

- A. Membrane Materials, General: Provide combination of base, ply, and cap sheet materials that have been tested in combination and comply with load/strain properties performance requirement in Part 1 of this Section.
- B. Base Sheet: ASTM D4601, Type II, non-perforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:
  - 1. Breaking Strength, minimum, ASTM D146: cross machine direction, 12.2 kN/m (70 lbf/in).
  - 2. Pliability, 12.7 mm (1/2 inch) radius bend, ASTM D146: No failures.
- C. Membrane Ply Sheet: ASTM D6163, Grade S, Type II or III, glass-fiber-reinforced, SBS/SEBS-modified asphalt sheet, or ASTM D6162, Grade S, Type II or III, SBS/SEBS-modified asphalt sheet; smooth surfaced; suitable for application method specified, with the following minimum properties:
  - 1. Tensile Strength at 23 deg. C (73 deg. F), minimum, ASTM D5147: cross machine direction, 21 kN/m (120 lbf/in).
  - 2. Tear Strength at 23 deg. C (73 deg. F), minimum, ASTM D5147: cross machine direction 890 N (200 lbf).
  - 3. Elongation at 23 deg. C (73 deg. F), minimum, at 5 percent maximum load ASTM D5147: cross machine direction, 40 percent.
- D. Membrane Cap Sheet: ASTM D6163, Grade G, Type II, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced with a factory applied, white, reflective, acrylic coating; CRRC listed and California Title 24 Energy Code compliant; and as follows:
  - 1. Exterior Fire-Test Exposure, ASTM E108: Class A.
  - 2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 12.2 kN/m (70 lbf/in).
  - 3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 440 N (100 lbf).
  - 4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 7.5 percent.
  - 5. Low Temperature Flex, maximum, ASTM D5147, -26 deg. C (-15 deg. F).
  - 6. Reflectance, ASTM C1549: 71 percent.
  - 7. Thermal Emittance, ASTM C1371: 0.87.
  - 8. Solar Reflectance Index (SRI), ASTM E1980: 87.

- E. Base Flashing Backer Sheet: ASTM D4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- F. Base Flashing Sheet: ASTM D6164, Grade G, Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; Granule Color: White.

## **2.3 FASTENERS**

- A. Roofing Fasteners: Factory-coated steel fasteners and metal or plastic plates, where applicable, meeting requirements of FM Approvals 4470, tested by fastener manufacturer for required pullout strength, and recommended by roofing manufacturer for application.
- B. Accessory Fasteners: Corrosion-resistant fasteners compatible with adjacent materials and recommended for application by manufacturer of component to be fastened.

## **2.4 ROOF WALKWAY**

- A. Prefabricated asphalt plank consisting of a homogeneous core of asphalt, plasticizers and inert fillers, bonded by heat and pressure between two saturated and coated sheets of felt:
  - 1. Top side of plank surfaced with ceramic granules. Granule Color: White.
  - 2. Size: Minimum 13 mm (1/2-inch) thick, manufacturer's standard size, but not less than 300 mm (12 inches) in least dimension and 600 mm (24 inches) in length.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

### **3.2 PREPARATION**

- A. Complete roof deck construction prior to commencing roofing work:
  - 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
  - 2. Complete deck and insulation to provide designed drainage to working roof drains.
  - 3. Document installation of related materials to be concealed prior to installing roofing work.



- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.

### **3.3 HEATING BITUMEN**

- A. Heat the asphalt to the equiviscous temperature plus or minus -4 deg. C (25 deg. F) at the time of application:
  - 1. Do not heat asphalt greater than 38 deg. C (100 deg. F) above the equiviscous temperature.
  - 2. When the equiviscous temperature is not furnished by the asphalt manufacturer, do not heat asphalt above 275 deg. C (525 deg. F) for Type III and IV with temperature not less than 250 deg. C (475 deg. F) at time of application.
- B. Do not heat bitumen above the flash point temperature.
- C. Provide heating kettles with a thermometer kept in operating condition. Attend kettle during heating to insure that the bitumens are heated within the temperatures specified.
- D. Use type III and Type IV asphalt between plies.
- E. Do not mix different type of asphalt in kettle.

### **3.4 TEMPORARY PROTECTION**

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
  - 1. Glaze coat exposed surfaces of felts to seal within the bitumen coating. Do not leave felt surfaces or edges exposed.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by COTR, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

### **3.5 INSTALLATION, GENERAL**

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.
- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations, including ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing"
- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
  - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
  - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
  - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
    - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
    - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

### **3.6 INSTALLATION OF MODIFIED BITUMEN MEMBRANE**

- A. Primer: Apply primer to substrates where recommended by roofing manufacturer, in application quantities recommended by roofing manufacturer.
- B. Hot Roofing Asphalt: Apply hot roofing asphalt in quantities required, immediately followed by membrane materials embedded therein before bitumen cools below the application temperature limit.
  - 1. Do not apply more material than can be covered at one time except for glaze coats.
  - 2. Recoat cooled areas.

3. Application rate between substrate and sheets: 7 to 11 Kg (15 to 25 pounds) per square.
4. Application rate for glaze coats: 7 to 11 Kg (15 to 25 pounds).

C. Membrane Sheets:

1. Number of Plies: 3, minimum, including base sheet and cap sheet, and additional plies as required to meet load/strain properties specified in Part 1 of this Section.
2. Commence the laying of sheets at the low points.
3. Roll sheets into hot roofing asphalt brushing down to firmly embed, free of wrinkles, fish mouths, blisters, bubbles, voids, air pockets or other defects that prevent complete adhesion.
4. Cut to fit closely around pipes, roof drains, bitumen stops, and similar roof projections.
5. Lap sheets shingle fashion starting with starter strips at right angles to slope of roof.
6. Laps for Top Sheet and Base Sheet:
  - a. Base sheet, lapped 75 mm (three inches).
  - b. Use 450 mm (18 inch) starting widths, lap top sheet 475 mm (19 inches).
  - c. Lap end joints of sheet 150 mm (six inches). Stagger end joints in relation to end joints in adjacent and proceeding plies.

D. Roof Edges and Terminations:

1. Where nailers occur at roof edges under gravel stops or penetrations to receive metal base flashing, apply a continuous strip of underlayment over the nailers before the first ply sheet is applied. Install strip on top of venting base sheet if any.
2. After membrane is installed, turn the underlayment back over the roofing, and secure in place with hot roofing asphalt before gravel stops or other metal flanges extending out onto the membrane are installed.
3. Where cants occur at vertical surfaces, cut off roofing sheets two inches above top of cant strips, except at prefabricated curbs, scuttles and other roof accessories having integral cants, extend membrane over cant and up vertical surface to top of curb or nailer as shown.
4. Where fascia-cant occurs at roof edges, extend membrane beyond outside cant face and cut off at outside after base flashing is installed.
5. Where reglet occurs at vertical surfaces, extend plies roofing sheets up into reglet the full depth of the reglet.

### 3.7 BASE FLASHING

- A. Provide built-up base flashing over cants and as necessary to make work watertight.
- B. Prime vertical surfaces of masonry and concrete with asphalt primer except where vented base sheet is required to provide edge venting.
- C. Apply flashing on top of roofing, up face of cant and up the face of the vertical surface, at least 200 mm (eight inches) above the roofing but not more than 350 mm (14 inches) above the roofing, generally full height beneath counter flashing or top of curb flashing.
  - 1. At fascia-cants, extend to top of cant and cut off at top of cant.
  - 2. At reglet, extend full depth into the reglet.
  - 3. Where venting base sheet is used with insulating concrete, do not seal edges of venting base sheet with bitumen; allow for venting.
- D. Use two plies of modified bituminous sheet.
  - 1. Extend the first ply 100 mm (four inches) out on the roofing, and the second ply 75 mm (three inches) beyond the first ply. Lap ends 75 mm (three inches) with joints broken 450 mm (18 inches) in each ply. Use smooth surface modified bituminous sheet for first ply.
  - 2. Use granular surfaced modified bitumen cap sheet.
- E. Set base flashing in Type III or Type IV asphalt.
  - 1. Embed each sheet in asphalt so sheets do not touch.
  - 2. Set cap sheet in cold-applied adhesive with laps sealed with cold-applied adhesive.
  - 3. Except for venting roof edges, seal the top edge of the base flashing with roof cement.
- F. Except at metal fascia cants, secure top edge of base flashing with nails on a line approximately 25 mm (one inch) below top edge, spaced not more than 200 mm (eight inches) on center.
  - 1. Cover nail heads with roof cement.
  - 2. Cover the top of the base flashing with counterflashing as specified in Section 07 60 00, FLASHING AND SHEET METAL. At the fascia cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07 60 00, FLASHING AND SHEET METAL.

### **3.8 STRIPPING**

- A. Coordinate to set flanges of metal flashing in roof cement on top sheet of the modified bituminous roofing and mailing to blocking with Section 07 60 00, FLASHING AND SHEET METAL.
- B. Cover that portion of the horizontal flanges of metal base flashings, gravel stops, and other flanges extending out onto the roofing with modified bituminous sheet.
- C. Extend the sheet out on the roofing 150 mm six inches beyond the edge of the metal flange. Cut edge to fit tight against vertical members of flange.
- D. Prime flange before stripping, embed sheet in cold-applied adhesive.

### **3.9 ROOF WALKWAYS**

- A. Install roof walkways where indicated.
- B. Set prefabricated planks in solid application of cold-applied adhesive. Maintain 75 mm (three inch) to 150 mm (six-inch) space between planks.

### **3.10 FIELD QUALITY CONTROL**

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

### **3.13 PROTECTING AND CLEANING**

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

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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. Membrane base flashings and stripping: Section 07 52 16, STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING.
- 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: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Integral flashing components of manufactured roof specialties and accessories or equipment: 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.

#### **1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Aluminum Association (AA):
  - AA-C22A41 Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
  - AA-C22A42 Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
  - AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish
- C. American Architectural Manufacturers Association (AAMA):

- |          |                                                                                                                                      |
|----------|--------------------------------------------------------------------------------------------------------------------------------------|
| AAMA 620 | High Performance Organic Coatings on Coil Coated Architectural Aluminum                                                              |
| AAMA 621 | High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates |
- D. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
- |                   |                                                                           |
|-------------------|---------------------------------------------------------------------------|
| ANSI/SPRI ES-1-03 | Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems |
|-------------------|---------------------------------------------------------------------------|
- E. ASTM International (ASTM):
- |                 |                                                                                               |
|-----------------|-----------------------------------------------------------------------------------------------|
| A167-99(R2009)  | Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip                    |
| A653/A653M-09   | Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot-Dip Process |
| B32-08          | Solder Metal                                                                                  |
| B209-10         | Aluminum and Aluminum-Alloy Sheet and Plate                                                   |
| B370-09         | Copper Sheet and Strip for Building Construction                                              |
| D173-03         | Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing                            |
| D412-06         | Vulcanized Rubber and Thermoplastic Elastomers-Tension                                        |
| D1187-97(R2002) | Asphalt Base Emulsions for Use as Protective Coatings for Metal                               |
| D3656-07        | Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns                         |
| D4586-07        | Asphalt Roof Cement, Asbestos Free                                                            |
- F. FM Approvals: RoofNav Approved Roofing Assemblies and Products:
- |         |                                                |
|---------|------------------------------------------------|
| 1-49-09 | Loss Prevention Data Sheet: Perimeter Flashing |
|---------|------------------------------------------------|
- G. International Code Commission (ICC):
- International Building Code, Current Edition
- H. National Association of Architectural Metal Manufacturers (NAAMM):
- |            |                       |
|------------|-----------------------|
| AMP 500-06 | Metal Finishes Manual |
|------------|-----------------------|
- I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
- Architectural Sheet Metal Manual 2012



## **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.

## **1.5 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content requirements.

## **1.6 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. Gutter and Conductors.
  3. Expansion joints.
  4. Fascia-cant.
- C. Manufacturer's Literature and Data: For all specified items, including:
1. Two-piece counterflashing.
  2. Thru wall flashing.
  3. Non-reinforced, elastomeric sheeting.
  4. Copper clad stainless steel.
  5. Polyethylene coated copper.

6. Bituminous coated copper.
  7. Fascia-cant.
- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

## **1.7 PRE-INSTALLATION CONFERENCE**

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

## **PART 2 - PRODUCTS**

### **2.1 FLASHING AND SHEET METAL MATERIALS**

- A. Stainless Steel: ASTM A167, 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/m<sup>2</sup> (3 oz/sf); bituminous coating weight not less than 2 kg/m<sup>2</sup> (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Provide crimped exposed fabric surface.
- D. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m<sup>2</sup> (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- E. Aluminum Sheet: ASTM B209, Alloy 3003-H14 except alloy used for color anodized aluminum to be as required to produce specified color. Alloy required to produce specified color must have the same structural properties as Alloy 3003-H14.
- F. Galvanized Sheet: ASTM A653.
- G. Non-reinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick.
  1. Tensile Strength: Minimum 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.
  2. 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).

- H. Self-Adhered Rubberized Asphalt/Polyethylene: Minimum 40 mil (1 mm) total thickness self-adhesive, cold applied flashing membrane consisting of 32 mils (0.8 mm) of rubberized asphalt integrally bonded to an 8 mil (0.2 mm) high density, cross laminated polyethylene film faced with disposable silicone-coated release sheet. Provide membrane in sufficient width for one-piece continuous application as indicated.

## **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: Sheathing paper, weighing minimum 141 g m<sup>2</sup>(3 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.
- 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. Lock and solder copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick to be done by lapping, riveting and soldering.
3. Provide joints conforming to following requirements:
  - a. Finish flat-lock joints not less than 19 mm (3/4 inch) wide.
  - b. Finish lap joints subject to stress not less than 25 mm (one inch) wide; soldered and riveted.
  - c. Finish unsoldered lap joints not less than 100 mm (4 inches) wide.
4. Make flat and lap joints in direction of flow.
5. Edges of bituminous coated copper, non-reinforced elastomeric sheeting and polyethylene coated copper to 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 of minimum 0.6 mm (0.024 inch) thick stainless steel or 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 0.8 mm (0.031 inch) thick stainless steel or 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. Turn up edges of flashings concealed in masonry joints and opposite drain side 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 must 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.

## 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.

## 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. Use 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. Window Sill Flashing and Lintel Flashing:
  1. Use copper, stainless steel, copper clad stainless steel plane flat sheet, or non-reinforced 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.
- EF. Door Sill Flashing:
  1. Where concealed, use 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 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 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. Use copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
  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 instead 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 cannot 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.

## 2.8 HANGING GUTTERS

A. Fabricate gutters of not less than the following:

1. 1.3 mm (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. Provide building side of gutter 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 instead 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.

**2.9 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 instead 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 (1 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.

**2.10 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.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

- C. 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.
- D. Fabricate mitered corners, fittings, and special shapes as may be required by details.

## **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. Anchor sheet metal flashing and trim and other components of the work securely in place with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required, to complete flashing and trim assemblies.
3. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
4. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
5. 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.
6. 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.
7. 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.
8. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nails not over 100 mm (4 inches) on center unless specified otherwise.
9. 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.

10. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
11. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
12. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
13. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
14. 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.
15. Isolate aluminum in contact with dissimilar metals other 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.
16. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
17. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

### **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 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.
- C. 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.
- D. 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.
- E. 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.
- F. 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 manufacturer's 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 or 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 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 fascia or wood nailer by at least two screws or nails.
  1. For aluminum gutters use aluminum brackets or stainless steel brackets.
  2. Use 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.

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## **SECTION 07 72 00 ROOF ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies roof hatches, aluminum downspout boots and precast concrete splashblocks.

#### **1.2 RELATED WORK**

- A. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. General insulation: Section 07 21 13, THERMAL INSULATION.
- C. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION.

#### **1.3 QUALITY CONTROL**

- A. All roof accessories to be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type to be the same and be 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. Shop Drawings: Indicate each item specified showing design, details of construction, installation and fastenings.
- C. Manufacturer's Literature and Data: Provide for each item specified.
- D. Certificates: State that aluminum has been given specified thickness of anodizing.

#### **1.5 PRE-INSTALLATION CONFERENCE**

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by the basic designation only. Comply with applicable

provisions and recommendations of the following, except as otherwise shown or specified.

B. American Architectural Manufacturers Association (AAMA):

2605-11	High Performance Organic Coatings on Architectural Extrusions and Panels
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C. American Society for Testing and Material (ASTM):

A653/A653M-11	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
B209-10	Aluminum and Aluminum Alloy-Sheet and Plate
B221-13	Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

D. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series	Metal Finishes Manual
MGB 531	Metal Bar Grating Manual

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.
- D. Metal Grating for Roof Walkway: NAAMM MBG 531.

### **2.2 ROOF HATCH (SCUTTLE)**

- A. Basis of Design: Type S roof hatch, nominal 36 inch x 30 inch size, as manufactured by The Bilco Company; PO Box 1203, New Haven, CT 06505; ([www.bilco.com](http://www.bilco.com)); Phone: 203-934-6363; Fax: 203-933-8478; or approved equal.
- B. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
  - 1. Exterior Facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 2. Interior Facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
  - 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
  - 4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.

5. Make curb 300 mm (12 inches).
6. Form cover to lap curb and cap flashing.
7. Size opening as shown.

C. 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.
2. Provide pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Covers must automatically lock in the open position at not less than 70 degrees.
5. Provide weatherstripping at cover closure.
6. Galvanize all hardware items.

D. Assembly:

1. Completely shop assemble roof scuttle.
2. Fully weld all joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.

## 2.3 DOWNSPOUT BOOTS

- A. Basis of Design: Model No. B25C, minimum 36 inch length, as manufactured by Barry Pattern and Foundry Company, Inc. ([www.barrycraft.com](http://www.barrycraft.com)); 3333 35<sup>th</sup> Avenue North, Birmingham, AL 35207; Phone: 800-524-1809; Fax: 205-841-1972 or approved equal.
- B. Downspout booth size to be coordinated with building aluminum gutter and downspout sizes and with civil storm drainage collection system.
- C. Provide downspout boot at each downspout location indicated on Drawings.
- D. For select locations as identified on Drawings; adjust installed height of specified downspout boot to discharge onto precast concrete splashblock placed at grade.

## 2.4 PRECAST CONCRETE SPLASHBLOCK

- A. Basis of Design: 30 inch splashblock as manufactured by Modern Precast, Inc. 370 W 1550 S, Salt Lake City, UT 84115; ([www.modernprecast.com](http://www.modernprecast.com)); Phone: 801-466-1374; Fax: 801-466-1835 or approved equal.
- B. Precast concrete splashblock to be provided at select downspout location identified on Drawings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof specialties where shown.
- 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 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.
- F. Install cast aluminum downspout boots where indicated on Drawings and as recommended by cast aluminum downspout boot manufacturer. Provide appropriate anchors per building substrate at each location.
- G. Install precast concrete splashblocks where indicated on Drawings.

### **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 coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

### **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.

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## **SECTION 07 84 00 FIRESTOPPING**

### **ART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.
  - 1. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
  - 2. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material cannot interfere with the required movement of the joint.
  - 3. Gaps requiring firestopping include gaps between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

#### **1.2 RELATED WORK**

- A. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- B. 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 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, for project // local/regional materials, low-emitting materials, recycled content requirements.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly instead of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, submit a

manufacturer's engineering judgment, derived from similar UL system designs or other tests, for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application; when more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F", "T" and "L" ratings, and type of application.

- C. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer must provide certification from UL of passing the "Aging and Environmental Exposure Testing" portion of UL 1479.
- D. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements. Manufacturer's representative must be a direct employee of the manufacturer (not a distributor or an agent) and be qualified to perform the specified inspections and certify the firestopping installation.

#### **1.5 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.

#### **1.6 WARRANTY**

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

#### **1.7 QUALITY ASSURANCE**

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

#### **1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
  - E84-12c                      Surface Burning Characteristics of Building Materials
  - E814-11a                    Fire Tests of Penetration Firestop Systems
  - E2174-10ae1                On-Site Inspection of Installed Fire Stops



E2393-10a

On-Site Inspection of Installed Fire Resistive Joint Systems  
and Perimeter Fire Barriers

C. FM Global (FM):

Annual Issue                      Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue                      Building Materials Directory

Annual Issue                      Fire Resistance Directory

1479                                  Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue                      Certification Listings

## 1.9 SEQUENCING

- A. Coordinate the specified work with other trades.
- B. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping.
- C. Apply firestopping materials at building joints and construction gaps, prior to completion of enclosing walls or assemblies.
- D. Inspect and receive approval for firestop material prior to final completion and enclosing of any assemblies that may conceal installed firestop.

## PART 2 - PRODUCTS

### 2.1 FIRESTOP SYSTEMS

- A. Use 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.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating must maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation that seal an opening by its intumescence must exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Provide firestop sealants used for firestopping or smoke sealing with the following properties:
  - 1. Contain no flammable or toxic solvents.

2. Have 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 used in exposed areas, firestop sealant can be sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Provide firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials with 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.
  3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Provide products with maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. Provide products FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials must be asbestos free.

## **2.2 SMOKE STOPPING IN SMOKE PARTITIONS**

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants must have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with 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.

### **3.2 PREPARATION**

- A. Remove dirt, grease, oil, 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 either 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.

### **3.3 INSTALLATION**

- A. Do not begin 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 INSPECTIONS**

- A. Manufacturer's technical representative to inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results; ASTM E2174 and E2393.

### **3.5 CLEAN-UP AND ACCEPTANCE OF WORK**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COTR; COTR inspection does not supersede requirement for inspection by manufacturer's representative or requirements of local jurisdiction.
- C. Clean up spills of liquid type materials.

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## **SECTION 07 92 00 JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

#### **1.2 RELATED WORK**

- A. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- B. Sealing joints in stone veneer: Section 04 43 00, NATURAL STONE VENEER.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed aluminum curtain wall: Section 08 41 13, ALUMINUM FRAMED ENTRANCES AND STOREFRONTS.
- F. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- G. Mechanical Work: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING//  
Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM  
GENERATION.

#### **1.3 QUALITY CONTROL**

- A. Installer Qualifications: An experienced installer 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.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Meet VOC requirements of pertinent CARB and/or SCAQMD Rule for sealants VOC (4 percent by weight VOC or less in less than 16 ounce package or less than 250 g/L in larger package). All non-porous sealant primers must be below 250g/L and primers for porous substrates less than 775 g/L.

#### **1.4 SUSTAINABILITY REQUIREMENTS**

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content requirements.

- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

## **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
1. Caulking compound.
  2. Primers.
  3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

## **1.6 PRE-INSTALLATION CONFERENCE**

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

## **1.7 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 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions: 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: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

## **1.8 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 materials to sustained temperatures less than 5° C (40° F) or exceeding 32° C (90° F).

## **1.9 DEFINITIONS**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up 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.

## **1.10 WARRANTY**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period to be extended to five (5) years.
- B. General Warranty: Special warranty specified in this Article will not deprive NCA of other rights NCA may have under other provisions of Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

## **1.11 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
  - C612-10 Mineral Fiber Block and Board Thermal Insulation
  - C717-12b Standard Terminology of Building Seals and Sealants
  - C734-06(2012) Low Temperature Flexibility of Latex Sealants after Artificial Weathering
  - C834-10 Latex Sealants
  - C919-12 Use of Sealants in Acoustical Applications
  - C920-11 Elastomeric Joint Sealants
  - C1021-08 Laboratories Engaged in Testing of Building Sealants

C1193-13	Use of Joint Sealants
C1248-08(2012)	Staining of Porous Substrate by Joint Sealants
C1330-02(2013)	Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
D217-10	Cone Penetration of Lubricating Grease
D1056-07	Flexible Cellular Materials—Sponge or Expanded Rubber
E84-12c	Surface Burning Characteristics of Building Materials

- C. California Air Resources Board (CARB)
- D. South Coast Air Quality Management District (SCAQMD)
- E. Sealant, Waterproofing and Restoration Institute (SWRI):  
The Professionals' Guide

## **PART 2 - PRODUCTS**

### **2.1 SEALANTS**

- A. S-1:
  - 1. ASTM C920, polyurethane.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade NS.
  - 5. Shore A hardness of 20-40.
- B. S-2:
  - 1. ASTM C920, polyurethane.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade P.
  - 5. Shore A hardness of 25-40.
- C. S-3:
  - 1. ASTM C920, polyurethane.
  - 2. Type S.
  - 3. Class 25, joint movement range of plus or minus 50 percent.
  - 4. Grade NS.
  - 5. Shore A hardness of 15-25.
  - 6. Minimum elongation of 700 percent.
- D. S-4:



1. ASTM C920 polyurethane.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxycure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.

3. Class 25.
  4. Grade NS.
  5. Shore A hardness of 25-30.
  6. Non-yellowing, mildew resistant.
- J. S-10:
1. ASTM C920, coal tar extended fuel resistance polyurethane.
  2. Type M/S.
  3. Class 25.
  4. Grade P/NS.
  5. Shore A hardness of 15-20.
- K. S-11:
1. ASTM C920 polyurethane.
  2. Type M/S.
  3. Class 25.
  4. Grade P/NS.
  5. Shore A hardness of 35 to 50.
- L. S-12:
1. ASTM C920, polyurethane.
  2. Type M/S.
  3. Class 25, joint movement range of plus or minus 50 percent.
  4. Grade P/NS.
  5. Shore A hardness of 25 to 50.

## **2.2 CAULKING COMPOUND**

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: Polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

## **2.3 COLOR**

- A. Match color of mortar joints at exposed masonry.
- B. Match color of adjacent concrete at unpainted concrete.

- C. Provide light gray or aluminum, unless specified otherwise, for other locations.
- D. Provide light gray or white caulking, unless specified otherwise for selected locations.

## **2.4 JOINT SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are non-staining; 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, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° 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.

## **2.5 FILLER**

- A. Mineral fiber board: ASTM C612, Type IVA.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

## **2.6 PRIMER**

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

## **2.7 CLEANERS-NON POURIOUS SURFACES**

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, 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 as specified only when installers are ready to initiate sealant application as soon as practicable after preparation and before subsequent surface deterioration.
- 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 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.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.

- D. Apply 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.
  - 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.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.3 BACKING INSTALLATION**

- A. Install back-up 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 back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up 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 back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **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. Comply with manufacturer's written installation instructions for products and applications indicated.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

- C. 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 cut-outs 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 CLEANING**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

### **3.7 PROTECTION**

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

### **3.8 LOCATIONS**

- A. Exterior Building Joints, Horizontal and Vertical:
  1. Metal to Metal: Type S-6, S-7.
  2. Metal to Masonry or Stone: Type S-1.
  3. Masonry to Masonry or Stone: Type S-1.
  4. Stone to Stone: Type S-1.

5. Cast Stone to Cast Stone: Type S-1.
  6. Threshold Setting Bed: Type S-1, S-3, S-4.
  7. Masonry Expansion and Control Joints: Type S-6.
  8. Wood to Masonry: Type S-1.
- B. Metal Reglets and Flashings:
1. Flashings to Wall: Type S-6.
  2. Metal to Metal: Type S-6.
- C. Sanitary Joints:
1. Walls to Plumbing Fixtures: Type S-9.
  2. Counter Tops to Walls: Type S-9.
  3. Pipe Penetrations: Type S-9.
- D. Horizontal Traffic Joints:
1. Concrete Paving, Unit Pavers: Type S-11 or S-12.
- E. Interior Caulking:
1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components:  
Types C-1, C-2 and C-3.
  2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry  
Surfaces: Types C-1, C-2 and C-3.
  3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls:  
Types C-1, C-2 and C-3.
  4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
  5. Exposed Acoustical Joint at Sound Rated Partitions: Type C-2.
  6. Concealed Acoustic Sealant Type: S-4, C-1, C-2 and C-3.

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