SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof curbs.
   2. Equipment supports.
   3. Roof Crossovers, ramps and platforms
   4. Roof hatches.
   5. Roof hatch safety railing.
   6. Pipe and duct supports.
   7. Pipe conduit and duct Penetration Enclosures.
   8. Preformed flashing sleeves.
   9. Precast concrete splash blocks

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each type of roof accessory including construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Submit plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant and field assembled work.

C. Samples: Submit for each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Delegated Design Submittal: For roof curbs equipment supports [and roof crossovers] indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
   3. Provide additional roof membrane protection for all roof crossovers, equipment supports bearing plates and pads and other items which may result in damage to the roof system.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof mounted items. Show the following:

1. Size and location of roof accessories.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.

B. Roof Crossover Installer Qualifications: Certified by the manufacturer with minimum 5 years of experience installing similar products on Projects of similar size and scope.

C. Provide the services of a factory-trained representative of manufacturer for roof crossovers to review Work in progress and provide written report of conditions noted to assure that installation complies with design requirements, manufacturer's installation requirements and temporary roof protection.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough in information or Shop Drawings of equipment to be supported.

C. Coordinate all Work of this section with the roof system protection requirements required in Section 07 54 00 Polyvinyl Chloride (PVC) Roofing. provide roof system temporary protection for all areas of Work as indicated in Section 07 54 00.

1. Provide an appropriately sized additional roof membrane layer beneath all roof crossover and equipment support bearing plates and pads prior to installing roof crossovers and equipment support.

1.7 WARRANTY

A. Guard Railings and related Fall Protection: Written warranty signed by manufacturer's in which manufacturer agrees to repair or replace guard rails and related fall protection equipment that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

B. Painted Finishes: Written warranty signed by manufacturer in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or defects in construction.

A. Delegated Design: Engage a qualified professional engineer to design roof curbs and equipment supports and roof crossovers ramps and platforms to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Wind Restraint Performance: Indicated on Drawings.

C. Structural Design Criteria for roof crossovers: Crossovers shall be custom designed to meet project specific requirements, OSHA 1910 Subpart D standards including handrails, and the following:
   1. Wind and Seismic Design Criteria:
      a. Adopted Building Codes: As indicated on the Drawings.
      b. Occupancy Category: II
      c. Exposure Category: B
      d. Wind Design Criteria: As indicated on the Drawings.
         1) Crossover structures shall be designed and installed to resist wind pressures determined in accordance with ASCE 7 chapter 29.
      e. Seismic Design Criteria: As indicated on the Drawings.
         1) Crossover structures shall be designed and installed in accordance with ASCE 7 chapter 13.
      f. The design requirements for crossover structures, components, supports and attachments shall be supported by Project-specific design and

documentation submitted for approval to the Authority Having Jurisdiction and the Architect of Record.

g. Submittal of manufacturer's certification that the component is qualified by an independent third party via either analysis or testing in accordance with industry standards.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C, material surfaces).

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Bristolite Daylighting Systems, Inc.
   c. Curbs Plus, Inc.
   d. Custom Solution Roof and Metal Products.
   e. Greenheck Fan Corporation.
   f. LMCurbs.
   g. Metallic Products Corp.
   h. Milcor; Commercial Products Group of Hart & Cooley, Inc.
   i. Pate Company (The).
   j. Roof Products, Inc.
   k. Thybar Corporation.
   l. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Actual load with a Factor of Safety of 2.0.

D. Material: Aluminum zinc alloy coated steel sheet, 0.079 inch (2.01 mm) thick.

1. Finish: Baked enamel or powder coat.
2. Color: Selected by Architect.

E. Material: Stainless steel sheet, 0.078 inch (1.98 mm) thick.

1. Finish: No. 2D, directional polish finish.

F. Construction:

1. Curb Profile: Profile indicated on Drawings compatible with roofing system.

2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck mounting flange.
5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
6. Insulation: Factory insulated with 1-1/2 inch (38 mm) thick glass fiber board insulation.
7. Liner: Same material as curb, of manufacturer recommended thickness and finish.
8. Nailer: Factory installed wood nailer along top flange of curb, continuous around curb perimeter.
9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4 inch (19 mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
11. Metal Counterflashing: Removable, fabricated of same metal and finish as curb.
12. Security Grille: Provide where indicated.

2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Rail type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure mounting flange at bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Conn-Fab Sales, Inc.
   c. Curbs Plus, Inc.
   d. Custom Solution Roof and Metal Products.
   e. Greenheck Fan Corporation.
   f. LMCurbs.
   g. Milcor; Commercial Products Group of Hart & Cooley, Inc.
   h. Pate Company (The).
   i. Plenums Incorporated.
   j. Roof Curb Systems.
   k. Roof Products, Inc.
   l. Thybar Corporation.

m. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Actual Load with a Factor of Safety of 2.0.

D. Material: Aluminum zinc alloy coated steel sheet, 0.079 inch (2.01 mm) thick.
1. Finish: Baked enamel or powder coat.
2. Color: Selected by Architect.

E. Material: Stainless steel sheet, 0.078 inch (1.98 mm) thick.
1. Finish: No. 2D, directional polish finish.

F. Construction:
1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2 inch (38 mm) thick glass fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer recommended thickness and finish.
4. Nailer: Factory installed continuous wood nailers 5-1/2 inches (140 mm) wide unless otherwise indicated on top flange of equipment supports, continuous around support perimeter.
5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4 inch (19 mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
11. Support Pads: Provide Custom Fitted Support Pads designed specifically by the manufacturer to fit non-penetrating rooftop supports, and for protection of the rooftop envelope and meeting the following:
    a. Slip resistant pads, heat molded with a small lip to secure the support pads and reduce movement on the rooftop.
    b. Provide holes in the pad to save weight and allow for venting and drainage.
    c. Support Pad Material: 100 percent recycled rubber.

d. Dimensions: Custom Fitted to all support plates of the roof crossover assembly.

12. Protection & Abrasion pads: 60 mil minimum smooth back roofing membrane as indicated in Section 07 54 00 to be utilized as a sacrificial pad between the roof membrane and support pads at all points of contact. Protection & Abrasion pads shall extend a minimum of 2 inches beyond support pads on all sides.

13. Security Grille: Provide where indicated on Drawings.

2.4 ROOF CROSSOVERS RAMPS AND PLATFORMS

A. Roof Crossovers, stairs, ramps and platforms shall be custom designed to meet project specific requirements, OSHA 1910 Subpart D standards including handrails, with the following properties:

1. Clearance Height Required: As indicated on the Drawings and coordinated with Project specific requirements and as built, field verified dimensions.
2. Clearance Length Required: As indicated on the Drawings but in no case less than 6 inches.
3. Crossover Width Required: As indicated on the Drawings.
4. Metal Components: Hot-dipped galvanized steel.
5. Walking Surfaces: Bar Grating with serrated surface.
6. Railings: Standard railings shall be provided on all stairways having 4 or more risers and platforms 4 feet (1.22 m) or more above adjacent level.
7. Toeboards: 4 inch (102 mm) Toeboards shall be provided whenever, beneath the open side:
   a. A person can pass;
   b. There is moving machinery;
   c. Where falling material may create a hazard.
8. Fabricate crossovers, including railings and platform from powder coated steel.
9. Treads: Minimum 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, with maximum riser height of 9-1/2 inches (241 mm).
   a. Fabricate treads and platforms from welded or pressure locked steel bar grating. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
10. Galvanize, prime, and factory finish pipe crossovers, including treads, railings, brackets, and fasteners.
11. Structural Design Criteria shall be in accordance with the Performance Requirements included herein.

B. Support Pads: Provide Custom Fitted Support Pads designed specifically by the manufacturer to fit non-penetrating rooftop supports, and for protection of the rooftop envelope and meeting the following:

1. Slip resistant pads, heat molded with a small lip to secure the support pads and reduce movement on the rooftop.
2. Provide holes in the pad to save weight and allow for venting and drainage.

3. Support Pad Material: 100 percent recycled rubber.
4. Dimensions: Custom Fitted to all support plates of the roof crossover assembly.

C. Basis-of-Design Product: Provide Roof Crossover Stairs ramps and platforms by MIRO Industries Inc. Subject to compliance with requirements and an aesthetic equivalent determination by the Architect, products by one of the following may also be acceptable:
   a. PHP Systems Design

2.5 ROOF HATCH

A. Roof Hatches: Metal roof hatch units with lids and insulated double walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid to curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck mounting flange at perimeter bottom.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bilco Company (The).
      b. JL Industries, Inc.; a division of the Activar Construction Products Group.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. O'Keeffe's Inc.
      e. Pate Company (The).
      f. Precision Ladders, LLC.
      g. Williams Bros. Corporation of America (The).

B. Type and Size: Single leaf lid, 36 inches by 72 inches unless otherwise indicated.

C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material: Aluminum zinc alloy coated steel sheet.
   1. Thickness: Recommended thickness for hatch size indicated but no less than 0.079 inch (2.01 mm).
   2. Finish: Baked enamel or powder coat.
   3. Color: Selected by Architect.

E. Construction:
   1. Insulation: Polyisocyanurate board.
      a. R-Value: 12.0 according to ASTM C 1363.
   2. Nailer: Factory installed wood nailer continuous around hatch perimeter.
   3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's recommended metal liner of same material and finish as outer metal lid.
   4. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's recommended metal liner of same material and finish as outer metal lid.
   5. Curb Liner: Of same material and finish as metal curb.
   6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

7. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

F. Hardware: Spring operators, hold open arm, stainless steel spring latch with turn handles, stainless steel butt or pintle type hinge system, and padlock hasps inside and outside.
   1. Provide two point latch on lids larger than 84 inches (2130 mm).
   2. Provide remote control operation.

G. Safety Railing System: Standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; mounted to cap flashing without penetrating roof membrane; and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
   1. Height: 42 inches (1060 mm) above finished roof deck.
   2. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
   3. Posts and Rails: Galvanized steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized steel tube, 1-5/8 inches (41 mm) in diameter.
   4. Flat Bar: Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.
   5. Self Closing Gate: Fabricated of same material and rail spacing as safety railing system. Provide manufacturer recommended hinges and self latching mechanism.
   6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
   7. Deflection Load: Anchoring of posts and framing of members for rails capable of withstanding a minimum load of 200 lb (890 N) applied in any direction at any point on the top rail when mounted to roof hatch counterflashing.
   8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
   9. Fabricate joints exposed to weather to be watertight.
   10. Fasteners: Manufacturer recommended, finished to match railing system.
   11. Label: Safety warning and manufacturer contact information.
   12. Finish: Powder coat.
      a. Color: Safety yellow.

H. Ladder Assist Post: Roof hatch manufacturer's recommended device for attachment to roof access ladder.
   1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
   2. Height: 42 inches (1060 mm) above finished roof deck.
   3. Material: Stainless steel.
   4. Post: 1-5/8 inch (41 mm) diameter pipe.
   5. Finish: Baked enamel or powder coat.
      a. Color: Selected by Architect.

2.6 PIPE AND DUCT SUPPORTS

A. Fixed Height Cradle Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2 inch (38 mm) diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration free installation over roof membrane type; as required for quantity of pipe runs and sizes.

B. Fixed Height Roller Bearing Pipe Supports: Polycarbonate pipe stand with stainless steel roller carrying assembly accommodating up to 7 inch (178 mm) diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration free installation over roof membrane type; as required for quantity of pipe runs and sizes.

C. Adjustable Height Roller Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless steel threaded rod designed for adjusting support height, accommodating up to 18 inch (457 mm) diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration free installation over roof membrane type; as required for quantity of pipe runs and sizes.

D. Adjustable Height Structure Mounted Pipe Supports: Extruded aluminum tube, filled with urethane insulation; 2 inches (50 mm) in diameter; accommodating up to 7 inch (178 mm) diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless steel roller and retainer, and extruded aluminum carrier assemblies; as required for quantity of pipe runs and sizes.

E. Curb Mounted Pipe Supports: Galvanized steel support with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck mounting flange at perimeter bottom; with adjustable height roller bearing pipe support accommodating up to 20 inch (508 mm) diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIRO Industries, Inc.
      b. Pate Company (The).
      c. PHP Systems/Design.
      d. Thaler Metal Industries Ltd.

F. Duct Supports: Extruded aluminum, urethane insulated supports, 2 inches (50 mm) in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Thaler Metal Industries Ltd.
   2. Finish: Baked Enamel color selected by Architect.

2.7 PIPE CONDUIT AND DUCT PENETRATION ENCLOSURE

A. Pipe conduit and Duct Penetration Enclosure; Rooftop Unit(s): Heavy Gauge Aluminum assembly powder coated, with vandal resistant lid, preinsulated housing to a minimum R-Values of 4.3R at 75 Degrees F, insulation extension and curb with stainless steel fasteners.

1. Construction: 0.080 inch thick aluminum pre-insulated housing and curb.
   a. UV protected powder coated finish 2 mil
   b. Stainless Steel. V.P. fasteners
   c. Gasketed removable lid to housing and housing to curb connection joints to ensure compliance to ICC 2015 Air Permeance Levels
   d. Standard Color: As selected by Architect.
2. Loading: Refer to drawings.
3. Rating: ASTM E1886 and E1996, FEMA 320/361 and ICC 500-2014 compliant to 225 mph winds.
4. Size: As required to accommodate penetrations; refer to Drawings for additional information; size and configuration as approved by Architect.
5. Product: Provide Custom AWI Series Roof VAULT® by Roof Penetration Housings, www.RoofPenetrationHousings.com.
   a. Substitutions Not Permitted.
   b. Warranty: 20 year limited warranty provided in the name of the Owner beginning at the date of Substantial Completion.
6. Provide roof insulation base extension sized to accommodate location; maintain a minimum of 8 inches vertical flashing above finished roof surface and all other requirements to maintain warranty and requirements of Local Authority.
7. Penetration Seals: Weather tight seal for vertical surface/plane penetrations.
   a. Product(s): Weather-tight Silx14 Exit Seals, sealed duct adapters and other seals as recommended by manufacturer for all project specific penetrations. Provide properly sized and configured penetrations for all piping, conduit and other penetrating items.
8. Clarification: Conduits, piping and ductwork penetrations through the enclosure require level, square and perpendicular penetrations for the enclosure seals to maintain a weatherproof condition. The Contractor shall coordinate and provide double 45 degree fittings or other accessories for all piping & conduit and other components in lieu of simple bent changes in direction to maintain proper seals. Any leaks developed from penetrations which are not level, square and perpendicular to the enclosure, shall be repaired or modified by the Contractor at no additional cost to the Project.

B. [Pipe and Duct Penetration Enclosure; Rooftop Unit(s): Heavy Gauge Aluminum assembly powder coated, with vandal resistant lid, preinsulated housing to a minimum R-Values of 4.3R at 75 Degrees F, insulation extension and curb with stainless steel fasteners.

1. Construction: 0.080 inch thick aluminum pre-insulated housing and curb.
   a. UV protected powder coated finish 2 mil
   b. Stainless Steel. V.P. fasteners

c. Gasketed removable lid to housing and housing to curb connection joints to ensure compliance to ICC 2015 Air Permeance Levels

d. Standard Color: As selected by Architect.

2. Loading: Refer to drawings.

3. Rating: ASTM E1886 and E1996, FEMA 320/361 and ICC 500-2014 compliant to 225 mph winds.

4. Size: As required to accommodate penetrations; refer to Drawings for additional information; size and configuration as approved by Architect.

5. Product: Provide Custom AWI Series Roof VAULT® by Roof Penetration Housings, www.RoofPenetrationHousings.com.
   a. Product deemed acceptable by the Owner for QTS projects:
      1) AL-343424 Large Pipe Chase Housing with Curb by Alta Products LLC.
   b. Warranty: 20 year limited warranty provided in the name of the Owner beginning at the date of Substantial Completion.

6. Provide roof insulation base extension sized to accommodate location; maintain a minimum of 8 inches vertical flashing above finished roof surface and all other requirements to maintain warranty and requirements of Local Authority.

7. Penetration Seals: Weather tight seal for vertical surface/plane penetrations.
   a. Product(s): Weather-tight Silx14 Exit Seals, sealed duct adapters and other seals as recommended by manufacturer for all project specific penetrations. Provide properly sized and configured penetrations for all piping, conduit and other penetrating items.

8. Clarification: Conduits, piping and ductwork penetrations through the enclosure require level, square and perpendicular penetrations for the enclosure seals to maintain a weatherproof condition. The Contractor shall coordinate and provide double 45 degree fittings or other accessories for all piping & conduit and other components in lieu of simple bent changes in direction to maintain proper seals. Any leaks developed from penetrations which are not level, square and perpendicular to the enclosure, shall be repaired or modified by the Contractor at no additional cost to the Project.

2.8 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and perforated metal collar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Custom Solution Roof and Metal Products.
   b. Menzies Metal Products.
   c. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

3. Diameter: Indicated on Drawings.

4. Finish: Baked enamel color selected by Architect.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. Thaler Metal Industries Ltd.
   2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
   3. Height: 8 inches above finished roof surface minimum.
   4. Diameter: Indicated on Drawings or as required for piping.
   5. Finish: Manufacturer's standard finish color selected by Architect.

2.9 METAL MATERIALS

A. Aluminum Zinc Alloy Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
   1. Baked Enamel or Powder Coat Finish: After cleaning and pretreating, apply two coat, baked on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
   2. Concealed Finish: Pretreat with white or light colored acrylic or polyester backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy for finish required, with temper to suit forming operations and performance required.
   1. Exposed Coil Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   2. Concealed Finish: Pretreat with white or light colored acrylic or polyester backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

E. Steel Shapes: ASTM A 36/A 36M, hot dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

F. Steel Tube: ASTM A 500/A 500M, round tube.

G. Galvanized Steel Tube: ASTM A 500/A 500M, round tube, hot dip galvanized according to ASTM A 123/A 123M.

H. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.10 PRECAST CONCRETE SPLASH BLOCKS

A. Concrete Mix: Minimum 3,500 psi minimum compressive strength at 28 days, air entrained to 5 to 7 percent.

1. Fly Ash Content: Maximum 4 percent by weight of cementitious material in mix.

B. Nominal Size: 4 inches high x 12 inches wide x 30 inches long with 2 inch depression. Provide raised lip at sides and rear edge of each unit.

C. Finish: Color selected by Architect from manufacturer's standard. Smooth finish with rounded edges acceptable for rooftop use without damage to roof membrane.

D. Provide roofing membrane support pad 2 inches larger than footprint in both directions.

E. Acceptable Manufacturer: Century Group.

2.11 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Security Grilles: 3/4 inch (19 mm) diameter, ASTM A 1011/A 1011M steel bars spaced 6 inches (150 mm) o.c. in one direction and 12 inches (300 mm) o.c. in the other; factory finished as follows:

1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 White Metal Blast Cleaning, or SSPC-SP 8 Pickling.
2. Factory Priming for Field Painted Finish: Apply shop primer immediately after surface preparation and pretreatment.
3. Shop Primer: Fast curing, lead and chromate free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field applied finish paint system indicated, and for capability to provide a sound foundation for field applied topcoats under prolonged exposure.

E. Bituminous Coating: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Underlayment:

1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6 mil (0.15 mm) thick polyethylene sheet complying with ASTM D 4397.

3. Slip Sheet: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
4. Self Adhering, High Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip resisting polyethylene film top surface laminated to layer of butyl or SBS modified asphalt adhesive, with release paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
6. Fasteners for Zinc Coated or Aluminum Zinc Alloy Coated Steel: Series 300 stainless steel or hot dip zinc coated steel according to ASTM A 153/A 153M or ASTM F 2329.
7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
8. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

G. Gaskets: Tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C 1311, single component, solvent release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.12 FINISH REQUIREMENTS

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure and provide additional support for all pipe and duct penetration enclosures required to maintain the manufacturer’s warranty:
1. All roof deck penetrations shall be supported no more than 10 inches from the enclosure housing meeting the roof deck.
2. Provide H frame steel angle below deck opening supports at all pipe and duct penetration enclosures.

3. Coordinate all openings with manufacturer’s requirements and obtain written confirmation that all openings meet requirements for warranty.

3.2 EXAMINATION

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

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Verify all Pipe and Duct Penetration Enclosure openings comply with support requirements for warranty.

E. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and miscellaneous items necessary to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. [Roof Hatch and Safety Rail Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof hatch curb in accordance with manufacturer recommendations.
3. Attach ladder assist post according to manufacturer's written instructions.]

F. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

G. Pipe and Duct Penetration Enclosure Installation; Rooftop Units: Secure properly sized flashing sleeve to roof structure according to manufacturer's written instructions and to uphold warranty;

1. Coordinate and Provide sufficient structural support for all enclosures as required by the manufacturer for warranty. Such support shall be provided for all units whether or not indicated on the Drawings.
2. Flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
3. Provide conduits, piping and ductwork penetrations into the enclosure that are level, square and perpendicular to facilitate weather tight conditions. The Contractor shall provide double 45 degree fittings or other accessories for all piping, conduit and other penetrations in lieu of simple bent changes in direction to achieve and maintain proper seals. Any leaks developed from penetrations that are not level, square and perpendicular to the enclosure, shall be repaired or modified by the Contractor at no additional cost to the Project.
4. Provide manufacturer’s weather tight penetration seals for all piping and duct entering the enclosure.

H. Pipe and Duct Penetration Enclosure Installation; Wall Units:

I. Security Grilles: Weld bar intersections and, using tamper resistant bolts, attach the ends of bars to structural frame or primary curb walls.

J. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

K. Provide precast concrete splash blocks at all downspout drainage locations unless otherwise indicated.

3.1 [INSTALLATION OF ROOF CROSSOVERS RAMPS AND PLATFORMS

A. Provide specified roof protection in accordance with Section 07 54 00 Polyvinyl Chloride (PVC) Roofing prior to proceeding with installation.

B. Clean roofing surfaces in accordance with the roofing manufacturer's instructions prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for each substrate under the project conditions.

D. Install an additional sheet of roofing material beneath all support pads, heat welded to primary roof membrane. The additional sheet shall be over-sized by 6 inches on all sides of the support pads.

E. Place all supports and support pads in accordance with the manufacturer's recommendations, instructions provided by the Designing Engineer and in accordance with the roofing system manufacturer's recommendations.

F. Install roof crossovers, ramps and platforms in accordance with the manufacturer's instructions, approved submittals and in accordance with all Contract Documents including but not limited to roofing system specifications and protection requirements.]

3.2 FIELD QUALITY CONTROL

A. Roof Crossovers: Provide the services of a factory-trained representative of manufacturer to visit site while Work is in progress to assure that installation complies with design requirements and manufacturer's installation requirements and that appropriate measures have been taken for temporary roof system protection.

B. Provide written field review report to the Architect and Owner noting all field conditions observed and the following:

1. Compliance with design and manufacturers installation recommendations and / or requirements.
2. Compliance with the delegated design approved submittals.
3. Anomalies noted and any recommendations for compliance, revision or remedial Work required.
4. Report shall note all weather conditions, day and time of visit, progress of Work and all previous system installations, protections provided and no less than 10 photographs of each crossover unit reviewed.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory primed surfaces with compatible primer ready for field painting according to Section 09 91 13.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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