Architectural Alliance,Inc.

Addendum No. **5**

Project: **Port Arthur Branch Renovations**

Date: **5 / 24 / 2022**

All bidders are herewith notified of the following additions, deletions, changes or clarifications to the drawings dated 4/11/2021 and shall be acknowledged as received on the proposal.

Corrections/Clarifications:

1. Include following specification sections in the Project Manual:
    a. 024000 Minor Demolition and Renovation
    b. 072200 Roof Board Insulation
    c. 075200 Modified Bitumen Membrane Roofing
    d. 076200 Metal Flashing and Trim

End of Addendum 5

Date: 5/24/2022

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SECTION 024000 - MINOR DEMOLITION AND RENOVATION WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Removing existing roofing, insulation, flashing, and sheet metal.

B. Removing abandoned equipment, curbs, and penetrations and repairing openings in decking.

C. Modifying existing roof penetrations, equipment supports, curbs, and piping to provide proper flashing height and flashing detail.

D. Installing new nailers, blocking, and sheathing at designated locations.

E. Providing new supports for roof-top equipment and utility piping.

F. Performing other miscellaneous and incidental work required to install complete roofing system as specified and to obtain specified manufacturer's warranty.

1.2 RELATED SECTIONS:

A. 07 22 00 - Roof Board Insulation.

B. 07 52 00 - Modified Bitumen Membrane Roofing.

C. 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES:

A. American Society for Testing and Materials (ASTM).

B. Corps of Engineers (CRD).

C. FMG Property Loss Prevention Data Sheet 1-49 “Perimeter Flashing”.

1.4 PROJECT CONDITIONS:

A. Environmental Requirements:

1. Do not remove existing roofing and flashing in inclement weather or when rain is predicted with 30 percent possibility or greater.
2. When ambient temperature is below 60 degrees Fahrenheit (15 degrees Celsius), expose only enough temperature sensitive materials required within four hour period.
3. Do not expose materials to constant temperature in excess of 180 degrees Fahrenheit (82 degrees Celsius).

B. Emergency Equipment: Maintain on-site adequate materials necessary to apply emergency temporary weather protection of incomplete work area in event of sudden storms or inclement weather.

C. Smoking is prohibited on roof areas, in existing building, and Owner's property except at designated locations.

1.5 SEQUENCING AND SCHEDULING:

A. Sequence demolition and renovation with sequence of new work to maintain facility in dry, watertight condition on daily basis.

B. Coordinate roof work so that no more existing items are removed in one day than can be replaced with new materials in same day.

C. Coordinate work with Owner's operational requirements.

D. Coordinate demolition work and removal with roofing work to maintain facility in dry, watertight condition on a daily basis.

1.6 WARRANTY:

A. Provide Contractor's warranty covering defects in installed materials and workmanship for period of two years from date of final acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Wood Members, Nailers, and Blocking Lumber: Noncombustible Standard Grade Fir or No. 2 Southern Yellow Pine bearing UL label, Kiln-dried after treatment (KDAT), complying with American Lumber Standards of manufacturer’s association under whose rules lumber is produced, minimum size 2-inches (50mm) by 6-inches (150mm), nominal.

B. Treatment for Wood Members: Pressure-preservative treated in accordance with AWPA C2, C9 standards, Above Ground Contact Alkaline Copper Quat Type C (ACQ-C) or Copper Azole Type A (CBA-A) at 0.20 pcf.

C. Plywood: Exterior-grade sheathing; Grade: CDX; 1/2-inch thickness.

D. Gypsum Sheathing/Roof Board: 1/2-inch (13mm) thick moisture resistant gypsum core roof board such as "Dens-Deck Prime" by Georgia Pacific or “SecuRock” by U.S. Gypsum.

E. Fasteners:

1. Wood Substrate:
   a. Securement of metal flanged items such as flashing pans, metal edge/fascia, cleats, etc., shall be nails, No. 11 gauge, double hot-dipped galvanized, ASTM A153, steel or stainless steel wire with 3/8-inch (9mm) diameter head and ring shank fasteners for anchoring flanges of sheet metal fabrications shall be of sufficient length to achieve a minimum 1-1/4-inch embedment into solid wood substrate such as "R-103-A Stormguard Asphalt and Fiberglass Shingle Nail" by Maze Nails (800/435-5949).
   b. Securement of wood to wood shall be nails, No. 11 gauge, double hot-dipped galvanized steel or stainless steel wire nail with ring shank and 9/32-inch (7mm) diameter head such as "Stormguard PTL Anchor-Down Nail" by Maze Nails (800/435-5949); 10d or length required to provide 1-inch (25mm) penetration minimum into substrate.
   c. Securement of exposed items to wood substrate shall be No. 14 stainless steel screw with stainless steel washer and integral rubber seal; length required to provide 1-inch (25mm) penetration minimum into substrate.
   d. Fasteners for securing roofing materials to wood substrate shall be a hardened stainless steel nail with a 1-inch (25mm) diameter round head and ring shank; length to provide 1-inch (25mm) penetration into substrate, as manufactured by Simplex Nail Co.
   e. Fasteners for securing steel to wood substrate shall be No. 10 stainless steel wood screw with stainless steel washer and integral rubber seal, length to achieve 1-inch embedment into wood.
   f. Fasteners for securing wood nailer to wood nailer in vertical position shall be 20 gauge galvanized steel plate, 2-inches wide by 4-inches long such as “MP 24 Mending Plate” by Simpson Strong-Tie Co., Inc. and “A34 Framing Anchor” by Simpson Strong-Tie Co., Inc. for corner connections.
2. Steel Substrate:
   a. Fasteners for securing plywood to steel substrate shall be self-drilling, 1-1/2-inch long coated No. 10 screw with wafer head such as "Traxx Wood to Metal Fastener" by ITW Buildex. Fasteners for securing wood nailers/blocking to steel substrate shall be self-drilling coated heavy duty screw, 1/4-inch (6mm) diameter (minimum), with 5/8-inch (16mm) diameter washer such as "No. 14 Heavy Duty Screw" by OMG Roof Products.
   b. Fasteners for securing steel to steel substrate shall be self-tapping No. 14, 1-1/2-inch long stainless steel screw with stainless steel washer and bonded integral rubber seal.
3. Plywood Clip: 20 gauge galvanized steel H-clip such as "PSCL Panel Sheathing Clip" by Simpson Strong-Tie Co., Inc. (800/999-5099).
4. Receiver in Reglet: Soft, malleable lead sheet, size and shape to fit in joint and maintain compression against receiver.

F. Rust Inhibitive Primer: 100 percent acrylic resin primer such as “Metalclad Interior-Exterior Acrylic Latex Flat Primer & Finish #41702”, Devoe & Raynolds Co.

G. Piping/Conduit Supports: Pre-manufactured assembly with molded plastic/rubber base, 10-inches by 16-inches (250mm by 400mm); 1/2-inch (13mm) threaded rods and accessory bar, "Type PP-10 with Strut" for conduit/condensate or "Type PP-10 with Roller" for steel/gas piping as manufactured by PHP System/Design, Houston, Texas (800/797-6585) or Models 48-R-AH and 24-R-AH by Miro Industries, Inc. (800/768-9678).

H. Equipment Supports: Pre-manufactured supports constructed from 1-7/8-inch by 1-7/8-inch (47mm by 47mm) 12 gauge channel steel with rectangular support bases and steel angle supports. Provide threaded rod to connect supports such as "Type RTU-20" as manufactured by PHP System/Design, Houston, Texas (800/797-6585).

I. Pre-manufactured Equipment Curb Supports: Pre-engineered and shop fabricated 18 gauge galvanized steel shell with integral base plate, cap flashing, and nailer, 16-inches high such as "TEMS-3" by Thycurb.

J. Non-shrink Grout: Quick-setting grout formula meeting Corps of Engineers specification CRD-C-621, Type D and ASTM C-1107, Grade C, such as "Five Star Instant Grout" by Five Star Products, Inc., "Sika Grout 212" by Sika Corp., or approved equal.

K. Tie-Down Wire Rope: 1/16-inch diameter; 7 x 19 strand type; Type 304 stainless steel wire rope, minimum working load of 740 pounds, minimum breaking load of 3700 pounds with stainless steel thimbles and clamps.

L. Paint for Roof-top Items: Lusterless (Flat) Acrylic Finish: Two coats over filler coat or primer coat such as Acrylic Primer of "ProIndustrial Acrylic Primer" by Sherwin Williams and Finish Coat of "ProIndustrial Acrylic Paint" by Sherwin Williams or approved equal.

M. Deck Repair Materials:

1. Steel Deck: 22-gauge; Type "B"; 1-1/2-inch depth; G-60 galvanized steel decking, flute dimension, and spacing to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine existing building and existing roofing to determine existing physical conditions that affect removal of existing roofing and installation of new roofing.

B. Verify that required barricades and other protective measures are in place.

3.2 PREPARATION:

A. Take measures to maintain watertight conditions during term of Contract.

B. Install interior protection and dust partitions where deck penetrations shall be removed or replaced.

C. Protect adjacent surfaces.

D. Roof Drains:

1. Examine existing drain lines for debris or blockage.
2. Clean drains and drain lines, removing debris, excessive bitumen, or aggregate. Flush with water to ensure that drains flow freely.
3. Cap drains with drain plugs during daily operations.
4. Remove plugs after daily clean-up and prior to onset of rainfall.

3.3 MINOR DEMOLITION OPERATIONS:

A. Execute demolition in careful and orderly manner with least possible disturbance or damage to adjoining surfaces and structure.

B. Avoid excessive vibrations in demolition procedures that would be transmitted through existing structure and finish materials.

C. Roof Removal:

1. Remove existing roofing, insulation, and flashings; abandoned and obsolete equipment; metal flashings, vents, curbs, and other such items; and sheet metal down to roof deck.
2. Retain existing polyiscyanurate insulation that is deemed acceptable for re-installation.
3. Do not stockpile debris on roof surface. Promptly dispose of obsolete equipment and debris at authorized disposal site each day. Use chutes to transfer debris from roof surface to dumpsters.
4. Provide protective method, such as plywood set on minimum 1-inch (25mm) EPS insulation, when hauling debris over existing roof membrane.

3.4 MINOR RENOVATION WORK:

A. Prepare substrates in accordance with roofing manufacturer's recommendations.

B. Decking:

1. Steel Deck:
   a. Cover holes or openings 12-inches (300mm) in diameter or smaller with a plate of 18 gauge sheet metal. Extend plate minimum 4-inches (100mm) beyond edge of hole and onto adjacent unaffected rib. Mechanically fasten new decking or plate with screws spaced 6-inches (150mm) on-center.
   b. Repair holes or openings greater than 12-inches (300mm) in diameter with new deck material. Extend new decking 18-inches (300mm) minimum past nearest bar joist or support member. Mechanically fasten new decking or plate with screws spaced 6-inches (150mm) on-center.
   c. Remove rust or other foreign material from existing deck that would prohibit proper installation of new materials.
   d. Remove rust by wire brushing or other appropriate method. Apply rust inhibitor over prepared areas of metal deck.

C. Nailers:

1. Install wood nailers/blocking in general accordance with FMG DS 1-49 and as supplemented herein with these specifications.
2. Replace wood nailers and curbs with new nailers and curbs as required.
3. Install wood nailers to match height of new insulation board.
4. Secure 2X base nailer into structure and/or substrate for anchorage of cleats and/or fascias of sheet metal fabrications, width as necessary to extend beyond horizontal flange of sheet metal fabrication.
5. Clean and prepare existing surfaces to receive wood nailers and curbs.
6. Install 2 X 6 wood nailer, minimum, as base nailer at perimeters. Nailers shall match width of wall and provide minimum 1-inch per foot slope toward roof.
7. Install wood nailers and curbs continuously with 1/4-inch (6mm) gap between each section. Set level and true. Pre-drill nailers prior to attachment. Countersink fastener in base nailer so that washer and head of fastener or nut are recessed below top of nailer.
8. Securely fasten to structure with appropriate fasteners to resist minimum 175 pounds per linear foot (780N per 300mm) force in any direction and spaced 12-inches on-center. Use of powder-actuated fasteners is prohibited. Place a fastener within 3-inches (75mm) of each end of each section of wood blocking.
9. Stagger joints in subsequent layers of nailers from joints in underlying layer of nailers a minimum of 12-inches (300mm).
10. Install nailers so that ends and sides of adjoining nailers are aligned to form right angles (nominal) at corners.
11. Weave ends of subsequent layers of nailers at corners so that ends of nailers do not align.
12. Secure nailers to wood substrate using nails 24-inches (600mm) on-center, staggered. Install nails on an angle.
13. Secure nailers with self-tapping steel fastener to structural steel with self-drilling screw or through-bolt spaced 12-inches on-center.
14. If attaching wood nailer to concrete masonry block, install stainless steel threaded rod spaced 12-inches (300mm) on-center in fully grouted cell/core of CMU.
15. Reduce fastener spacing 50 percent at a distance of 10 feet (3m) from each corner.
16. Secure new nailer to existing nailer or curb when increasing curb height utilizing appropriate fasteners, gusset plates positioned 12-inches o.c., and framing anchors positioned at corners.

D. Plywood/Gypsum Sheathing:

1. Install new sheathing at walls, curbs, and over unsuitable substrates to receive new roofing. Replace damaged, deteriorated, or non-salvageable existing sheathing.
2. Secure sheathing to substrate with flat head fasteners (type appropriate for substrate) spaced 12-inches (300mm) on-center.
3. Secure sheathing to wood substrate with nails spaced 6-inches (150mm) on-center.
4. Install new sheathing at roof hatches and metal curbs. Secure sheathing to substrate with flat head fasteners (type appropriate for substrate) spaced 12-inches (300mm) on-center. Trim exposed ends of screws on inside of hatch/curb.

E. Abandoned Equipment/Curb and Deck Opening Infill:

1. Remove and disconnect abandoned existing equipment, curb, and/or penetrating element as necessary and required to expose opening in deck and facilitate new repair.
2. Secure 3-inch X 3-inch X ¼-inch galvanized steel angles around perimeter of opening to provide new supports for new decking with 3/8-inch diameter stainless steel bolts with stainless steel nuts and washers spaced 12-inches on-center.
3. Secure new fluted steel decking to steel angles with #12 self-drilling/tapping screws with ¾-inch diameter washer spaced 6-inches on-center.

F. Rooftop Equipment:

1. Move and elevate air conditioning units and other rooftop equipment as required to install roofing materials complete and in accordance with plans and specifications.
2. When units or equipment are to be moved, disconnect and move to protected area to prevent damage to parts or components. Reset and reconnect at Contractor's expense.
3. Contractor shall employ mechanics trained, proficient, and certified in the trade involved. Contractor shall disconnect equipment only as scheduled in the approved construction schedule and when performing roofing work in the immediate area of the equipment. Each piece of equipment shall be fully operational immediately after reinstallation. Shut-down time for each piece of equipment shall be limited to timeframe designated by Owner. Prior to commencing any disconnections, the Owner shall be given forty-eight hours notice.
4. Prior to commencing roofing work, the Contractor shall test equipment in the presence of Owner’s Representative. All deficiencies in operation including unusual noises will be noted in writing and shall become a matter of records. Upon completion of the reinstallation of equipment, it shall be retested by the Contractor in the presence of the Owner’s Representative. Any deficiencies which were not noted in the initial testing shall be corrected by the Contractor at his expense.
5. Install equipment on top of curb or pre-manufactured support/curb. Secure equipment hoods/covers to curb with grommetted fasteners spaced 12-inches (300mm) on-center, minimum two fasteners per side.
6. Set equipment on top of pre-manufactured support/curb and secure to support. Install support on a layer of heavy-duty protection pad on top of a cut section of modified bitumen protection pad.
7. After installation of equipment support (if required), the unit shall be reset on the support. Reconnecting of pipe, conduit, wiring, and reactivation of the unit to its original condition shall be provided by Contractor. All conduit modifications, extension of ductwork, etc., shall be provided by Contractor at no additional cost to Owner. Equipment shall be installed level, plumb, and free of vibration and in accordance with manufacturer's installation practices.
8. Install set of braided stainless steel cables/wire ropes in opposing directions over top of equipment housings/hoods and secure through sides of curb cap flashing and into curb with appropriate fasteners.

9. Attach respective roof-top equipment in general accordance with the following table:

Curb Size and Equipment Type	Equipment Attachment	Number of No.14 Screws Each Side of Curb or Flange
12-inch X 12-inch curb with relief air hood	Hood attached to curb	2
12-inch X 12-inch relief air hood with flange	Flange attached to 22 gauge steel deck	3
24-inch X 24-inch curb with relief air hood	Hood attached to curb	5
24-inch X 24-inch relief air hood with flange	Flange attached to 22 gauge steel deck	8
24-inch X 24-inch curb with exhaust fan	Fan/hood attached to curb	3
36-inch X 36-inch curb with exhaust fan	Fan/hood attached to curb	3
5’-9” X 3’-8” curb with 2’-8” high HVAC unit	HVAC unit attached to curb	5

G. Curbs and Ducts:

1. Secure and modify curbs, ducts, and other work which pass through roof as required to receive new roofing system.
2. Seal joints in sheet metal ducts and vent hoods with reinforcing fabric and elastomeric coating. Apply elastomeric coating to exposed surfaces of ducts and vent hoods.

H. Piping and Conduit Modifications:

1. Schedule piping and unit downtime for equipment modifications to coordinate with Owner's operations. Switchover time shall be limited to meet Owner's requirements.
2. Replace existing supports for units and associated piping with new supports.
3. Provide temporary supports to maintain unit and piping in operational condition except during switchover.
4. Furnish new fittings, piping, and accessories to match existing to replace deteriorated, damaged, or non-functional components or to accommodate new unit elevation, where necessary.
5. Provide auxiliary make-up air units to supply HVAC needs during equipment downtime, when required.
6. Upon completion of roof installation, paint steel piping and replace or clean aluminum jacketing of insulated pipe.

I. Existing Roof Drains:

1. Secure and modify drains to receive new roofing system.
2. Verify drain bowls and pipes are properly secured and sealed.
3. Remove, replace, lower, or raise drain bowl as required to accommodate new roofing system, including insulation and deck conditions.
4. Replace damaged, missing, or otherwise non-salvageable piping and drain components with new components. Replace plastic strainers with cast iron units.
5. Drill and tap existing drain bowls as required for complete assembly of drain. Secure clamp rings with stainless steel bolts and washers. Clamp rings to be secured throughout project. Wire brush, clean, and paint existing cast iron clamp rings and strainers to be reinstalled.
6. Paint new strainers and clamp rings prior to installation.
7. Water test each roof drain with inflatable plug. Position plug in leader so test will cover connection of pipe to bowl. Extend “test” water on top of roof membrane beyond clamping ring. Maintain “test” water for one hour while performing interior observations for water leakage. Replace drain bowl assemblies and associated piping that cannot be made watertight during leak test.

J. Plumbing Vents:

1. Extend plumbing vents or modify as necessary to accommodate new roof installation.
2. Provide pipe extensions and no-hub couplings where necessary to achieve minimum 8-inch (200mm) height above top of newly finished roof surface.
3. Utilize same material type and size as existing for new extension.

K. Sheet Metal Fabrications:

1. Remove and replace ferrous rooftop sheet metal fabrications to match existing.
2. Modify existing sleeves and umbrellas on existing equipment as scheduled.
3. Repair and renovate non-ferrous rooftop sheet metal fabrications as required for permanent watertight installation.
4. Paint sheet metal with metal primer

3.5 CLEANING:

A. Materials, equipment, and debris resulting from demolition operations shall become property of Contractor. Remove and dispose of demolition debris in accordance with applicable city, state, and federal laws at authorized disposal site.

B. Leave substrate clean and dry, ready to receive roofing system.

END OF DOCUMENT 024000

SECTION 072200 ROOF BOARD INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Installation of polyisocyanurate insulation, tapered insulation sumps and crickets, and secondary/cover board insulation.

1.2 RELATED SECTIONS:

A. 02 40 00 - Minor Demolition and Renovation.

B. 07 52 00 - Modified Bitumen Membrane Roofing.

C. 07 62 00 - Sheet Metal Flashing & Trim.

1.3 REFERENCES:

A. American Society for Testing and Materials (ASTM).

B. FM Global Approval Guide.

C. Underwriters Laboratories (UL): Building Materials Directory.

D. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual.

E. ASCE 7-10: "Minimum Design Loads for Buildings and Other Structures."

F. Polyisocyanurate Insulation Manufacturer’s Association: Technical Bulletin 109 – “Storage and Handling Recommendations for Polyisocyanurate”.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. Classified by Underwriters Laboratories Inc. as Class A rated material.
2. Follow local, state, and federal regulations, safety standards, and codes. When conflict exists, the more restrictive document shall govern.

B. Installation:

1. Install in accordance with manufacturer's current published application procedures, general requirements of NRCA, and as supplemented by these documents.

2. Consider roof system manufacturer's technical specifications part of this Specification and use as reference for specific application procedures.
3. Pressures are based on ASCE 7-10 and following criteria: 140 mph wind speed; Exposure B; Risk Category II; and Safety Factor of 2.0. Install roof system in manner to resist minimum wind uplift pressures of:
   a. Roof “A”: 45 psf for the field of the roof; 75 psf in 12-feet wide perimeter zones; and 112.5 psf in 12-feet by 12-feet corners.
   b. Roof “B”: 45 psf for the field of the roof, 75 psf in 4-feet wide perimeter zone, and 112.5 psf in 4-feet by 4-feet corners.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store materials in accordance with manufacturer's recommendations.

B. Outdoor Storage:

1. Tarp and shield insulation from moisture and exposure to sun.
2. Elevate insulation above substrate 4-inches minimum.
3. Secure insulation to resist high winds.
4. Do not use insulation which has been determined "wet" or which has been wet and has dried.
5. Distribute insulation stored on roof deck to prevent concentrated loads that would impose excessive stress or strain on deck or structural members, or impede drainage.
6. Remove manufacturer plastic shrink wrapping from materials prior to covering with protective tarps/canvas.

1.6 SUBMITTALS:

A. Product Data: Submit manufacturer’s product data sheets, providing descriptive data, dimensions, LTTR values, and other pertinent criteria for each material proposed for use in construction of roof assembly.

B. Samples: Provide physical examples of materials/components proposed for use to comprise the specified roof system.

1.7 SEQUENCING AND SCHEDULING:

A. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing.

B. Do not install more insulation than can be made watertight in same day.

1.8 PROJECT CONDITIONS:

A. Environmental Recommendations:

1. Apply roofing and insulation in dry weather.
2. Do not proceed with roof construction during inclement weather or when precipitation is predicted with 30 percent or more possibility.
3. Do not apply insulation over wet or moist deck or in foggy conditions.
4. Consider days when wind speeds are 30 mph or greater as "inclement weather" days.

B. Maintain on site equipment and material necessary to apply emergency temporary weather protection to incomplete work in event of sudden precipitation.

PART 2 - PRODUCTS

2.1 ROOF INSULATION:

A. Flat Stock Layer Insulation: Rigid, closed-cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic coated fiberglass facers meeting ASTM C 1289, Type II, Class 2, Grade 2; maximum board size is 4 feet by 8 feet; 2-inch thickness such as "ACFoam-III" by Atlas Roofing Corp, “Paratherm CG” by Siplast, “FlintBoard ISO Cold" by Certainteed, "Resista" by Firestone, "ENRGY3 CGF" by Johns Manville, or approved equal.

B. Tapered Insulation: Tapered Rigid, closed-cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to coated fiberglass facers meeting ASTM C 1289, Type II, Class 2, Grade 2; maximum board size is 4 feet by 4 feet; tapered 1/2-inch/foot with ½-inch starting thickness such as "Tapered ACFoam-III" by Atlas Roofing Corp, “Tapered Paratherm CG” by Siplast, “Tapered FlintBoard ISO Cold" by Certainteed, "Tapered Resista" by Firestone, "Tapered ENRGY3 CGF" by Johns Manville, or approved equal.

C. Cover Board: Moisture-resistant, 1/2-inch thick gypsum core roof board such as “SecuRock” by US Gypsum, “DensDeck Prime” by Georgia-Pacific, or approved equal.

D. Tapered Edge Strip: Tapered perlite complying with ASTM C-728, to be used for tapered edge strips, size 1/2-inch (13mm) to 1-1/2-inch (37.5mm) thick by 6-inches (150mm) to 24-inches (600mm) wide such as “Tapered Fesco Edge Strip” by Johns Manville.

2.2 RELATED MATERIALS:

A. Heat Resistant Insulation: Molded hydrous calcium silicate-based or mineral wool-based heat resistant rigid pipe insulation, 2-inches in thickness and sized for installation around circular/tubular element such as “Sproule WR-1200” by Johns Manville or “Thermafiber Pro Section WR” by Owens Corning

B. Compressible Fill Insulation: Foil or paper faced compressible fiberglass batten roll insulation of proper size and thickness to insert at openings at penetrations, perimeters, and curbs such as manufactured by Owens Corning.

C. Low-Rise Foam Insulation Adhesive:

1. Single-component Moisture-cured Adhesive: ASTM D-2126, dispensed from portable pressurized containers, such as “Insta-Stik Professional Roofing Adhesive" by Dow Chemical Co., “Para-Stick” by Siplast, or approved equal
2. Dual-component Reaction-cure Adhesive: Two-part spray-applied low-rise urethane foam adhesive such as "OlyBond 500" by OMG, “JM Two-Part Urethane Adhesive” by Johns Manville, “Twin Jet” by Firestone, or approved equal.

D. Insulation Fasteners: Metal Deck: CR-10 fluorocarbon coated, heavy duty self-tapping screws of sufficient length to penetrate the deck a minimum of 1-inch (25mm) with minimum 3-inch (75mm) diameter steel plates with recessed screw head such as “#14 Heavy Duty Roofing Fastener”, or “#15 Extra Heavy Duty Roofing Fastener” as manufactured by OMG, or as approved by roof material manufacturer and as determined by results of pull-tests.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Roof system manufacturer's representative shall inspect roof deck and associated substrates and provide written acceptance of conditions.

B. Manufacturer's approved roofing contractor shall inspect and approve deck and substrates.

C. Roofing contractor shall examine roof deck and related substrates and verify that there are no conditions that would prevent roof system manufacturer's approved application of roof system. These conditions include, but are not limited to, the following:

1. Inadequate support or anchorage of decking or substrates to structure.
2. Accumulations of moisture.
3. Tears, holes, cracks, or punctures.
4. Ridges, uneven conditions, or gaps.
5. Rust or other forms of deterioration.
6. Presence of foreign materials.

D. Start of work constitutes acceptance of substrate and site conditions.

3.2 PROTECTION:

A. Provide special protection from traffic on yet to be removed roofing and newly installed roof materials.

3.3 PREPARATION:

A. Do not install insulation until defects in roof deck and substrates are corrected in order to meet roof system manufacturer's requirements and to ensure that deck conditions will not restrict roof drainage.

B. Remove and retain existing polyisocyanurate insulation; store appropriately; and visually inspect the insulation for moisture damage and/or biological growth contamination and discard non-salvageable materials.

C. Broom sweep and clean areas to receive insulation.

D. Perform pull-out resistance tests in general accordance with ANSI/SPRI FX-1-2006 with specified screw fasteners on the existing steel deck. Provide results of the tests to Consultant/Engineer and manufacturer for determination of method of attachment.

3.4 INSTALLATION:

A. Insulation - General:

1. Install specified insulation continuous across the roof deck in general accordance with manufacturer’s guidelines.
2. Stagger end joints of insulation boards 1/2 of overall length of board.
3. Butt joints tightly allowing no more than 1/4-inch (6mm) wide gaps between units. Fill joints between adjacent boards with like insulation or foam adhesive.
4. Do not use warped, bent, or otherwise damaged insulation boards.
5. Field cut and fit insulation at penetrations, curbs, and walls.
6. After installation of initial layer of insulation, install subsequent layers of insulation directly over preceding layer.
7. Stagger all joints (side and end) between layers of insulation.
8. Field cut tapered insulation boards to create crickets at upslope sides of curbs and between drains to direct water to drainage medium. Install tapered insulation on top of base and subsequent layers of polyisocyanurate insulation layers.
9. Install tapered edge strips at changes in elevations, edges of crickets, and other locations to create monolithic and uniform substrate for installation of roof membrane.

B. Mechanically Attached Insulation Layers:

1. Install salvaged insulation on top of deck with ends of boards supported by deck.
2. Install secondary insulation layer on top of base layer with end joints and side joints staggered from previous layer installed.
3. Mechanically fasten insulation layers to roof deck in strict accordance with manufacturer's criteria to achieve specified wind uplift resistance.
4. Fully engage and seat fasteners. Do not overtighten or strip threads. Bent, deformed, or unseated fasteners or plates are unacceptable.
5. Fasteners must penetrate through the deck. Do not overdrive fasteners. Remove and replace overdriven, stripped, or non-engaged fasteners.
6. Properly seat mechanical fasteners and keep heads flush with plates. Cupped plates or

unseated screw heads are not acceptable.

7. Do not rupture or deform surface of the insulation by mechanical fastening.

C. Adhered Cover Board:

1. Install and adhere cover board over polyiscyanurate insulation layers to serve as substrate to receive roof membrane in accordance with manufacturer's guidelines and as specified herein.
2. Ribbon Application of Low-rise Foam Adhesive: Dispense 3/4-inch to 1-inch (19mm to 25mm) diameter continuous ribbon of adhesive placed 3-inches (75mm) inside each edge/side of the insulation board in picture-frame fashion. Dispense remaining ribbons of adhesive between “picture-frame” placed adhesive ribbons spaced 12-inches (300mm) on-center in the field of the roof, spaced 6-inches (150mm) on-center within a 12-feet wide area along the roof perimeters, and spaced 3-inches on-center within a 12-feet by 12-feet area at corners of roof.
3. Firmly set insulation boards in the ribbons of foam adhesive following application of the adhesive when adhesive has risen to proper height and walk-in the insulation to spread the adhesive ribbons, ensuring maximum contact. Do not push or slide insulation into position. Set weighted objects on sides, ends, and corners of boards until insulation is firmly attached (approximately 20 to 45 minutes).
4. Fill voids or open joints in top layer of insulation and cover board with spray-foam adhesive to provide monolithic surface to receive new membrane.
5. Adhere partial boards and tapered edge strips with adhesive ribbon positioned in picture-frame fashion along perimeter of board and remaining adhesive ribbons spaced in accordance with location on roof (field, perimeter, or corner).

D. Heat Exhaust Vents:

1. Install heat resistant insulation around existing heat exhaust flue, vent pipes, or other penetrations that experience elevated operation temperature.
2. Install new sheet metal base around insulation and strip flange into new roof.

E. Insulation Filler: Install compressible fiberglass insulation at openings in deck at penetrations, perimeters, expansion joints, and/or curbs.

3.5 CLEANING:

A. Remove debris and material wrappers from roof to dumpster daily. Leave insulation clean, dry, and ready to receive new roofing.

3.6 ADJUSTING:

A. Remove damaged insulation and install acceptable new units before installation of roof system.

3.7 PROTECTION:

A. Provide special protection from traffic on completed work.

END OF SECTION 072200

SECTION 07 52 00 MODIFIED BITUMEN MEMBRANE ROOFING

PART ONE - GENERAL

1.01 SECTION INCLUDES:
- A. Installation of two-ply modified bitumen roof membrane and related flashings.

1.02 RELATED SECTIONS:
- A. 02 40 00 - Minor Demolition and Renovation Work.
- B. 07 22 00 - Roof Board Insulation.
- C. 07 62 00 - Sheet Metal Flashing and Trim.

1.03 REFERENCES:
- A. American Society for Testing and Materials (ASTM).
- B. FM Global Approval Guide.
- C. Underwriters Laboratories (UL): Building Materials Directory.
- D. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual.
- E. ASCE 7-16: "Minimum Design Loads for Buildings and Other Structures."
- F. Cool Roof Rating Council (CRRC).
- G. SPRI: Application Guidelines for Modified Bitumen Roofing Systems.
- H. FM Global Property Loss Prevention Data Sheets
  1. DS 1-28 “Wind Design”.
  2. DS 1-29 “Roof Deck Securement and Above-deck Roof Components”.
  3. DS 1-33 “Safeguarding Torch-applied Roof Installations”
  4. DS 1-49 “Perimeter Flashing”.

1.04 QUALITY ASSURANCE:
- A. Application:
  1. Approved by manufacturer of accepted roofing system.
  2. A single applicator with a minimum of five years previous successful experience in installations of similar systems.
  3. Demonstrated successful installation in three other comparable buildings will be preferred. Submit subcontractor qualification statement.
- B. Manufacturer Requirements:
  1. Roof Membrane Assembly: Classified by Underwriters' Laboratories, Inc. as a Class A roof covering with no slope limitations.
  2. Roof Membrane Assembly: Classified by FM Global as a Class 1, approved assembly and Class 1-SH (Severe Hail) exposure.
  3. Manufacturer to have direct actual in-house experience in the manufacturing of the specified or similar products for a period of a minimum of twenty years.
  4. Manufacturer to have documented project history of installation of the specified or similar products in the United States for a period of a minimum of twenty years.
  5. Manufacturer to provide authorized documentation of the physical/ mechanical properties from the testing laboratory of Manufacturer of the actual materials utilized for the project indicating compliance with applicable ASTM standards D 5147 and D 6298.
  6. Manufacturer's top membrane ply product shall be tested by CRRC and meet the following requirements: Initial Solar Reflectance of 0.70 (minimum) and Thermal Emittance of 0.75 (minimum).

7. Manufacturer's products shall comply with the following standards:
   a. Polyester/Fiberglass composite reinforcement SBS modified bitumen sheet, ASTM D 6162, Grade S or G, Type 1 – 3.
   b. Fiberglass-reinforced SBS modified bitumen sheet, ASTM D 6163, Type 1 – 3, Grade S or G.
   c. Polyester-reinforced SBS modified bitumen sheet, ASTM D 6164, Type 1 – 3, Grade S or G.
   d. Polyester-reinforced APP modified bitumen sheet, ASTM D 6222, Type 1 or 2, Grade S or G.

C. Regulatory Requirements:
1. Classified by Underwriters' Laboratories, Inc. as a Class A roof covering.
2. Classified by FM Global as a Class 1A assembly.
3. Follow local, state, and federal regulations, safety standards and codes.
4. Install roof system in manner to resist minimum wind uplift pressures of: 60 psf for the field of the roof; 90 psf in 8-feet wide perimeter zones; and 135 psf in 8-feet by 8-feet corners. Pressures are based on ASCE 7-16 and following criteria: 145 mph (verified on ATC website) wind speed; Exposure B; Risk Category III-IV; and Safety Factor of 2.
5. Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.
6. Provide tested and approved system to meet or exceed the specified wind uplift pressures.

D. Laboratory Testing and Samples:
1. At Owner's request, obtain field samples of the completed roof membrane, laps, and/or assembly.
2. Take samples at locations designated by Owner's Representative and test for compliance with the requirements of the Contract Documents and with manufacturer's published performance criteria.
3. Assume all costs for extraction and patching of all samples. Owner shall assume all costs for testing of field samples.
4. Correct all deficiencies in accordance with the manufacturer's recommended procedures at no cost to Owner.
5. If for any reason, areas that are tested by Owner fail to meet manufacturer's requirements, then all subsequent expense for retesting of those areas will be borne by Contractor.

E. Installation:
1. Install in accordance with the manufacturer's current published application procedures, the general recommendations of the National Roofing Contractor's Association, and as supplemented by these documents.
2. Follow Underwriters Laboratories requirements acceptable for use with specified products or systems.
3. During installation and upon completion of installation, an inspection shall be conducted by a technical representative of the manufacturer to certify that roofing system has been installed according to manufacturer's most current published specifications and details.
4. All roofing shall be as described in this Section and shall be provided and/or approved by roof system manufacturer.
5. Obtain written approval from the manufacturer for any materials not manufactured or provided by manufacturer stating that materials are acceptable and are compatible with other materials and systems required.
6. Personnel designated to utilized propane torching equipment to install roofing materials must have current CERTA safety certification issued by MRCA.

F. Make no deviations from this Specification or the approved shop drawings without the prior written approval of the Architect, Owner's Representative, and roof membrane manufacturer.
G. Perform entire work of this Section in accordance with the best standards of practice relating to the trades involved.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.
B. Store materials in accordance with manufacturer's recommendations. Store rolled goods on end on clean raised platforms. Store other materials in dry area, protected from water and direct sunlight, and maintain at a temperature of 60 to 80 degrees Fahrenheit (16 to 27 degrees Celsius).
C. Provide continuous protection of materials against deterioration.
D. Materials Stored on Roof Levels:
   1. Distribute materials stored on roof to prevent concentrated loads that would impose excessive strain on deck or structural members or impede drainage. Position materials stored on roof over structural support beams and/or columns.
   2. Positively secure materials and protective covers to prevent displacement by wind.
   3. Tarp for protection from exposure.
   4. Cut and remove manufacturer's plastic "shrink wrapping" from materials during storage.

1.06 SUBMITTAL:

A. General:
   1. Material manufacturer's roof system letter indicating the following: proposed roof system components; general installation requirements (adhesive coverage rate, fastener pattern layout, etc.); roof system uplift pressure resistance; supporting independent laboratory test report indicating respective test pressures; and warranty coverage to be provided.
   2. Material manufacturer's written approval/acceptance of specified roof system and issuance of specified warranty for project.
   3. Shop drawings of details.
   4. Manufacturer's product data sheets with Safety Data Sheets (SDS) on each material proposed for usage.
   5. Sample of warranty that is to be issued upon project completion.
   6. Samples of products proposed for use.
B. Shop Drawings:
   1. Shop drawings which illustrate the Work, showing fabrication, layout, setting, or installation details.
   2. Prepare shop drawings for details that are proposed for the project. Indicate on a roof plan, the proposed location of detail presented on shop drawing.
   3. Indicate joints, types, and locations of fasteners, shapes, sizes, expansion joints, special conditions, and installation procedures for each flashing condition. Note critical dimensions, gauge, and finish of sheet metal for each flashing condition.
   4. Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work.
   5. Provide drawings depicting insulation board attachment for field, perimeter, and corner zones.

C. Product Data: Submit manufacturer's catalog sheets, providing descriptive data for each material proposed for use in construction of roof assembly and related flashings and components.
D. Samples: Provide physical examples of materials/components proposed for use to comprise the specified roof system.

1.07 PROJECT CONDITIONS:
A. Existing Conditions: Examine existing building and existing roofing and decking to determine physical conditions that affect removal of existing roofing and installation of new roofing and decking.
B. Environmental Requirements:
1. Apply roofing in dry weather.
2. Do not remove existing roofing and flashing in inclement weather or when rain is predicted (30% or more possibility).
3. Do not apply materials when ambient temperature is below 40 degrees Fahrenheit (5 degrees Celsius).
4. Do not expose material to a constant temperature in excess of 180 degrees Fahrenheit (82 degrees Celsius).
C. Protection:
1. Provide special protection or avoid heavy traffic on completed work when ambient temperature is above 80 degrees Fahrenheit (27 degrees Celsius).
2. Restore to original condition or replace work or materials damaged during handling or roofing materials.
D. Emergency Equipment: Maintain on-site equipment necessary to apply emergency temporary edge seal in the event of sudden storms or inclement weather.

1.08 SEQUENCING AND SCHEDULING:
A. Do not remove more existing roofing in one day than can be replaced with new roofing and flashing in same day.

1.09 WARRANTY:
A. Contractor shall submit to Owner prior to final payment, two copies of the following warranties:
1. Roofing Material Manufacturer's Warranty: Project shall be installed in such a manner that the roof system manufacturer will furnish a written full-system (including, but not limited to, insulation layers, fasteners, adhesives, flashing sheets, etc.), no dollar limitation, labor and material warranty agreeing to replace/repair defective materials and workmanship, including leakage of water, abnormal aging or deterioration of materials, and other failures of the materials to perform for a warranty period of twenty years after date of written final acceptance by Owner.
2. Contractor's Warranty: In addition, Contractor shall furnish a written warranty agreeing to repair/replace defective installation and workmanship causing leakage of water, deterioration of materials, and other failures of the installed system, sealants, painting coatings and related work on this project, to perform for a warranty period of two-years after date of written final acceptance by Owner.

PART TWO - PRODUCTS

2.01 MANUFACTURER:

A. Acceptable SBS Modified Bitumen Roofing Manufacturers:
   1. Siplast.
   2. Soprema.
   3. Firestone.
   4. Johns Manville.
   5. Or approved equal.

B. Acceptable APP Modified Bitumen Roofing Manufacturers:
   1. Derbigum.
   2. Certainteed.
   3. Firestone.
   4. Or approved equal.

2.02 SHEET MATERIALS:

A. SBS Membrane System:
   1. Membrane Base Ply: ASTM D 6164, Type I, Grade S; smooth-surfaced, polyester-reinforced, SBS modified bitumen sheet, suitable for application with cold-adhesive and/or heat-welding/torching methods such as "Paradiene 20 PR TG" or "Paradiene 20 PR" by Siplast, "Sopralene Flam 180" or "Sopralene 180 PS" by Soprema, "SBS Poly Torch Base" or "SBS Poly Base" by Firestone, or "DynaWeld 180S" or "DynaBase PR" by Johns Manville, or approved equal.
   2. Membrane Top Ply: White-colored granule-surfaced, fiberglass/polyester reinforced, SBS modified bitumen sheet suitable for application with torch-application/heat welding such as "Paradiene 30 HT FR TG BW" by Siplast, "Sopralene 180 FR GR (SG)" by Soprema, "SBS FR Torch UltraWhite" by Firestone, "DynaWeld Cap 180 CR FR G" by Johns Manville.
   3. Base Flashing System: One-ply of specified membrane base ply and one ply of specified top ply or other granule-surfaced (color to match cap sheet) polyester-reinforced SBS modified bitumen flashing sheet.

B. APP Membrane System:
   1. Membrane Base Ply: ASTM D 6222, Type 1 or 2, Grade S; smooth-surfaced, polyester-reinforced APP modified bitumen sheet suitable for application with cold adhesive and/or heat welding/torching such as "DerbiBase HV" by DerbiGum, "Flintlastic STA" by Certainteed, or "APP 160" by Firestone.
   2. Membrane Top Ply: ASTM D 6222, Type 1 or 2, Grade G; white-colored surfacing, polyester-reinforced, APP modified bitumen sheet suitable for application with cold adhesive and/or heat welding/torching methods such as "DerbiColor P CR FR" by DerbiGum, "Flintlastic GTA-FR with Cool Star" by Certainteed, or "APP 180 FR UltraWhite" by Firestone.
   3. Base Flashing System: One ply of specified membrane base ply and one ply of specified membrane top ply.

2.03 RELATED MATERIALS:

A. Asphalt Primer: ASTM D 41.

B. Edge Sealant: Rubberized asphaltic plastic roof cement that is gun-grade version for sealing terminations of cap sheet such as “PerFlash” by DerbiGum, "Elastomastic 209" by Henry Co, or "#19 Ultra Rubberized Flashing Cement" by Karnak.

C. Elastomeric Plastic Roof Cement: Rubberized plastic roof cement such as "PerFlash" by Performance or "SopraMastic" by Soprema to be used for temporary seals of flashings, embedding flanged sheet metal flashings, and three coursing of seams, termination bars, and cuts in modified bitumen sheets.
D. Cold Process Adhesive: Low VOC or solvent free asphaltic or polymeric based adhesive suitable for use with modified bitumen sheets such as “Permastic” by DerbiGum, “COLPLY EF Adhesive” by Soprema, “SFT Adhesive” by Siplast, “LiquiGard Adhesive” by Firestone, "MBR Bonding Adhesive" by Johns Manville, or approved equal.
E. Cant Strip: 3-5/8-inches (92mm) by 1-1/2-inches (38mm) composite cant strips of perlite such as "FesCant Plus" by Johns Manville or "Energy Guard Perlite Cant Strip" by GAF with field-cut strips of cover board with chamfered ends or triangular-shaped modified bitumen cant strip comprised of cut sections of “DerbiGum GP”, 2-1/4-inch X 2-1/4-inch X 3-1/4-inch in size such as “Double DerbiCant” by DerbiGum..
F. Walk Pads/Protection Pads: Pre-manufactured sheet or cut sections of granule surfaced polyester-reinforced modified bitumen sheet, extending minimum 2-inches (50mm) beyond edge of overlying element, with rounded corners and to have contrasting granule color from top ply such as “DerbiGum FR” by DerbiGum, “ParaTred” by Siplast, “DynaTred” by Johns Manville, or approved equal.
G. Heavy-duty Protection Pad: Asphaltic composite board with mineral surfacing, 3/4-inch thick, (3’ X 3’) (3’ X 5’) size to suit application, such as “Whitewalk” by W.R. Meadows (2555 N.E. 33rd Street, Fort Worth, Texas 76111, 817/834-1969) or panel composed of recycled rubber particles such as “Roof-Gard Pads” by Humane Manufacturing, LLC (805 Moore Street, Baraboo, Wisconsin 53913, 800/369-6263), “Duo-Pad” by W.R. Meadows (1/2-inch by 30-inch by 4 foot) (3/4-inch by 33-inch by 4-foot), or “Walkway Roof Pads” by RB Rubber Products, Inc. (904 N.E. 10th Avenue, Portland, Oregon 97128, 503/472-4691).
H. Liquid Flashing System: Fluid-applied reinforced flashing system to apply around roof penetrations, low-profile flashing substrates, at roof drains, or other suitable locations that would be included in the warranty coverage for the roof membrane system and match color of finish ply such as "SeamFree" by Johns Manville, "Parapro" by Siplast, “DerbiFlash” by Derbigum, "Alsan" by Soprema, or approved equal.

2.04 MISCELLANEOUS MATERIALS:
A. Best grade or quality approved by the manufacturer for the specific application.

PART THREE - EXECUTION

3.01 EXAMINATION OF SURFACES
A. Examine substrate, roof deck, and related surfaces, and verify that there are no conditions such as inadequate anchorage, foreign materials, moisture, ridges, or other conditions that would prevent satisfactory installation of the roofing system.
B. Correct or complete any condition requiring correction or completion prior to installation of the roofing system. Notify Owner's Representative in writing of unacceptable conditions.
C. Verify the location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. Perform all work in such a manner as to avoid contact with the above-mentioned items.
D. Verify insulation is installed correctly.
E. Start of work under this Part Three constitutes acceptance of deck substrate and site conditions.

3.02 PREPARATION:

A. Do not stockpile debris on roof surface.
B. Promptly remove debris each day. Use chutes, hoists, or other equipment to transfer debris from roof surface to disposal container.
C. Cleaning:
   1. Verify that debris has been completely removed.
   2. Clean roof insulation with stiff bristle broom and forced-air blower immediately prior to base ply application.

3.03 APPLICATION

A. Prior to roof membrane installation, seal all openings, projections, and penetrations in the substrate to prevent material or debris entry into the building. Correct damage to the building or interior components caused by work at Contractor's sole expense.
B. Membrane Installation - General:
   1. Apply roofing in accordance with roofing system manufacturer's instructions and the following requirements. Apply roofing immediately following application of insulation as a continuous operation.
   2. The overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply specified materials, and exercise care to ensure finished application is acceptable to Consultant and Owner.
   3. When applicable, install sheet materials using adhesives applied to substrate for adhering the field of the sheet. Side laps and end laps shall be fused together using electric-operated hot-air welding equipment suitable for use with modified bitumen materials such as provided by Cadillac Products, Leister, or other suitable equipment.
   4. Prime top and bottom of metal surfaces, concrete surfaces, and masonry surfaces to receive roofing with a uniform coating of asphalt primer, at a nominal rate of one-gallon (3.8 liters) per 100 square feet (9.29 square meters).
   5. Place cant strips on top of substrate to form continuous monolithic substrate at walls and curbs. Nail wood cants to nailer and to wall or vertical nailer, where possible. Secure fibrous cants by embedding in ribbons of low-rise foam adhesive. Miter cut cant strips to form continuous substrate at corners. Adhere cut piece of roof cover board in low-rise foam adhesive over top of fibrous cant.
   6. Lay all layers of roofing free of wrinkles, creases, or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
   7. Lay layers of roofing perpendicular or parallel to the slope of the deck as recommended by manufacturer.
   8. Install roof system configuration and components as required to meet the requirements of the testing assembly for the respective proposed roof material manufacturer.
C. Membrane Application - Base Ply:
   1. Cold Adhesive Application Option: Apply one ply of modified bitumen base ply over substrate in uniform continuous application of cold process adhesive. Apply adhesive at a nominal rate of 1-1/2 gallons to 2-1/2 gallons (5.71 liters to 9.5 liters) per 100 square feet (9.29 square meters), depending on the substrate (base sheet or insulation). Keep the adhesive applicator in close proximity to the material roll, maximum 2 feet (.7m). Exert sufficient pressure on roll during application. Roll field of sheet after initial installation of base ply with weighted lawn/linoleum roller. Heat-fuse the side and end lap seams of base ply with controlled hot-air equipment.

2. Heat-Fusing Application Option: Apply one ply of modified bitumen base ply over substrate using heat-fusing methods with hot-air gun equipment suitable for modified bitumen sheets. Apply heat evenly across the front face and full width of the roll while pulling roll forward and unrolling roll uniformly with an even downward pressure. Apply heat to roll until the bitumen back coating reaches the desired application temperature, resulting in complete melting of the burn-off film, a glossy appearance of the back coating, and an approximate 1/4-inch (6mm) to 1/2-inch (13mm) bitumen flow from edge of sheet. Exert sufficient pressure on roll during application. Do not stand on the subject sheet during the installation process.
3. Fully adhere membrane base ply to base sheet or insulation and have a minimum of 3-inch (75mm) side laps and 6-inch (150mm) end laps. Stagger end laps of adjacent sheets of membrane base ply a minimum of 3 feet. Extend field sheet of membrane base ply to top edge of cant.
4. Complete membrane base ply application over respective roof area prior to application of membrane top ply. Apply additional ply of membrane base ply in low areas or areas that may be subjected to ponding water or to promote positive drainage.
5. Apply a patch over areas of base ply with areas of physical damage or other defects. Patch to be the full width of membrane base ply and extend a minimum of 2-inches (50mm) beyond the defect in each direction.
6. Check lap seams and seal unbonded or discontinuous seams using a heated steel trowel.

D. Base Flashing Application - Base Ply:
1. Install and complete application of base ply of flashing each day base ply of membrane is installed. Install base ply flashings at curbs and parapet walls.
2. Install first ply of base flashing extending horizontally 4-inches (100mm) beyond edge of cant or sheet metal flashing flange and vertically to top edge of curb, wall, or minimum 4-inches (100mm) above the top of the cant.
3. Length of base flashings shall be maximum 6-feet (2m). Lap ends of base flashings 4-inches (100mm), minimum. Seal top edge of base flashing on a daily basis with a continuous troweling of elastomeric roof cement.
4. Check lap seams and seal unbonded or discontinuous seams using a heated steel trowel.
5. For wood substrate, mechanically attach a base sheet 8-inches (200mm) on-center in all directions and along lap seams, overlapping adjacent sheets 4-inches (100mm), minimum. Adhere modified bitumen base ply flashing to base sheet.
6. Where existing substrate is deemed unacceptable to install new materials, attached plywood or acceptable gypsum sheathing to serve as new substrate for flashing membrane.

E. Strip-in Flashing:
1. Prime top and bottom of metal flanges and other sheet metal components completely and allow to dry prior to installation.
2. After membrane base ply has been applied, install metal flange flashings according to Section 07 62 00 - Sheet Metal Flashing and Trim. Strip-in flange/metal with strips of base flashing (base ply) concealing entire flange or horizontal surface of metal flashing and extending a minimum of 4-inches (100mm) beyond edge of flange/metal and heat-fusing strip-in to base ply.

3. Membrane Application - Top Ply:

1. Unroll top ply and cut roll length in half approximately 15-foot lengths. Lay cut sections of top ply with underside exposed to allow the sheet to relax prior to application. Prior to application, re-roll "relaxed" sheet using insert provided with roll.

2. Beginning at the low point on the roof, fully adhere membrane top ply to membrane base ply with minimum of 3-inch (100mm) side laps or width of selvage edge and 6-inch (150mm) end laps. Extend membrane top ply to top edge of cant. Apply each sheet directly behind applicator. Stagger side laps of top ply a minimum of 12-inches (300mm) from side laps of base ply.
3. Cold Adhesive Application: Apply modified bitumen top ply in uniform continuous application of cold process adhesive. Apply adhesive at a nominal rate of 1-1/2 gallons to 2-1/2 gallons (5.71 liters to 9.5 liters) per 100 square feet (9.29 square meters. Keep the adhesive applicator in close proximity to the material roll, maximum 2 feet (.7m). Exert sufficient pressure on roll during application. Roll field of sheet after initial installation of top ply. Heat-fuse the side and end lap seams of the cap sheet with hot-air gun equipment.
4. Heat-Welding/Fusing Application: Apply heat evenly across the face and full width of the roll while unrolling roll uniformly with an even downward pressure. Apply heat to roll using hot-air equipment until the bitumen back coating reaches the design application temperature, resulting in complete melting of the burn-off film, a glossy appearance of the back coating, and an approximate 1/4-inch (6mm) to 1/2-inch (13mm) bitumen flow from edge of sheet. Roll lap seams with steel roller immediately upon fusing/ mating of the sheets.
5. While installing membrane top ply, provide proper protection or method during application to prevent contamination, soiling, charring, or marring the finish surfacing of previously installed sheet. Exert sufficient downward pressure on roll during application.
6. During end lap application, trim the inside corner along the selvage edge of the underlying sheet at the end of the roll. The trimmed area shall be the width of the selvage edge and extend downward from the end of the roll to the outer side of the roll in a linear direction approximately 5-1/2-inches (138mm) from end of roll. Trim outside corner of membrane top ply at end laps to provide rounded finished corner. Remove surfacing or de-granulate areas of underlying top ply to receive overlapped portion of adjacent sheet. Pre-heat the subject area of the underlying sheet so that surfacing material can be removed or that granules can be "depressed" or sunk into the compound and the bitumen compound exudes up through the granules to result in a bituminous material-to-bituminous material contact.
7. Embed white-colored granules into bituminous bleed-out along edges of cap sheet to provide monolithic surface color.
8. Install membrane top ply so that end laps of every other sheet are aligned.
9. Apply a patch over areas of membrane with displaced/dislodged granules/ surfacing or other surface discoloration or defects. Patch shall be the full width of membrane top ply and extend a minimum of 2-inches (50mm) beyond the defect in each direction. Round corners of membrane patches.
10. Apply additional finish material, color to match top ply, over stains, soiling, and other areas of the top ply with displaced or discolored surfacing.
11. Check lap seams and seal unbonded or discontinuous seams using a heated steel trowel.
12. Apply membrane top ply and terminate at the rise in the metal component. Apply a continuous bead of edge sealant along edge terminations of modified bitumen sheet (i.e. flashing flanges, exhaust vents, metal edge, etc.). Bead of edge sealant shall match height of top sheet surfacing and shall be "canted" to shed water. Embed loose granules or coat with elastomeric coating, color to match top ply, into newly installed edge sealant.

F. Base Flashing Application - Top Ply:
1. Apply top ply of flashings only after membrane top ply is in place at curbs and parapet walls.
2. Remove surfacing or de-granulate granulated surfaces on top ply sheet of membrane and flashings to receive flashing top ply. Pre-heat the subject area of the underlying surfaced sheet so that surfacing can be removed or so that granules can be "depressed" or sunk into the compound and the bitumen compound exudes up through the granules to result in a bituminous material-to-bituminous material contact.
3. Cut modified bitumen flashing membrane to extend a minimum of 4-inches (100mm) above the top of the membrane top ply covering the cant. The overall minimum height of the top of the flashing membrane above the top of the roof surface is 8-inches (200mm). Extend flashings to full height of vertical substrate.
4. Extend the flashing membrane horizontally 4-inches (100mm) onto the field of the roof surface beyond the bottom edge of the cant strip.
5. Cut flashing from roll using selvage edge as lap seam for adjacent sheets, resulting in sheet lengths of nominal 3 feet (1m). Lap ends a minimum of 4-inches (100mm) and stagger laps from laps of underlying plies.
6. Fully adhere and conform top ply of flashing to substrate. Extend bleed-out of applied base flashing a minimum of 1/2-inch (13mm) beyond the side or end lap. "Broom-in" foil-faced flashing ply immediately upon installation using a damp sponge mop. Embed granules or coat bleed-out with aluminum dust/elastomeric coating, to match finish surfacing.
7. Walls: Mechanically attach top edge of modified bitumen membrane flashing with termination bar and appropriate fasteners spaced 6-inches (150mm) on-center. Apply three-coursing consisting of an initial continuous troweling of elastomeric plastic roof cement, embedded reinforcing fabric, and a secondary application of elastomeric plastic roof cement along and concealing the top edge of base flashing and termination bar. Utilize duct/masking tape, or similar tape, to provide line of demarcation for three-coursing located parallel and 2-inches below termination bar.
8. For wall substrates greater than 12-inches (300mm) in height, install base flashing to a height of 12-inches (300mm) as specified. For remaining wall height, Adhere modified bitumen flashing to substrate and overlap wall flashing on top edge of base flashing a minimum of 4-inches (100mm). Install appropriate fasteners in vertical lap seams spaced 6-inches (150mm) on-center. Apply three-coursing over completed lap seams.
9. Apply cut section of modified bitumen over corners of curb flashings to conceal cuts in flashing material at corner laps.
10. Install flashing sheets on adjoining perpendicular sides (outside corners) of curbs or walls so that outside corners of flashing sheet align and are rounded.
11. Curbs: For curbs with non-removable hoods/covers/units, extend flashing to full height of curb, secure with termination bar and appropriate fastener, and apply three-coursing of plastic cement and reinforcing fabric over top edge of sheet. Utilize duct/masking tape, or similar tape, to provide line of demarcation for three-coursing located parallel and 2-inches below termination bar. For curbs with removable hoods/covers/units, wrap flashing sheet over top of curb and secure to top or inside of curb with angle termination bar and appropriate fasteners spaced 6-inches (150mm) on-center.

G. Metal Flanged Flashings:
1. Apply membrane top ply and terminate at the rise in the metal component.
2. Apply a target around penetrations or utilize flashing method to conceal cuts in the membrane top ply.

3. Apply a continuous bead of edge sealant along edge terminations of modified bitumen sheet (i.e. flashing flanges, exhaust vents, metal edge, etc.). "Cant" bead of edge sealant to shed water. Embed loose granules in newly installed edge sealant and apply coating to match finish of top ply, where applicable.

H. Liquid-Flashings
1. Apply liquid flashing systems in accordance with the manufacturer's application guidelines at select and designated locations in-lieu of conventional flashing or where conventional flashings cannot be installed to meet manufacturer's warranty requirements and around roof drain sump areas.
2. Apply liquid flashing systems in accordance with the manufacturer's application guidelines around roof drain sump areas.
3. Clean penetrating element or approved substrate to receive liquid flashing system.
4. Apply masking tape on substrate to create straight-edge terminations of the liquid flashing system.
5. Embed reinforcing fabric in the liquid flashing system to form monolithic flashing with the finished roofing membrane. Apply finish surfacing on the liquid flashing system to match the color of the finished top ply of the roof membrane or substrate to which the coating is applied as approved by Architect.
6. Apply reinforced liquid flashing system on top of cap sheet in area 3-feet X 3-feet around each primary roof drain. Embed granules, color to match cap sheet, in surface of liquid flashing.

I. Daily Seal:
1. Install temporary seal at completion of each day's work.
2. Ensure that water does not flow beneath any completed sections of the membrane system. This will include completion of all flashings, terminations, and daily seals. When possible, install starting at the highest point of the project area, working to the lowest point.
3. Temporarily seal membrane edge with plastic roof cement. Exercise caution to ensure that membrane is not temporarily sealed near drains in such a way to promote water migration below the membrane or impede drainage.
4. Install primary night seal beneath daily night seal in such a manner to seal both new and existing roof system to roof deck to prevent moisture migration from or into either old roof or new roof.
5. Install daily night seals by extending the new roof membrane beyond the insulation and sealing to the existing roof surface using plastic roof cement, sealant, self-adhering membrane or other material/method to achieve watertight seal.
6. When work is resumed, remove and dispose of portion of membrane where materials were applied to achieve night seal.

J. Daily Fire Watch: Contractor personnel to perform daily "Fire Watch" a minimum of two-hours upon completion of heat-fusing installation methods. Contractor to utilize an infrared-sensing thermometer or similar equipment that can provide instant detection of elevated and/or different temperatures of roofing materials. If elevated or suspect temperatures or underlying conditions are detected, contractor to remove necessary materials and perform necessary actions to alleviate the noted condition. Maintain appropriate number of fire extinguishers on roof during installation of roofing, minimum one per application location.

3.04 PROTECTION PADS:

A. Install layer of heavy-duty protection pad loose laid on top of cut section of modified bitumen protection pad adhered to roof surface for large-sized (greater than 4-inch diameter) or heavy roof-top piping. . Install and adhere a layer of modified bitumen protection pad under each support for typical roof-top piping including condensate piping, conduit (2-inch dimeter and smaller), coolant, gas, and other similar piping. Size of protection layers shall be minimum 2-inches longer in each direction through base of support with rounded corners

B. Install protection pads, adhered to capsheet, in locations where items are to be installed on roof surface including, but not limited to, lightning protection system components

3.05 WALK PADS:

A. Install walkpads around serviced equipment, at roof access points, in areas where water is discharged onto roof surface from adjacent/higher roof area, highly trafficked areas, and as required by Owner. Install adjacent walkpads with approximate 4-inch space between ends and/or sides. Apply walkpads on top of membrane top ply.

3.06 FIELD QUALITY CONTROL:

A. Inspections:

1. During installation on individual roof areas, provide for one on-site inspection by a technical representative of roof membrane manufacturer.
2. Upon completion of installation, provide a final inspection and written report by a technical representative of roof membrane manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.

3.07 CLEANING:

A. Remove debris, adhesives, and sealants from surfaces.

B. Remove debris and material waste from project site.

END OF SECTION 07 52 00

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Shop or field-formed sheet metal work for moisture protection.

B. Types of work specified in this Section include:

1. Roof penetration sleeves and bonnets.
2. Receivers.
3. Counter flashings.
4. Coping.
5. Edge metal/fascia.
6. Roof drains.
7. Plumbing vent pipes.
8. Through-wall overflow scuppers.
9. Miscellaneous sheet metal accessories.

1.2 RELATED SECTIONS:

A. 02 40 00 - Minor Demolition and Renovation Work.

B. 07 52 00 - Modified Bitumen Membrane Roofing.

1.3 REFERENCES:

A. American Society for Testing and Materials (ASTM).

B. Federal Specifications (FS).

C. National Roofing Contractor's Association (NRCA): NRCA Roofing and Waterproofing Manual, latest edition.

D. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA): Architectural Sheet Metal Manual, latest edition.

E. ANSI/SPRI ES-1: "Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems."

1.4 WARRANTY:

A. Contractor's Warranty: Provide Owner a written warranty which shall warrant sheet metal work to be free of leaks and defects in materials and workmanship for two years after date of final acceptance by Owner.

B. For pre-finished metal, provide manufacturer's twenty-year guarantee covering deterioration or failure of the fluoropolymer finish.

1.5 PERFORMANCE REQUIREMENTS:

A. Roof edge sheet metal flashing shall be certified by the manufacturer or shop-fabricator to comply with ANSI/SPRI Standard ES-1 for 150 mph wind speed and horizontal design pressure and vertical design pressure applicable for the eave height of the subject building. ANSI/SPRI ES-1 Test Method RE-3 Test for Copings: The coping shall be tested for 150 mph wind speed and horizontal design pressure and vertical design pressure applicable for the eave height of the subject building.

B. The sheet metal coping product shall be UL Classified by Underwriters Laboratories, Inc. or other third-party verification of compliance with the ANSI/SPRI ES-1 Wind Design Standard.

C. Provide base sheet metal that is manufactured in the United States and incorporates some percentage of recycled content. Provide documentation from manufacturer/supplier supporting this information.

1.6 MOCK-UPS:

A. Contractor to prepare mock-ups utilizing materials proposed for the finished product and to simulate the desired appearance of the finished product. Mock-ups shall be of appropriate size to depict finishes and connections

B. Schedule of mock-ups shall include the following: Typical wall counter flashing condition(s); Typical metal edge/fascia condition(s); size of mock-ups shall be 3 feet minimum.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Pre-finished Sheet Metal Manufacturers:

1. Berridge Manufacturing Company.
2. Peterson Aluminum Corporation (PAC CLAD).
3. McElroy Metals, Inc.
4. Metal Building Components, Inc. (MBCI).
5. Firestone Metal Co (Una-Clad).
6. Or approved equal.

2.2 SHEET METAL MATERIAL:

A. Pre-finished Metal: "Kynar 500" or "Hylar 5000" fluoropolymer pre-finished G90 galvanized/galvalume sheet metal, minimum 24 gauge. "Kynar 500" or "Hylar 5000" finish shall consist of a two coat Polyvinyladine flouride, minimum 70 percent by weight in coatings, dry film thickness 1 mil, factory applied by metal manufacturer or supplier. Color selected by Owner from manufacturer's standard color chart.

B. Zinc-coated (Galvanized) Sheet Metal: Commercial quality with 0.20 percent copper, in accordance with ASTM A 526 except ASTM A 527 for lock forming; coating designation G90 hot-dip galvanized, 24 gauge minimum.

C. Sheet Lead: FS QQ-L-201, Grade B; 4 pounds per square foot ($140n/m^2$) 0.0625-inches (1.6mm) thick minimum as used for roof drains.

D. Stainless Steel Sheet Metal: ASTM A240, Type 304, ASTM A480, No. 2B/2D Mill Finish, gauge as scheduled.

2.3 FASTENERS:

A. Fasteners shall be same metal as flashing and sheet metal being joined.

B. Exposed fasteners shall be self-sealing or gasketed for watertight installation.

C. Heads of fasteners, including but not limited to, rivets, screws, and bolts, that are exposed or visible shall have same manufactured finishes as item being secured; color to match when applicable.

D. Mechanical Fasteners:

1. Refer to Section 02 40 00 – Minor Demolition and Renovation Work.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type compatible with material fastened.
4. Rivets: Stainless steel material for the head and stem, closed end, color to match sheet metal items being adjoined.

2.4 RELATED MATERIALS:

A. Solder:

1. ASTM B 32, alloy grade 58, 50 percent tin, 50 percent lead.
2. For Use with Stainless Steel: 60-40 tin/lead solder, ASTM B 32.

B. Flux:

1. Phosphoric acid type, manufacturer's standard.
2. For Use with Steel or Copper: Rosin flux.
3. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment: Self-adhering rubberized asphalt sheet membrane, 40-mil thick, suitable for high-temperature applications up to 250 degrees Fahrenheit such as "Blueskin PR 200HT" by Henry, “WIP 300 HT” by Carlisle, or approved equal.

D. Adhesives: Type recommended by flashing sheet manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.

F. Sealant:

1. Type A: One component polyurethane sealant such as "Sikaflex 1a" by Sika Corp. or “Sonolastic NP1” by BASF, color to match finish of metal.
2. Type B: Low modulus silicone sealant for sealing metal-to-metal surface (i.e. metal edge, cover plates) such as “Sikasil WS-290” or “Sikasil WS-295” by Sika Corp., “795 Silicone Building Sealant” or “790 Silicone Building Sealant” by Dow Corning, or “GE Silpruf 2000” by Momentive Performance Technologies; color to match finish of metal.
3. Type C: Self-adhering elastomeric butyl tape, 1/8-inch (3mm) by 3/8-inch (9mm), such as "Extru-Seal" by Pecora Corp.
4. Type D: Type A: One component moisture cure polyether polymer sealant available in over 175 standard colors such as "Tite Bond Weather Master Sealant" by Franklin International, color to match finish/color of adjacent sheet metal.

G. Base Material for Flashing Pans:

1. Flashing Pans 12-inch by 12-inch and Smaller: Quick-setting grout formula meeting Corps of Engineers specification CRD-C-621, Type D and ASTM C-1107, Grade C, such as “Five Star Instant Grout” by Five Star Products, Inc., “Sika Grout 212” by Sika Corp., or approved equal.
2. Flashing Pans Larger than 12-inch by 12-inch: Spray-foam such as “FrothPak” by InstaFoam.

H. Pourable Sealer: Single-component pourable polyurethane sealer such as "Pourable Sealer" by JM, "1-Part Pourable Sealer" by Chem-Link, or approved equal.

I. Termination Bar: 1/8-inch (3mm) thick, 1-inch (25mm) wide extruded aluminum bar with flat profile, factory punched oval holes (1/4-inch by 3/8-inch [6mm by 9mm]) spaced 6-inches (150mm) on-center, such as "TB 125" by The TruFast Corp. or “Heavy Flat Bar” by OMG.

J. Stainless Steel Clamp: Stainless steel banding with worm-drive tightening, sized for application such as "Make-A-Clamp Kit" by Dynamic Fastener, 800/821-5448.

2.5 FABRICATION - GENERAL:

A. Fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and approved shop drawings.

B. Comply with material manufacturer's instructions and recommendations for forming material.

C. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edge flashings and copings from single piece with equal length legs, minimum 3 feet. Notch, lap, and seam inside and outside corners of counter flashings.

D. Fabricate for waterproof and weather resistant performance with expansion provisions for running work sufficient to permanently prevent leakage, damage, or deterioration of work. Form work to fit substrates.

E. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling.

F. Form materials with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

G. Fold back edges of exposed ends of sheet metal edge to form hem, 1/2-inch minimum.

H. Lap joints 1-inch (25mm) minimum. Rivet and solder joints on parts that are to be permanently and rigidly assembled for copper, stainless, aluminum, and galvanized sheet metal. Install rivets, spaced 1-inch (25mm) on-center and apply solder to secure and seal exposed edge of sheet metal in a uniform continuous bead with smooth top finish. Clean residue upon completion of soldering process. Fabricate sheet metal assemblies so that adjoining sections are nested to achieve continuous metal-to-metal contact.

I. Seams:

1. Fabricate non-moving seams in sheet metal with flat-lock seams.
2. Pre-finished Galvanized Sheet Metal: Seal pre-finished metal seams with rivets, spaced 1-inch (25mm) on-center, and silicone sealant, color to match metal finish.
3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.

J. Expansion Provisions: Where lapped type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with sealant concealed within joints.

K. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.

2.6 FABRICATED ITEMS:

A. Receivers and Counter Flashings: Minimum 24-gauge pre-finished sheet metal formed in maximum 10 foot (3m) lengths; fabricate "S"-shaped receiver to engage counter flashing a minimum of 1-inch; fabricate counter flashing with broken fascia of length to extend over top edge of base flashing a minimum of 4-inches with 1/2-inch hemmed drip edge.

B. Wind Clips: Minimum 24-gauge pre-finished sheet metal, 1-inch (25mm) wide, length to engage counter flashing a minimum of 1/2-inch (13mm).

C. Roof Penetration Flashing Pan and Bonnet: Minimum 24-gauge stainless steel sheet metal. Fabricate pan with 1/4-inch (6mm) hem at top edge, 4-inch (100mm) wide horizontal flanges with rounded corners; to provide installed minimum clear inside perimeter dimension of 2-inches (50mm) on each side of penetrating element and 6-inch height. Fabricate bonnet in two-piece adjustable construction with 1/2-inch caulk trough along top edge and a skirt, with hemmed edge, of length to extend over top edge of pan a minimum of 2-inches (50mm).

D. Angle Termination Bar: 1-inch by 1-inch (25mm by 25mm) 24-gauge galvanized sheet metal.

E. Cleats/Clips:

1. Concealed Cleats/Clips: Continuous strips, 22-gauge sheet metal, same metal type and fascia profile as adjacent metal item, with 3/4-inch drip edge formed at a 30 degree angle with vertical wall.
2. Exposed Cleats/Clips: 24-gauge pre-finished sheet metal.

F. Roof Drain: 4 pound lead, size 30-inch by 30-inch (750mm by 750mm).

G. Fascia Extender: 24 gauge pre-finished sheet metal with 1/2-inch stiffening rib at mid-span with 3/4-inch drips with 5/8-inch returns at 30-degree angle with vertical wall at bottom end formed in 10-foot lengths.

H. Coping:

1. Shop-fabricated Option: 24-gauge pre-finished sheet metal with 6-inch (150mm) wide cover plates of same profile. Form 3/4-inch drips with 5/8-inch returns at 30-degree angle with vertical wall at bottom end of both interior and exterior fascias complying with ANSI/SPRI ES-1 Standard, 140 mph during Test.
2. Pre-manufactured Option: Pre-manufactured prefinished sheet metal coping of designated dimensions and meeting ANSI/SPRI ES-1 requirements for 110 mph with continuous cleat installed over sloped substrate such as "Sloped Formed Coping" by Hickman Engineered Systems, "One Coping" by Metal Era, or approved equal complying with ANSI/SPRI ES-1 Standard.

I. Metal Edge/Fascia:
1. Shop-Fabricated Option: 24-gauge Pre-finished sheet metal with 4-inch horizontal flange, 1/2-inch high knuckle, and fascia length to extend a minimum of 1-inch below top edge of exterior wall cladding meeting ANSI/SPRI ES-1 for 150 mph wind speed. Form 3/4-inch drip with 5/8-inch return at 30° angle with vertical wall.
2. Premanufactured Option: Continuous 24-gauge prefinished Kynar 500 coated galvanized sheet metal canted gravel stop with fascia extender meeting ANSI/SPRI ES-1 for 110 mph wind speed such as “MBED Style G” by Hickman, “EdgeSystem One Gravel Stop” by Metal Era or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify that substrates are smooth and clean to extent needed for sheet metal work.

B. Verify that reglets, nails, cants, and blocking to receive sheet metal are installed and free of concrete and soil.

C. Do not start sheet metal work until conditions are satisfactory.

3.2 INSTALLATION:

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch (6mm) hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Install prefabricated corners or transitions at changes in direction, elevation or plane, and at intersections. Locate field joints not less than 12-inches (300mm), nor more than 3 feet (1m) from actual corner. Laps for all metals, except for prefinished metal, shall be 1-inch (25mm) wide, fastened with rivets spaced 1-inch (25mm) on-center and soldered.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners where possible; and set units true to line and level as indicated. Install work with laps, joints, and seams permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

D. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating affected surfaces with zinc chromate or other permanent liquid-applied or sheet product separation at locations of contact.

E. Continuous Cleat: At exposed edges of metal edge flashings, fascias, copings, and where required, attach continuous cleat at 6-inches (150mm) on-center with appropriate fasteners positioned on the vertical face and fastened into 2X blocking, concrete/masonry substrate, metal wall panels, or steel substrate. At a distance of 10 feet (3m) from each direction of corner, install fasteners 3-inches (75mm) on-center. Install cleat so fascia extends a minimum of 1-inch (25mm) below top of exterior wall finish.

F. Counter Flashings:

1. Install new counter flashings under equipment housing flanges and existing or new receivers along rise or parapet walls to extend a minimum of 4-inches below top edge of base flashing.
2. Secure counter flashing at 6-inches (150mm) on-center with self-tapping screws.
3. Saw-cut Reglet Mounted Assemblies: Saw cut new joint, 1/2-inch by 1-inch deep, in existing masonry/concrete where required and to install new receiver. Clean and prepare joint surfaces to receive sealant and insert receiver into joint. Secure new receiver in place with lead wedges spaced 12-inches (300mm) on-center wedged into joint. Install backer rod into saw-cut reglet and apply a continuous bead of sealant, Type B, along reglet and top edge of receiver and tool sealant to provide outward sloping finished surface. Secure counter flashing to receiver utilizing self-tapping grommetted screws spaced 6-inches (150mm) on-center.
4. Surface-mounted Assemblies: Secure two-piece surface-mounted receiver and counter flashing assemblies along concrete substrates. Install sealant tape, Type C, between receiver and substrate. Secure receiver to substrate with termination bar and appropriate fasteners spaced 12-inches on-center. Install a continuous bead of sealant, Type B, along caulk trough/top edge of receiver and tool sealant to provide outward sloping finished surface. Secure counter flashing to receiver utilizing grommetted self-tapping screws spaced 6-inches (150mm) on-center.
5. Install new receivers extending behind wall finish and secure vertical flange of receiver 6-inches on-center to back-up wall or metal wall panels. Extend underlayment and/or dampproofing material over vertical flange of receiver, where applicable.
6. Lap adjacent sections of receivers and counter flashings a minimum of 4-inches (100mm). Apply a continuous bead of sealant, Type B in lap.
7. Trim existing counter flashings at curbs and walls that are to remain to receive new flashings. Secure new counter flashing to trimmed existing flashing utilizing self-tapping screws spaced 6-inches (150mm) on-center.
8. Install wind clips to termination bar spaced 24-inches (600mm) on-center and engage drip edge of counter flashing a minimum of 1/2-inch (13mm).
9. Fabricate the counter flashing to form an integral closure at terminations.

G. Penetration Pans:

1. Install compressible fill insulation between penetrating element and deck.
2. Prime tops and bottoms of flanges of penetration pans.
3. Pop rivet and fully solder joints in pan and flanges.
4. Install penetration pan with flanges set in a uniform troweling of plastic roof cement on membrane base ply, secure flange with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in flanges.

5. Fill penetration pan to within 1-inch (25mm) of top of pan with non-shrink grout. Clean surfaces of pan and penetrating element and fill remainder of pan with pourable sealer.
6. Install sheet metal bonnet or hood to conceal the top of the penetration pan.

H. Roof Penetration Hoods and Bonnet:

1. Install sheet metal hood or bonnet on penetrating element to cover the top of the penetration pans.
2. Round or Pipe Penetrations:
   a. Set bonnet in sealant, Type C; utilize Type B sealant at heat sensitive areas.
   b. Install stainless steel draw band and tighten to secure to penetration.
   c. Seal top of bonnet with sealant, Type B.
3. Square Penetration:
   a. Secure bonnet to penetration with termination bar and self-drilling screws.
   b. Set bonnet in sealant, Type C.
   c. Seal top of bonnet with sealant, Type B.
4. Angle or Structural Steel Penetration:
   a. Attach bonnet to structural steel member by welding.
   b. Paint assembly after installation.

I. Roof Drains:

1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement on membrane base ply at roof drain locations.
2. Extend lead flashing into drain bowl or pipe a minimum of 2-inches (50mm) and over top of piping/ bowl connection, if possible. Apply a continuous bead of sealant, Type A, at intersection of pipe and drain bowl.
3. Mold lead flashing to conform to drain bowl assembly utilizing appropriate hand-held mallet/ hammer.
4. Prime top surface of lead flashing sleeve to receive strip-in membrane.

J. Plumbing Vent Pipe: Apply liquid flashing around plumbing vent pipe penetrations as noted in Section 075200, as depicted in detail drawings, and in general accordance with manufacturer's installation guidelines. Match color of liquid flashing to color of surfacing of cap sheet.

K. Pre-fabricated Metal Edge/Fascia:
1. After membrane installation, nail the continuous galvanized spring clip to the vertical face of the wood nailer. Locate the fasteners 3/4-inch below the roof edge (approximately center of nailer) and 12-inches on-center using a minimum 1-1/2-inch galvanized ring shank roofing nail. Allow 1/4-inch gap between sections of clip. Install mitered corners first then field sections. Insert one splice plate under each end of miter cover. Install miter covers by engaging miter cover onto anchor cleat and rotating miter cover up and over anchor bar miter until engaged along entire length of the anchor bar.
2. Install fascia extender in locations where indicated prior to installation of fascia/edge flashing system. Secure clip and fascia extender to wood nailers with appropriate fasteners at 6-inches on-center.
3. Install roofing membrane flashing over the spring clip allowing it to extend down the face to the drip edge. Locate and hang joint covers at all joints between corners and straight sections.
4. Install preformed curved sections to match radius of existing construction.
5. Install prefabricated inside and outside corners fabricated from one piece of sheet metal.

6. Hook each section of fascia cover over the top of the spring clip and membrane. Press down on the fascia until the drip edge is engaged. Allow 1/8-inch gap for expansion.

L. Low-profile Metal Edge:
1. Install metal edge flashing/cleat on top of single ply membrane along eaves.
2. Secure horizontal flange of metal flashing to substrate with appropriate fasteners spaced 3-inches on-center, staggered.
3. Butt adjacent sections of metal flashing and install back-up plate under butt joint with beads of sealant, Type B, in laps.
4. Strip-in flange of metal flashing with base ply membrane concealing flange and extending beyond edge of flange to achieve proper welded lap seam.

M. Curb Cap Flashing:

1. Install new wood nailers on top of curb to provide substrate to receive cap flashing.
2. Install and adhere underlayment/modified bitumen flashing over top of curb extending a minimum 4-inches below top of curb and overlapping top edge of base flashing.
3. Install metal cap flashing over curb. Install appropriate fasteners through the fascia spaced 12-inches on-center.
4. Reinstall equipment on top of cap flashing on top of vibration isolator pads.

N. Coping:

1. Install new 2X wood nailers and/or 2X wood nailers and plywood to provide substrate on top of wall to have a resulting positive slope (minimum 1-inch per foot) toward roof.
2. Install and adhere underlayment or flashing membrane over the wood substrate extending a minimum of 1-inch below top of wall system. Lap ends minimum of 3-inches (75mm) and secure membrane in place on exterior vertical face.
3. Install metal coping segments allowing 1/2-inch (13mm) spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24-inches (600mm) on-center in enlarged holes.
4. Install cover plate centered over coping joint in continuous beads of sealant, Type B, placed approximately 1-inch (25mm) from cover edges.
5. Install appropriate fastener through neoprene washer and cover plate between coping segments.
6. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of 4-inches (100mm). Fasten cover plate on one side of joint only.
7. Fabricate transitions of changes in direction, wall size, or elevation from one-piece with sealed and riveted lap seams.
8. Install cap bead of sealant, Type B, over sealed/riveted lap seam in coping at corners. Apply tape on coping to provide straight edges of tooled cap bead. Remove tape upon completion of tooling.
9. At terminations occurring at rise walls, install end coping section with upward vertical flange (4-inch height) and fascias that extend a minimum 4-inches onto wall. Install counter flashing/closure set in saw-cut reglet and extend over flanges of coping end cap.

O. Scupper:

1. After field membrane is installed, install sheet metal scupper at designated locations. Set scupper in bed of plastic roof cement or heat-softened membrane and secure flanges of scupper to wall and deck with appropriate fasteners.
2. Strip-in flanges of scupper with appropriate flashing plies.
3. Install sealant, Type A, around exterior of scupper between metal insert and wall.
4. Attach face plate to scupper and wall and apply sealant around perimeter.

3.3 CLEANING:

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean and free of stains, scrap, and debris.

B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration/damage of finishes. Paint (color to match) areas of prefinished metal where finish is damaged. Replace sheet metal items when damaged finish can not be repaired to an acceptable condition.

C. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

D. Paint with elastomeric coating, metal flashings that have been soiled with bitumen. Use medium nap roller to apply paint to surfaces to achieve monolithic finished color.

END OF SECTION 076200