DIVISION 7

THERMAL AND MOISTURE CONTROL

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Vapor retarders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION (RIGID INSUL)

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.

d. Pactiv Building Products.
e. Or approved equal.

2. Type X, 15 psi.

B. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Pactiv Building Products.
   d. Or approved equal.

C. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Atlas Roofing Corporation.
   b. Dow Chemical Company (The).
   c. Rmax, Inc.
   d. Or approved equal.

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

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.
4. Or approved equal.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 MINERAL-WOOL BLANKET INSULATION (SOUND ATTENUATION)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Thermafiber.
   4. Or approved equal.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.4 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Gemco; Spindle Type.
      c. Or approved equal.
   2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Gemco; 90-Degree Insulation Hangers.
      b. Or approved equal.
   2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGM Industries, Inc.; RC150.
   b. Gemco; R-150.
   c. Or approved equal.
2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
   a. Where indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
      a. Exterior Walls: Set units with facing placed toward interior of construction.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.7 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
   2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
   3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
   4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.8 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.9 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.10 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

PART 1 - GENERAL CONDITIONS

1.1 DESCRIPTION

A. Scope: To install a mechanically fastened Sarnafil roofing membrane with flashings, and other items to comprise a roofing system.

B. Related Work: The work includes but is not necessarily limited to General Conditions, Supplementary Conditions, Sections in Division 1 of Specifications and the installation of:
1. Wood Blocking
2. Insulation
3. Fasteners
4. Roof Membrane
5. Roof Membrane Flashings
6. Walkways
7. Metal Flashings
8. Sealants and Adhesives

C. Upon successful completion of work, the following warranties may be obtained:
1. Sarnafil's Warranty
2. Roofing Contractor's Warranty

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. This roofing system shall be applied only by a contractor authorized by Sarnafil prior to bid.

C. Upon completion of the installation, and the delivery to Sarnafil by the contractor of a certification that all work has been done in strict accordance with the contract specifications and Sarnafil's requirements. An inspection shall be made by a representative of Sarnafil to observe the roofing system.

D. There shall be no deviation made from the contract specification or the approved shop drawings without prior written approval by the owner, the owner's representative and Sarnafil.

E. All work shall be completed by personnel trained and authorized by Sarnafil.

1.3 CODE REQUIREMENTS

A. The roofing contractor shall submit evidence that the proposed roofing system will meet the identified requirement of the following recognized code approval or testing agencies. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.
1 Factory Mutual Research Laboratories, Norwood, Massachusetts
a. F.M. Class I system acceptance
b. F.M. I-90 wind uplift resistance
2. Underwriters Laboratories, Chicago, IL
a U.L. Class A membrane

1.4 SUBMITTALS

A. After the bid and prior to issuing the contract, the roofing contractor shall submit to the owner's representative the following:
   1. Copies of specification.
   2. Samples of each material to be used in the roof system including each component manufacturer's literature.
   3. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.
   4. Specimen copy of Sarnafil's warranty.
   5. Specimen copy of contractor's warranty
   6. Dimensioned shop drawings which shall include:
      a. outline of roof and roof size;
      b. profile details of flashing methods for penetrations and terminations;
      c. technical acceptance from Sarnafil.
   7. Certification that system specifications meets all identified code and insurance requirements.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protected from moisture.

C. Membrane rolls shall be stored lying down on pallets, and fully protected from moisture with clean canvas tarpaulins.

D. Bonding adhesives shall be stored at temperatures above 40E F.

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on container or supplied by material manufacturer/supplier.

F. All materials which are determined damaged by the owner's representative and Sarnafil are to be removed from the job site and replaced at no cost to the owner.

1.6 JOB CONDITIONS

A. Only as much of the new roofing as can be made weather tight each day, including all flashings, and metal work shall be installed.

B. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

C. The roofing contractor shall run pullout tests of fasteners to verify condition of deck/substrate and confirm pullout values.

D. All surfaces to receive new insulation, membrane or flashings shall be thoroughly dry. Should surface moisture occur, the contractor shall provide the necessary equipment to dry the surface prior to application.

E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or damage.

F. Temporary waterstops shall be installed at the end of each day's work, and shall be removed before proceeding with next day's work. Waterstops shall be compatible with all materials and shall not emit dangerous or incompatible fumes.

G. The contractor is cautioned that certain Sarnafil membranes are incompatible with asphalt, coal tar and oil-based materials and cements. Creosote and penta-based materials are also incompatible. Such materials should not come in contact with Sarnafil membranes at any time. If such contacts occur, the material shall be cut out and discarded. The contractor should consult Sarnafil with respect to material compatibility, precautions, and recommendations.

H. Arrange work sequence to avoid use of newly-constructed roofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. Both plywood and polyester felt protection shall be provided for all new and existing roof areas which receive traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. All roofing, insulation, flashings and metal work removed for construction shall be immediately taken off the site to a legal dumping area authorized to receive such materials. Any hazardous materials such as asbestos or materials containing asbestos fibers shall be disposed of in accordance with applicable City, State and Federal requirements.

K. The contractor shall follow all safety regulations as recommended by OSHA.

L. The contractor should take care during application and storage that overloading of deck and structure does not occur.

M. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.

N. Contaminants, such as grease, fats, oils, and solvents, shall not be allowed to come into contact with the roofing membrane.

O. Contractor shall verify that all roof drain lines are unblocked before starting work. Report any such blockages to the owner's representative in writing.

P. If any unusual or concealed condition is discovered, stop work and notify owner immediately in writing.

Q. Site clean-up, including both interior and exterior building areas which have been affected by construction, shall be completed daily to the owner's satisfaction.

R. All landscaped areas affected by construction activities shall be raked clean and replanted to the owner’s satisfaction.

1.7 BIDDING REQUIREMENTS

A. Pre-Bid Conference: A pre-bid conference shall be held with a representative of the owner and all involved trades to discuss all aspects of the project. The contractor's field representative or roofing foreman for the work shall be in attendance.

B Site Visit: Bidders shall visit the site and carefully examine the areas in question as to conditions which may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the contractor. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions.

1.8 WARRANTIES

A. Sarnafil's 20-Year Material and Labor Warranty: Upon successful completion of the work and receipt of final payment, the Sarnafil, Inc. 20-year No Dollar Limit (NDL) warranty shall be issued.

B. Roofing Contractor's Warranty: The roofing contractor shall supply the owner with a minimum five-year workmanship warranty. In the event any work related to roofing, flashings, or metal work is found to be defective or otherwise not in accordance with the contract documents within two years of substantial completion, the roofing contractor shall remove and replace at not cost to the owner. The contractor's warranty obligation shall run directly to the owner, and a copy shall be sent to Sarnafil.

PART 2 - PRODUCTS

2.2 GENERAL

A. The components of the Sarnafil Mechanically Fastened Roof System are to be products of Sarnafil Inc.

B. Components to be used that are other than those supplied or manufactured by Sarnafil may be submitted for review and acceptance by Sarnafil. Sarnafil's acceptance of any other product is only for chemical compatibility with Sarnafil products. The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the owner or the owner's representative for acceptability for use with Sarnafil products.

2.3 APPROVED MEMBRANE SYSTEMS

A. Sarnafil Inc.: Sarnafil S327L, 60 mil nominal (.060") thickness, polyester reinforced membrane with an acrylic coating to repel dirt.

2.4 MEMBRANE

A. Membrane shall conform to ASTM D4434 (latest revision) Standard for poly (vinyl chloride) sheet roofing. Classification Type III.

B. As manufactured, membrane shall conform to the following physical properties:

Parameters	**ASTM Test Method**	**Sarnafil Tropical Physical Properties**
overall thickness mm (inches)	D751	1.5 (0.060)
breaking strength, min. (1bf./in.)	D751	230
elongation at break, %	D751	20%
seam strength, % of breaking strength	D751	80%
retention of properties after heat aging	D3045	

tensile strength, % of original	D751	95%
elongation, % of original	D751	90%
tear resistance (1 bf.)	D751	50.0
low temperature (-40E F)	D2136	pass
accelerated weathering test (Xenon)	D2565	10,000 hours
cracking (7X magnification)	--	none
discoloration (observed)	--	negligible
crazing (7X magnification)	--	none
linear dimensional change %	D1204	0.1%
weight change after immersion in water, max. %	D570	2.5%

2.5 ACCESSORY PRODUCTS

A. Accessory products shall be supplied by the membrane manufacturer or approved by them for use with the roofing system.

2.6 RELATED MATERIALS

A. Wood Nailers: Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on project drawings. Height of nailers shall be matched to that of the insulation thickness being used.
   1. Wood nailers shall conform to Factory Mutual's Loss Prevention Data 1-49.
   2. All wood shall have a maximum moisture content of 19% by weight on a dry weight basis.
   3. 410 stainless steel fasteners shall be used with ACQ treated wood.

B. Plywood: When bonding directly to plywood, or laying roofing membrane directly over plywood, a minimum standard 1/2" smooth surfaced exterior grade plywood with exterior grade glue shall be used.
   1. Plywood shall have a maximum moisture content of 19% by weight on a dry weight basis.

2.7 INSULATION

A. Where specified or required, insulation shall be installed as a separation layer over the existing substrate and/or to obtain the desired thermal value.
   1. Insulation shall be a Factory Mutual Class 1 fire rated, I-90 uplift approved insulation board.
   2. Insulation shall meet all identified code/insurance requirements.
   3. Insulation shall be compatible with and accepted by the roofing membrane manufacturer.

B. Insulation shall be Sarnatherm isocyanurate or approved equal.

C. Total insulation thickness shall be a minimum of 4" to be installed in two layers of 2" insulation board.

2.8 ACCEPTED FASTENERS FOR ATTACHMENT OF INSULATION AND SARNAFIL MEMBRANE

A. The following fastener is approved for steel deck construction:
   1. Sarnafastener self-tapping screws and plates as supplied by Sarnafil, Inc.

2.9 WALKWAYS

A. Walkways shall consist of SarnaTred.

2.10 SEALANTS AND PITCH POCKET FILLERS

A. Silcaflex 1a shall be used where caulk is required.

B. Sarnafiller as provided by Sarnafil shall be the only accepted Pitch Pocket Filler.

2.10 ROOF EDGE

A. Terminedge or coping as manufactured by W.P. Hickman Company. .063 aluminum in Kynar Finish with color as selected by Architect.

2.11 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners shall be of the same type as metal being secured. In general all fasteners, anchors, nails, straps, shall be of zinc or cadmium plated steel, galvanized, or stainless steel. All fasteners and anchors shall have a minimum embedment of 1-1/4" and shall be approved for such use by the fastener manufacturer. Fasteners for attachment of metal to wood blocking shall be annular ring nails. Fasteners for attachment of metal to masonry shall be expansion type fasteners. All fasteners shall meet Factory Mutual Standard 4470 for corrosion resistance.

PART 3 - EXECUTION

3.1 GENERAL

A. The roofing contractor shall coordinate the installation so that each area is made watertight at the end of each work period.

3.2 DECK PREPARATION

A. The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The structure and deck must be capable of withstanding expected wind uplift forces created at fastening points. Sarnafil requires fastener pullout tests to verify deck condition and confirm fastener pullout values.

B. FM approved steel decks (22 ga. minimum). The roof deck construction shall conform to Factory Mutual's recommendations outlined in their Loss Prevention Data Sheet 1-28.

3.3 SUBSTRATE PREPARATION

A. A proper substrate shall be provided to receive the Sarnafil Membrane in a mechanically attached system.

B. The roofing contractor shall inspect the roofing surface for defects such as excessive surface roughness, contaminated surfaces, structurally unsound substrates, etc., that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

3.4 WOOD NAILERS

A. Install continuous treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as specified on project drawings.

B. Nailers shall be anchored to resist a minimum force of 175 pounds per lineal foot in any direction. A 1/2" space shall be provided between nailer lengths. Individual nailer lengths shall not be less than 3' long. Fasteners spacing shall be a maximum of 3" o.c. Fasteners shall be installed within 6' of each end. Spacing and fastener embedment shall conform to Factory Mutual Loss Prevention Data 1-49.

C. Thickness shall be as required to match substrate or insulation height.

D. Any existing woodwork which is to be reused shall be firmly anchored in place (shall resist a minimum force of 175 pounds per lineal foot in any direction) and free of rot. Only woodwork designated to be reused in detail drawings shall be left in place and all other woodwork shall be removed.

3.5 INSULATION INSTALLATION

A. General Criteria: Insulation shall be installed according to insulation manufacturer's instructions.
   1. Insulation shall be neatly cut to fit around penetrations and projections.
   2. Install tapered insulation in accordance with insulation manufacturer's shop drawings.
   3. Install tapered insulation around drains creating a drain sump.
   4. Do not install more insulation board than can be covered with Sarnafil membrane by the end of the day, or onset of inclement weather.
   5. Mechanical Attachment: Insulation shall be mechanically fastened to the deck with accepted fasteners and plates at a minimum rate of one fastener for every 8 sq. ft.
      a. FM I-90 Approved Perimeter Fastening Pattern
         Insulation panels which fall in the perimeter and corner areas of the building shall be fastened at a minimum rate of six fasteners for every 4 foot x 8 foot insulation panel, or according to the insulation manufacturer's requirements, whichever is more stringent.
      b. Fasteners are to be installed in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by fastener manufacturer and Sarnafil.
      c. Use fastener tools with a depth locator as recommended or supplied by fastener manufacturer to ensure proper installation.
      d. Sarnafil requires pullout tests be done to verify deck condition and actual pullout values, on reroofing projects.
      e. For mechanical attachments of insulation to wood or lumber decks, the fasteners shall achieve a 1" minimum penetration into the deck.

B. Two layers of insulation shall be mechanically fastened to the deck with accepted fasteners and plates. Insulation shall be laid in parallel courses with end joints staggered. The second layer of insulation shall be laid transverse to the first layer, with joints staggered at least 6" from those of the first layer.

3.6 INSTALLATION OF SARNAFIL MEMBRANE

A. The surface of the insulation or substrate shall be inspected prior to installation of the Sarnafil roof membrane. The substrate shall be clean, dry and smooth with no excessive surface roughness, contaminated surfaces, or unsound surfaces such as broken, delaminated or

damaged insulation boards.

1. Sarnafasteners and Sarnadiscs placed in overlap method of attachment.

B. General: Sarnafil membrane is to be attached with Sarnafasteners and Sarnadiscs according to Sarnafil's specifications and details.

1. Membrane overlaps shall be shingled with the flow of water where possible.

C. Perimeter and Corners: Over the properly installed and prepared substrate surface, two Sarnafil half sheets are to be installed around the entire perimeter edge. An overlap line has been provided to ensure proper overlap. Sarnadiscs are to be held back a minimum of 1" from the edge of the Sarnafil membrane. Fasteners shall be installed according to manufacturer's instructions. Fasteners shall be installed using fastener manufacturer's recommended fastening tools with dept locators.

1. Hot-air weld overlaps according to Sarnafil's recommendations.

D. Interior - Field Sheets: Over the properly installed and prepared substrate surface the standard-sized Sarnafil membrane is to be unrolled. An inch overlap line has been provided to ensure sufficient overlap. Sarnafil plates and screws or anchors are to be installed along the edge of the membrane. Sarnadiscs are to be held back a minimum of 1" from the edge of the Sarnafil membrane. Fasteners shall be installed according to the manufacturer's instructions. Fasteners shall be installed using the fastener manufacturer's recommended fastening tools with depth locators.

1. Hot-air welded overlaps according to Sarnafil's recommendations.

E. Securement Around Perimeter and Rooftop Penetrations: Around all perimeters, at the base of walls, drains, curbs, vent pipes, or any other roof penetrations, Sarnafasteners and Sarnadiscs shall be installed. Fasteners shall be installed according to the manufacturer's instructions. Fasteners shall be installed using the fastener manufacturer's recommended fastening tools with depth locators.

1. Sarnafil membrane flashings shall extend 3" past the Sarnadiscs and be hot-air welded to the Sarnafil deck sheet.
2. Two perimeter half sheets run parallel to the outside edge, continued into the corner to the outside edge. Sarnafasteners XP and Sarnadiscs XP spaced 12" o.c. in the overlaps. Interior sheets to be fastened with Sarnafasteners XP and Sarnadiscs XP spaced 12" o.c. in the overlaps.

3.7 HOT-AIR WELDING OF LAP AREAS

A. General: Adjacent sheets shall be welded in accordance with Sarnafil's written instructions. All side and end lap joints shall be hot-air welded. Lap area shall be a minimum of 3" wide when machine welding, and a minimum of 4" wide when hand welding.

1. Welding equipment shall be provided by or approved by Sarnafil. All mechanics intending to use the equipment shall have successfully completed a course of instruction provided by a Sarnafil representative prior to welding.
2. All surfaces to be welded shall be clean according to Sarnafil recommendations, and dry. No adhesive shall be present within the lap areas.

B. Hand Welding: Hand welded seams shall be completed in three stages. Equipment shall be allowed to warm up for at least one minute prior to start of welding.

1. The lap shall be tack welded every 3" to hold the seam in place.

   NOTE: WHEN HAND WELDING LAPS OF MECHANICALLY ATTACHED FIELD AND PERIMETER SHEETS, TACK WELDING IS NOT ADVISABLE, USE WEIGHTS OR METAL TRACKS TO HOLD THE SEAM IN PLACE FOR WELDING.

2. The back edge of the lap shall be welded with a thin, continuous weld to prevent loss of hot air during the final welding.

3. The hot air nozzle shall be inserted into the lap, at a 45 degree angle. Once the proper welding temperature has been reached and the material starts to flow, and the roller shall be applied at a right angle to the welding gun and pressed lightly. For straight laps, the 1-1/2" wide nozzle shall be used. For corners and compound connections, the ¾" wide nozzle shall be used.

C. Machine Welding: Machine welded seams may be achieved by the use of Sarnafil's various automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. The automatic welding machines require 218 to 230 volts at 30-40 amps. The use of a portable generator is recommended.

D. Quality Control of Welded Seams: All completed welded seams shall be checked after cooling for continuity using a rounded screwdriver or other suitable blunt object by the roofing contractor. Visible evidence that welding is proceeding acceptably is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of black material from the edge of completed joints. On-site evaluation of welded seams shall be made daily by the contractor to locations as directed by the owner's representative or Sarnafil's representative. Two inch wide cross-section samples shall be taken three times a day minimum through completed seams. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the contractor at no extra charge to the owner.

E. 15" wide metal tracks must be used over the deck sheet and under the machine to avoid wrinkles.

3-8 WALKWAY INSTALLATION

A. Walkways shall be provided for regular maintenance of rooftop equipment and for roof areas subject to foot traffic.

B. SarnaTred Installation: Roofing membrane to receive SarnaTred shall be clean and dry.
1. Chalk lines on deck sheet to indicate location of SarnaTred.
2. SarnaTred shall be unrolled and positioned within chalk lines.
3. Hot-air weld the perimeter of the SarnaTred to the Sarnafil deck sheet. Check all welds with a rounded screwdriver. Reweld any inconsistencies.

3.9 MEMBRANE FLASHINGS

A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the project manager and Sarnafil. Approval shall only be for specific locations on specific dates. Flashings shall be adhered to compatible, dry smooth, and solvent-resistant surfaces.

B. Sarnacol 2170 Contact Adhesive: Over the properly installed and prepared substrate surface, Sarnacol 2170 adhesive shall be applied using approved solvent-resistant ¾" nap paint rollers. The adhesive shall be applied at a rate of approximately 1-1/2 to 2-1/2 gallons per 100 sq. ft. of surface depending upon substrate. The adhesive shall be applied in smooth, even coatings with no holidays, globs, puddles or similar irregularities. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The surface with adhesive coating shall be allowed to dry completely prior to installing the membrane. **Note: Drying time increases with cooler temperatures. Also, the contractor is cautioned against work on days of high humidity because of extremely slow evaporation of the solvent. The Contractor shall check with the Sarnafil technical representative prior to roof operations on such days.**

1. When the surface is dry, the Sarnafil flashing membrane is cut to a workable length and the underside shall be evenly coated with Sarnacol 2170 adhesive at a rate of ½ gallon per 100 sq. ft. When the adhesive has dried sufficiently to produce strings when touched with a dry finger, the coated membrane shall be rolled onto the previously-coated substrate being careful to avoid wrinkles. Do not allow adhesive on the underside of the Sarnafil membrane to completely dry. The amount of membrane that can be coated with adhesive before applying to substrate will be determined by ambient temperature, humidity, and manpower. Adjacent sheets shall be overlapped a minimum of 4". Sarnafil flashings shall extend 5" onto the roofing membrane. The bonded sheet shall be pressed firmly in place with a hand roller.
2. No bonding adhesives shall be applied in lap areas that are to be welded to flashings or adjacent sheets. All sheets shall be applied in the same manner, lapping all sheets as required by welding techniques.

C. Sarnafil's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by Sarnafil prior to installation.

D. All flashings shall extend a minimum of 8" above roofing level unless previously accepted by owner's representative and Sarnafil.

E. All flashing membranes shall be adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bituminous elements shall be in contact with the Sarnafil membrane.

F. All flashings shall be hot-air welded at their joints and at their connections with the roof membrane.

G. All flashing membranes shall be mechanically fastened along the top edge through tin discs spaced a maximum of 1 foot o.c., or predrilled metal strips. Expansion pins with nylon sheaths set in predrilled holes shall be used to secure flashings to masonry and concrete surfaces.

H. Sarnafil flashings shall be terminated according to Sarnafil recommended details.

3.10 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA), (latest issue).

B. Metal, other than Sarnaclad metal, is not covered under the Sarnafil warranty.

C. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

D. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

E. Metal joints shall be watertight.

F. Metal flashings shall have a 4" minimum nailing flange and shall be fastened into solid wood blocking with fasteners of the same type with two rows of annular ring nails, 4" o.c., staggered. Fasteners shall penetrate the wood nailer a minimum of 1-1/4".

G. Continuous metal hook strips are required if Sarnaclad metal fascia exceeds 5" in width. Hook strip is to be fastened 12" o.c. into wood nailer or masonry wall.

3.11 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. When a break in the day's work occurs in the central area of a roof, a temporary waterstop shall be constructed to provide a 100% watertight seal. When work on the new system is suspended, the stagger of the insulation joints shall be maintained by installing partial fillers. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of roof cement of 6" girth. When work resumes, the contaminated PVC membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and disposed of off site. None of these materials shall be used in the new work.

B. If inclement weather occurs while a temporary waterstop is in place, the contractor shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the contractor's expense.

3.12 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the owner/project manager and contractor. All defects noted, non-compliance with the specifications or the recommendations of Sarnafil shall be itemized in a punch list. These items must be corrected immediately by the contractor prior to demobilization to the satisfaction of the owner/project manager and Sarnafil.

B. All warranties, as required in Part 1 of this specification shall be submitted for approval prior to final payment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured and formed through-wall flashing and counterflashing, reglets, fascia, and other fabricated sheet metal items as required by Contract Documents.

1.2 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of edge conditions, including crickets and counterflashings as applicable.
   6. Details of special conditions.
   7. Details of connections to adjoining work.
   8. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

E. Qualification Data: For qualified fabricator.

F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Contract Drawings.

C. Conform to applicable requirements of Section 01351, Sustainable Project Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.6 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
   1. Non-Patinated Exposed Finish: Mill.

C. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
   1. Surface: Smooth, flat.
   2. Exposed Coil-Coated Finishes:
      a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   3. Color: As selected by Professional from manufacturer’s full range.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
   1. Finish: 2D (dull, cold rolled).
   2. Surface: Smooth, flat.

E. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
   2. Surface: Smooth, flat.
   3. Exposed Coil-Coated Finish:
      a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   4. Color: As selected by Professional from manufacturer’s full range.
   5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   4. Fasteners for Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
   5. Fasteners for Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.

C. Solder:
   1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Single Ply Membrane: EPDM material; ASTM D 4637, Type 1 non-reinforced flexible sheet; 45 mils nominal thickness; black color. Provide bonding adhesive, lap sealant as recommended by membrane manufacturer.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

J. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
1. Galvanized Steel: 0.034 inch thick.

B. Counterflashing: Fabricate from the following material:
1. Galvanized Steel: 0.022 inch thick.

C. Flashing Receivers: Fabricate from the following material:
1. Galvanized Steel: 0.022 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.028 inch thick.

E. Roof-Drain Flashing: Fabricate from the following material:
1. Copper: 12 oz./sq. ft.

2.5 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing in Masonry: As specified in Section 04200, Unit Masonry Assemblies.

B. Through-Wall Flashing Other Than Masonry:
1. Stainless Steel: 0.0187 inch thick.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.
   7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07900, Joint Sealants.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed work.
   1. Do not solder metallic-coated steel and aluminum sheet.
   2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   3. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04810 - Unit Masonry Assemblies.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 WASTE MANAGEMENT

A. Process construction waste in accordance with Waste Management Plan, as specified in Section 01351, Sustainable Project Requirements, and as follows:
   1. Collect metal scrap and recycle where applicable.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Copings, Fascias, Fascia, Extruded Closure and Vents.

B. Reglets.

1.2 RELATED WORK

A. Section 07540 – Reinforced Single-Ply Membrane Roofing.

1.3 REFERENCES

A. ASTM D2822 - Asphalt Roof Cement

B. NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.

C. SMACNA - Architectural Sheet Metal Manual.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

C. Product Data: Provide product data on shape of components, materials and finishes, anchor types and locations.

D. Samples: Submit two (2) samples, 12 x 12 inches in size illustrating component shape, finish and color.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA details or as detailed within the documents.

B. All components shall be from one manufacturing source.

1.6 WARRANTY

A. Copings, fascia, fascia extenders, closures and reglets shall be covered by the roofing warranty specified in Section 07540 – Reinforced Single Ply Membrane Roofing.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified Manufacturer:
   1. Hickman

B. Other Acceptable Manufactures:
   1. Merchant and Evans
   2. Construction Specialties

C. Substitutions: Under provisions of Section 01600.

2.2 COMPONENTS

A. Fascias, Roof Edge, Fascia Extenders, Extruded Closures: Equal to Hickman system for single ply roofing systems .063 inch thick, shaped as indicated, with continuous cleat and splice plates. Include cover plates to conceal and weather seal joints and attachment flanges. Provide extruded closure plates as required and mitered, welded corners. Color shall be Hylar 20 year finish as selected by the Architect from the manufacturer=s full Hylar color range (including those colors not available as a standard on .063).
   1. Coping: .063 inch thick, shaped as indicated including special supports spaced at 48" o.c. Include cover plates to conceal and weather joints and attachment plates. Provide extruded closure plates as required. Color shall be Hylar 5000 with 20 year warranty as selected by the Architect from the manufacturer=s full Hylar color range (including those colors not available as a standard on .063).
   2. Manufactured Roof Edge/Fascia: Equal to Hickman Extruded Terminedge #TEX-525 with extruded aluminum retainer channel. Color as selected by Architect.

B. Reglets: shall be equal to Hickman Systems Drive-Lock and counterflashing fabricated from stainless steel. Provide factory fabricated corners and wind clips. Counterflashing shall be 4 3/4" long. Color shall be Hylar 20 year finish as selected by the Architect.

C. Gutters and Downspouts:
   1. Custom size rectangular gutter, as shown on drawings equal to Hickman Gutter and Downspout Systems. Gutter Sections: Length of 10’-0”.
      a. 1.5” wide .125” straps at 18” o.c. across top of gutter front edge.
      b. Include expansion joints not exceeding 40 feet maximum for long runs, locations as recommended by manufacturer.
   2. Downspouts:
      a. Factory fabricated rectangular downspouts, sizes as shown on drawings.
      b. Provide three (3) downspout anchor straps per 10’ section.
      c. Provide factory fabricated elbows.
   3. Fascia metal gauge .063” thick formed aluminum, extruded aluminum, with Kynar 500 finish.
   4. Fasteners: As recommended by the manufacturer per substrate application.
   5. Exterior finishes: Kynar 500 from manufacturer’s standard colors.
   6. Accessories:
      a. Corners, end caps, expansion joints, etc. shall be fabricated by the gutter manufacturer.

2.3 ACCESSORIES

A. Sealant: Roofing Manufacturer's standard type suitable for use with installation of system; non-staining, skinning, non-skinning, non-shrinking and non-sagging; ultra-violet and ozone resistant; color as selected.

2.4 FINISHES

A. Provide color as selected by the Architect from the full range of Kynar formulations with 20 year manufacturer's limited warranty.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Conform to NRCA - Waterproofing Manual drawing details.

C. Coordinate installation of components of the section with installation of roofing membrane and base flashings.

D. Coordinate installation of flashing flanges into reglets.

3.3 INSTALLATION GUTTER SYSTEM

A. Submit product design drawings for review and approval to Architect or Specifier before fabrication.

B. Installing contractor shall check-as-built conditions and verify the manufacturer’s gutter details for accuracy to fit the assembly prior to fabrication. The installer comply with the gutter edging manufacturer’s installation guide when setting gutter.

C. Installer shall furnish mechanical fasteners consistent with manufacturer’s instructions.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparing substrate surfaces.

B. Sealant and joint backing.

1.2 RELATED SECTIONS

A. Section 02525 - Concrete Curbs, Walks and Paving: Sealants required in conjunction with paving.

B. Section 03300 - Cast-in-Place Concrete: Sealants required in conjunction with cast-in-place concrete.

C. Section 04810 - Unit Masonry Assemblies: Sealants required in conjunction with masonry.

D. Section 08110 - Steel Doors and Frames: Sealants required in conjunction with door frames.

E. Section 08520 - Aluminum windows: Sealants required in conjunction with aluminum windows.

F. Section 09260 – Gypsum Board Systems: Sealants used in conjunction with gypsum board systems.

G. Section 09310 - Ceramic Tile: Sealants required in conjunction with floor and base finish.

1.3 REFERENCES

A. ASTM C790 - Use of Latex Sealing Compounds.

B. ASTM C804 - Use of Solvent-Release Type Sealants.

C. ASTM C834 - Latex Sealing Compounds.

D. ASTM C919 - Use of Sealants in Acoustical Applications.

E. ASTM C920 - Elastomeric Joint Sealants.

F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 1 x 4 inch in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 COORDINATION

A. Coordinate work with other trades.

B. Coordinate the work with all sections referencing this section.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Pecora

B. Tremco

C. Dow

D. GE Silicones

E. Substitutions shall be submitted in accordance with Section 01600.

2.2 SEALANTS

A. Polyurethane Traffic Grade Sealant (Type A): ASTM C920, Two Part, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type; color as selected; Urexpan NR-200 manufactured by Pecora.
   1. Elongation Capability 25 percent
   2. Service Temperature Range -40 to 180 degrees F
   3. Shore A Hardness Range 20 to 35

B. Polyurethane Sealant (Type B): ASTM C920, Grade NS, Class A, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected; Dynatrol II manufactured by Pecora.
   1. Elongation Capability 50 percent
   2. Service Temperature Range -20 to 180 degrees F
   3. Shore A Hardness Range 20 to 35

C. Silicone Sealant (Type C): ASTM C920, Grade NS, Class 25, Use NT; single component, fungus resistant, chemical curing, non-sagging, non-staining, non-bleeding; color as selected; 860 manufactured by Pecora.
   1. Elongation Capability 25 percent
   2. Service Temperature Range -75 to +400 degrees F
   3. Shore A Hardness Range 15 to 50

2.3 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1565; round, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions.

D. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.4 CLEANING

A. Clean work under provisions of 01700.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01500.

B. Protect sealants until cured.

3.6 SCHEDULE

General: The following sealants shall be installed throughout the construction where construction materials intersect or abut creating a joint which requires closure for appearance, weather, or as may be required by the Owner and Architect.

	Location	**Type**
A.	Exterior horizontal concrete paving & sidewalk expansion joints (Type A)	Two part polyurethane Traffic Grade Type II
B.	Exterior vertical joints (Type B)	Two part polyurethane Type II
C.	Interior vertical & horizontal joints (Type B)	Two part polyurethane Type II
D.	Interior wet areas, kitchen, & toilet fixtures joints w/fungicide (Type C)	High modulus silicone

3.7 WASTE MANAGEMENT

A. Process construction waste in accordance with Waste Management Plan, as specified in Section 01351, Sustainable Project Requirements, and as follows:
   1. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperatures.
   2. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION