SECTION 07 01 50.62

ACRYLIC LIQUID APPLIED SYSTEM OVER EXISTING MODIFIED BITUMEN ROOF

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The following specification outlines the requirements for a quick curing, cold fluid-applied, low-odor 2 coat reinforced waterproofing membrane and all other ancillary waterproofing work including but not limited to, installation of drains, pipe flashings, penetration flashings, sealants and metal work as specified.

1. All membrane materials shall have a superior coefficient of expansion, to allow for differential movement between the horizontal and vertical surface of the flashed penetration or projection.

2. New membrane system MUST provide fast-drying primers to allow substrate preparation, priming and membrane application to be completed the same day.

3. The use of cold fluid-applied low-odor 2 coat membrane materials will be required for all field membrane and flashings.

4. Any areas that pond water MUST be waterproofed using a fully reinforced system.

1.2 SECTION INCLUDES

A. Adhered cold fluid-applied low-odor acrylic waterproofing system including, membrane, penetration flashings, base flashings, and expansion joints.

B. Substrate preparation, cleaning, leveling and patching

C. Temporary waterproofing

D. Waterproofing membrane installation

E. Flashing installation and expansion joint installation

1.3 RELATED SECTIONS

A. Supplementary General Conditions

B. Basic Requirements

C. Wood Blocking and Nailers

D. Sheet Metal Flashing and Trim

1.4 REFERENCES

A American Society for Testing and Materials (ASTM) C 836 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane.

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

C. ACI-308 - Recommended Practice for Curing Concrete

D. ASTM - D638 - Test Methods for Tensile Properties of Plastics

E. ASTM - D4258 - Standard Practice for Surface Cleaning Concrete for Coatings

F. ASTM - D4259 - Standard Practice for Abrading Concrete

G. ASTM - D4541 - Method for Pull-Off Strength of Coatings using Portable Adhesion Tester

H. ASTM - E96(A) - Test Methods of Moisture Transmission of Material

I. ASTM E-108, ANSI/UL 790 for fire resistance

J. Steel Structures Painting Council (SSPC)

1.5 SUBMITTALS FOR REVIEW

A Membrane System Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and installation.

B. Product Samples: Submit product samples of membrane and flashing materials showing color, texture, thickness and surfacing representative of the proposed system for review and approval by the Owner's Representative.

C. Submit sample copies of both the Manufacturer and Applicator warranties for the periods stipulated. Each specimen must be a preprinted representative sample of the issuing company's standard warranty for the system specified.

D. Membrane Shop Drawings: Submit shop drawings of cold fluid-applied reinforced low-odor roof coating membrane showing all a project plan, size, flashing details, and attachment for review and approval by the Owner's Representative and Membrane Manufacturer.

1.6 QUALITY ASSURANCE

A Membrane Manufacturer: Company specializing in manufacturing the products specified in this section with ten (10) years documented experience. Membrane Manufacturer shall submit the following certifications for review:

1. Substrates and conditions are acceptable for purpose of providing specified warranty.
2. Materials supplied shall meet the specified requirements.

B. Applicator: Company specializing in performing the work of this section with (3) years documented experience and approved by system manufacturer for warranted membrane installation. Applicator shall submit the following certification for review:

1. Applicator shall submit documentation from the membrane manufacturer to verify contractor's status as an approved applicator for warranted installations.

C. Evaluate moisture content of substrate materials. Constructor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to the Owner or designated Representative, and Membrane Manufacturer.

D. Monitor quantities of installed materials. Monitor application of resin mixture, reinforcing fleece and flashing. Perform Work in accordance with manufacturer's instructions.

E. Mock-up areas shall be used to determine required methods and tools to obtain degree of substrate preparation required by the membrane manufacturer. Conduct tests as required to verify that substrate preparation meets specified requirements. Tests shall include, but are not limited to, tensile bond strength and moisture content of substrate.

1. Prepare and clean a three (3) foot (0.9 m) by three (3) foot (0.9 m) area of each substrate material type.
2. Submit findings in writing to Owner or his designated Representative and Membrane Manufacturer.
3. Mock-up areas shall be maintained for quality control for the entire project.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable building and jurisdictional codes for roofing/waterproofing assembly and fire resistance requirements.

B. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

C. Comply with authority or agency "Confined Space Policy" during and throughout all work to be performed.

1.8 PRE-INSTALLATION MEETING

A. Convene a pre-installation meeting at the job site (1) week before starting work of this section. Require attendance of parties directly affecting work of this section, including but not limited to, Architect, and Owner's Representative, Roofing/Waterproofing Contractor, and Membrane Manufacturer's Representative. Review roofing/waterproofing preparation and installation procedures, coordination and scheduling required with related work, and condition and structural loading limitations of deck/substrate.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. The Contractor together with the Owner or his designated Representative shall define a storage area for all components. The area shall be cool, dry, out of direct sunlight, and in accordance with manufacturer's recommendations and relevant regulatory agencies. Materials shall not be

stored in quantities that will exceed design loads, damage substrate materials, hinder installation or drainage.

B. Store solvent-bearing solutions, resins, additives, inhibitors or adhesives in accordance with the MSDS and/or local fire authority. After partial use of materials replace lids promptly and tightly to prevent contamination.

C. Roll goods shall be stored horizontally on platforms sufficiently elevated to prevent contact with water and other contaminants. DO NOT use rolls which are wet, dirty or have damaged ends.

D. Roofing/waterproofing materials must be kept dry at all times. If stored outside, raise materials above ground or roof level on pallets and cover with a tarpaulin or other waterproof material. Plastic wrapping installed at the factory should not be used as outside storage covers.

E. Follow manufacturer's directions for protection of materials prior to and during installation. Do not use materials which have been damaged to the point that they will not perform as specified. Fleece reinforcing materials must be clean, dry and free of all contaminants.

F. Copies of all current MSDS for all components shall be kept on site. Provide any and all crewmembers with appropriate safety data information and training as it relates to the specific chemical compound he or she may be expected to deal with. Each crewmember shall be fully aware of first-aid measures to be undertaken in case of incidents. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing/waterproofing membrane during or with the threat of inclement weather.

B. Application of cold fluid-applied reinforced low-odor roof coating roofing/waterproofing membrane may proceed while substrate temperature is between 41 °F and 104 °F providing the substrate is a minimum of 5 °F above the dew point.

C. When substrate temperatures are at or expected to fall below 41 °F (0 °C) or reach 104 °F or higher, follow Membrane System Manufacturer's recommendations for weather related restrictions and application procedures.

D. Ensure that substrate materials are dry and free of contaminants. DO NOT commence with the application unless substrate conditions are suitable. Contractor shall demonstrate that substrate conditions are suitable for the application of the materials.

E. Where required by the Owner or his designated Representative, Contractor shall implement odor control and elimination measures prior to and during the application of the roofing/waterproofing materials. Control/elimination measures shall be field tested at off-hours and typically consists of one (1) or a multiple of the following measures:

1. Sealing of air intakes with activated carbon filters. Install filters in accordance with requirements and recommendations of the filter manufacturer. Seal filters at joints and

against building exterior walls to prevent leakage of unfiltered air where required due to size of intake opening. Provide track system to secure filters.

2. Erection and use of moveable enclosure(s) sized to accommodate work area(s) and stationary enclosure for resin mixing station. Enclosure shall be field constructed or pre-manufactured of fire retardant materials in compliance with local code requirements in accordance with requirements of the Owner or his designated Representative. Equipment enclosure(s) with mechanical air intake/ exhaust openings and Odor Control Air Cleaners, as required to clean enclosed air volume and to prevent odor migration outside the enclosure. Exhaust opening shall be sealed with activated carbon filter.
3. Placement of odor elimination stations inside and outside of the enclosure(s) as required by field condition, in coordination with the Owner or his designated Representative.
4. Protection of Contractor personnel and occupants of the structure and surrounding buildings as necessary to comply with requirements of OSHA, NIOSH and/or governing local authority.
5. When disposing of all refuse or unused materials, observe all EPA, OSHA or local disposal requirements.

1.11 COORDINATION & PROTECTION

A. Coordinate the work with the installation of associated metal flashings, accessories, appurtenances, etc. as the work of this section proceeds.

B. Building components shall be protected adequately (with tarp or other suitable material) from soil, stains, or spills at all hoisting points and areas of application. Contractor shall be responsible for preventing damage from any operation under its Contract. Any such damage shall be repaired at Contractor's expense to Owner's satisfaction or be restored to original condition.

C. Provide barricades, retaining ropes, safety elements (active/passive) and any appropriate signage required by OSHA, NIOSH, and NSC and/or the Owner or designated Representative.

D. Protect finished roofing/waterproofing membrane from damage by other trades. Do not allow waste products containing petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the membrane. Contact membrane manufacturer for further exposure limitation and restrictions.

1.12 WARRANTY

A. Manufacturer's Premier Warranty: Provide Ten (10) Year NOL manufacturer's warranty under provisions of this section. This warranty provides for cost of labor and materials for loss of watertightness, limited to amounts necessary to effect repairs necessitated by either defective material or defects in related installation workmanship, with no dollar limitation ("NDL").

B. Waterproofing Contractor's Warranty: Provide Two (2) year "Applicator Maintenance Warranty" covering workmanship for all work of this section including installation of membrane, flashings, metal work, and roofing/waterproofing accessories.

C. Submit (2) executed copies of both the manufacturer and applicator warranties for the periods

stipulated, starting from the date of substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

PART 2 - PRODUCTS

2.1 GENERAL

A. The products herein specified are totally pre-engineered products of the listed manufacturer and establish criteria for this project.

2.2 MANUFACTURERS -MEMBRANE

A. Membrane: Two coat reinforced liquid applied acrylic roof coating. Provide products manufactured and supplied by the following:

1. R Nova Plus Peach Base Coat and R Nova Plus White Top Coat by Soprema, Inc., Wadsworth, Ohio
2. ASTEC Re-Ply Roof Reinforced Roofing System, Application Specification # AC- 2014-A & MB-15, Inverness Florida
3. Western Colloid's FARR - Fluid Applied Reinforced Roofing Systems, Los Angeles, California

2.3 FLASHINGS

A. Membrane Flashings: Two coat reinforced liquid applied acrylic roof coating. Provide products manufactured and supplied by the following:

1. R Nova Plus Peach Base Coat and R Nova Plus White Top Coat by Soprema, Inc., Wadsworth, Ohio
2. Re-Ply 2000 Base Coat and Re-Ply 2000 Finish Coat by ASTEC Re-Ply Roof Systems, Inverness Florida.
3. Western Colloid's FARR - Fluid Applied Reinforced Roofing Systems

2.4 ACCESSORIES

A. Reinforcement Fleece: material shall be 100% polyester non-woven, stitch bonded, heat-set fabric.

B. Sealants: Must be provided by coating manufacturer and included in the material warranty.

C. Tools, Accessories, and Cleaners: Supplied and/or approved by membrane manufacturer for product installation.

D. Topcoat Surfacing Aggregate at Roof Hatches: Kiln-dried Surfacing Silica Sand shall be washed, kiln-dried, and dust-free with the following size specification:

1. Pedestrian Traffic: 0.4 - 0.8 mm in a 4 ft. by 4 ft. area

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck/substrate openings, curbs, and protrusions through deck/substrate, wood cant strips and reglets are in place and solidly set.

C. Verify deck/substrate is structurally supported, secure and sound.

3.2 PREPARATION OF SUBSTRATE

A. General:

1. Prior to beginning any work on roofs, install drain through drain screens in all drains by Roof Top Drain Filters by Guardian or Roof Top Foam filters by TJM Innovations, LLC. All loose granules dirt and debris should be vacuumed from the roof.
2. All blisters need to be "X"- cut and patched with a smooth sanded top surface, heat weldable modified bitumen membrane.
3. Areas with excessive asphalt bleed out need to be heated and trowel smoothed or removed from the surface.
4. All metal penetrations to receive liquid flashings are to be cleaned per coating manufacturer's guidelines.
5. Lightning protection penetrations need to be encased in PVC piping utilizing a PVC cap with nut, washer and rubber gasket down to the roof deck. Lightning protection is to be re-certified once this work is complete.
6. All overflow drains without strainers are to receive aluminum adjustable Drain Guards by Marathon drains.
7. Where equipment is stored i.e. swing arms and were foot traffic is expected install a layer of granulated modified bitumen in that area prior to coating
8. Once the above has been completed a light power washing of the surface is required.

B. Steel/Metal:

1. Clean and prepare metal surfaces to near white metal in accordance with SSPC - SP3 (power tool clean) or as required by membrane manufacturer. Extend preparation a minimum of three (3) inches beyond the termination of the membrane flashing materials. Notch steel surfaces to provide a rust-stop.
2. Stainless steel (series 400, 300) shall be abraded to provide a rough open surface.

C. Other Flashing Surfaces:

1. Remove all contaminants as required by membrane manufacturer. Surface preparation shall be performed by means approved by Owner or his designated

Representative.

D. Finish Leveling, Patching and Crack Preparation

1. General: level low areas with a ply of granulated APP modified bitumen prior to installing the coating.

3.3 MEMBRANE APPLICATION

A. Application of 2 Coat Reinforced Acrylic Coating System For Field and Flashing work

1. Apply foundation coat at 2.0 gallons per square. Apply mixed base coating to the prepared surface in accordance with manufacturer's written instructions and details. The coating should be rolled or brushed liberally and evenly onto the surface using a broad, even stroke. Install 2.0 gallons of base coating per 100 sq. ft. and embed fabric directly into the coating while still wet. Overlap adjacent runs of fabric 3-inches minimum. Immediately follow with an embedment coat, at a rate of 1.5 gallons per square to create a monolithic membrane

2. Over the cured base coat, apply the mixed top coat in accordance with manufacturer'swritten instructions and details to finish the coating system. The coating should be rolled or brushed liberally and evenly onto the cured base coat using a broad, even stroke.

3. Install 2.0 gallons of finish coating per 100 sq. ft. and allow to cure.

3.4 FLASHING APPLICATION

A. General:

1. Install flashing system in accordance with the requirements/recommendations of the Membrane manufacturer and as depicted on standard drawings and details. Provide system with base flashing, edge flashing, penetration flashing, counter flashing, and all other flashings required for a complete watertight system.
2. Wherever possible, install the flashings before installing the field membrane to minimize foot traffic over newly installed field membrane.
3. All membrane flashings shall be installed concurrently with the waterproofing membrane as the job progresses. Temporary flashings are not allowed without prior written approval from the Membrane manufacturer. Should any water penetrate the new waterproofing membrane because of incomplete flashings, the affected area shall be removed and replaced at the contractor's expense.
4. Provide a minimum vertical height of 8" for all flashing terminations. Flashing height shall be at least as high as the potential water level that could be reached as a result of a deluging rain and/or poor slope. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
5. All flashings shall be terminated as required by the Membrane Manufacturer.

B. Pipes, Conduits, and Unusually Shaped Penetrations:

1. Flash all penetrations using cold fluid-applied un-reinforced acrylic roof coating.

Flashing material shall be the same as the field coating as specified by membrane manufacturer.

C. Flexible Penetrations:

1. Provide a weathertight gooseneck of round cross-section for each penetration or group of penetrations. Set in Water cut-off mastic and secure to the structural substrate.
2. Acceptable gooseneck material is copper, of a sheet weight appropriate for the application.
3. Flash all penetrations using cold fluid-applied reinforced roof coating roof membrane. Flashing material shall be resin as specified by membrane manufacturer with appropriate fleece reinforcement.
4. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

D. Walls, Curbs and Base Flashings:

1. Apply mixed base coating to the prepared surface in accordance with manufacturer's written instructions and details. The coating should be rolled or brushed liberally and evenly onto the surface using a broad, even stroke. Install 2.5 gallons of base coating per 100 sq. ft. and allow to cure.

2. Over the cured base coat, apply the mixed top coat in accordance with manufacturer's written instructions and details to finish the coating system. The coating should be rolled or brushed liberally and evenly onto the cured base coat using a broad, even stroke. Install 2.5 gallons of finish coating per 100 sq. ft. and allow to cure.

E. Drip Edges and Gravel Stops

1. Metal drip edges and gravel stops shall be installed to solid substrate surfaces only. Securement to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding or coping and other similar materials is not acceptable.
2. Flash all drip edges and gravel stops by extending the field membrane all the way to the edge of the exposed face prior to installing the metal edging. Strip in the metal flange with a separate 8-inch wide strip of membrane adhered to both the securement flange and to the field membrane.
3. For conditions where water infiltration behind the exposed drip edge or gravel stop face is possible, install a separate polyester fleece bottom layer positioned behind the face area and

3.6 SURFACING AND FINISHES

A. Approved Finish Surfacing

1. Follow Coating manufacturer's recommendations for coating thickness, application techniques, required primers, environmental limitations, and all other similar considerations.
2. While the finish coat is still wet broadcast sand surfacing into wet surface of coating to provide traction surfacing. Allow finish coat to cure. Once cured seal sand surfacing with an additional coating of finish coat with an application of 1 gallon per 100 square feet.

3.5 TEMPORARY CLOSURES & WATERSTOPS

A. Contractor shall be responsible to ensure that moisture does not damage any completed section of the new waterproofing system. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition. All temporary closures shall be made as recommended or required by the membrane manufacturer.

3.6 PROTECTION

A. Upon completion of waterproofing and flashings (including all associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. Protect all areas where membrane has been installed.

3.7 CLOSEOUT

A. Correction of Work:

1. Work that does not conform to specified requirements including tolerances, slopes, and finishes shall be corrected and/or replaced. Any deficiencies of membrane application, termination and/or protection as noted during the Membrane manufacturer's inspections shall be corrected and/or replaced at Contractor's expense.

B. Clean-Up:

1. Site clean-up, including both interior and exterior building areas that have been affected by construction, shall be restored to preconstruction condition.

END OF SECTION

SECTION 071413 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubberized-asphalt waterproofing membrane, reinforced.
2. Molded-sheet drainage panels.
3. Insulation.
4. Plaza deck pavers.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is approved or licensed by manufacturer for installation of waterproofing required for this Project and is eligible to receive special warranties specified.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

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. American Hydrotech, Inc.; Monolithic Membrane 6125.

2.2 FLASHING SHEET MATERIALS

A. Elastomeric Flashing Sheet: 50-mil- minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

2.3 AUXILIARY MATERIALS

A. Primer: ASTM D 41, asphaltic primer.

B. Elastomeric Sheet: 50-mil- minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch thick; with anchors.

D. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

E. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.

F. Protection Course: Manufacturer's standard, 80- to 90-mil- thick, fiberglass-reinforced rubberized asphalt or modified bituminous sheet.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve, laminated to one side without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm/ft..

2.5 INSULATION

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged.
   1. Type VII, 60-psi minimum compressive strength.
   2. Type V, 100-psi minimum compressive strength.

2.6 PLAZA DECK PAVERS

A. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza deck pavers; minimum compressive strength 6500 psi, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

   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. Hanover Architectural Products.
      b. Roofblok Limited.
      c. Sunny Brook Pressed Concrete.
      d. Wausau Tile, Inc.; Terra-Paving Division.
      e. Westile Roofing Products.

   2. Thickness 2 inches.
   3. Face Size: As indicated.
   4. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.2 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

1. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
2. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

3.3 FLASHING INSTALLATION

A. Install elastomeric flashing sheets at terminations of waterproofing membrane according to manufacturer's written instructions.

3.4 MEMBRANE APPLICATION

A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.

B. Heat and apply rubberized asphalt according to manufacturer's written instructions.

C. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils; embed reinforcing fabric, overlapping sheets 2 inches; spread another 125-mil- thick layer to provide a uniform, reinforced, seamless membrane 215 mils thick.

D. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

E. Cover waterproofing with protection course with overlapped joints.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.6 INSULATION INSTALLATION

A. Install insulation over waterproofed surfaces according to manufacturer's written instructions.

3.7 PLAZA DECK PAVER INSTALLATION

A. Install concrete pavers in locations indicated according to manufacturer's written instructions.

B. Accurately install adjustable-height paver pedestals and accessories in locations and to elevations required. Adjust for final level and slope with shims.

C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.

D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.

3.8 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413

SECTION 071700 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bentonite waterproofing.
2. Molded-sheet drainage panels.
3. Insulation.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Show installation details for interface with other work.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Product test reports.

C. Sample warranty.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPOSITE HDPE/BENTONITE MEMBRANE

A. Composite HDPE/Bentonite-Polymer Membrane: Minimum 200-mil- thick membrane consisting of HDPE geomembrane liner bonded to a layer of bentonite-polymer clay granules.

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. CETCO; Volclay Ultraseal SP.

2. Puncture Resistance: 75 lbf according to ASTM D 4833.
3. Vapor Permeance: 0.005 perms according to ASTM E 96.

2.2 COMPOSITE GEOTEXTILE-HDPE/BENTONITE MEMBRANE

A. Geotextile/Bentonite-Polymer Waterproofing: Minimum 250-mil- thick membrane of bentonite-polymer clay granules between two layers of geotextile polypropylene fabric, one woven and one nonwoven, needle punched and heat fused together.

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. CETCO; Volclay Ultraseal BT.

2. Puncture Resistance: 75 lbf according to ASTM D 4833.
3. Vapor Permeance: 0.005 perms according to ASTM E 96.

2.3 INSTALLATION ACCESSORIES

A. General: Manufacturer's standard accessories recommended for intended use and compatible with bentonite waterproofing.

B. Geotextile Protection Course: As recommended by waterproofing manufacturer.

C. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: If indicated in the Architectural drawings provide a manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per foot.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Prepare substrates to be waterproofed, install waterproofing and accessories, and protect waterproofing from damage and wetting according to manufacturer's written instructions.

B. Install protection course before backfilling or placing overburden when recommended by waterproofing manufacturer.

3.2 COMPOSITE GEOTEXTILE-HDPE/BENTONITE MEMBRANE INSTALLATION

A. Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 3 inches. Stagger end joints between membranes. Seal joints with permanent seam tape.

3.3 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

END OF SECTION 071700

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber board insulation.
3. Mineral-wool board insulation.
4. Glass-fiber blanket insulation.

1.2 ACTION SUBMITTALS

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

B. LEED Submittals (Projects Authorized for LEED certification only):

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, 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 Kingspan Group)

2. Type IV, 25 psi.

2.2 GLASS-FIBER BOARD 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. Knauf Insulation.
4. Owens Corning.

B. Glass-Fiber Board Insulation: ASTM C 612, Type IA; unfaced, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

1. Nominal density of 2.25 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.3 MINERAL-WOOL BOARD 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. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of 6 lb/cu. ft., Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fiber Color: Darkened, where indicated.

C. Foil-Faced, Mineral-Wool Board Insulation: ASTM C 612; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 5, respectively, per ASTM E 84.
1. Nominal density of 6 lb/cu. ft., Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.4 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. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

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.

PART 3 - EXECUTION

3.1 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.

3.2 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 Section 042000 "Unit Masonry."

3.3 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. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber 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.

D. 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.

3.4 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.

3.5 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.

END OF SECTION 072100

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as shown on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.

b. Include junction with roofing membrane and foundation wall intersection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side.

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. Henry Company; Blueskin SA.
   b. Grace, W. R. & Co. - Conn.; Perm-A-Barrier Wall Membrane
   c. Tremco Incorporated, an RPM company; ExoAir 110/110LT.

2. Physical and Performance Properties:

   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Tensile Strength: Minimum 250 psi; ASTM D 412, Die C.
   c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
   d. Puncture Resistance: Minimum 40 lbf; ASTM E 154.
   e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D 570.
   f. Vapor Permeance: Maximum 0.05 perm; ASTM E 96/E 96M, Water Method.

2.3 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

C. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft. density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

3.2 INSTALLATION

A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

D. Seal top of through-wall flashings to air-barrier sheet.

E. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

F. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

G. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

H. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions and flashing so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

I. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

J. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

L. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.

C. Tests: As determined by Owner's testing agency from among the following tests:
1. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E 783.

2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

END OF SECTION 072713

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, vapor-permeable membrane air barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

1. Include details for through-wall flashings, substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as shown on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
b. Include junction with roofing membrane and foundation wall intersection.

1.6 WARRANTY

A. Provide manufactures standard 10-year material warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 VAPOR-PERMEABLE MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane.

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. Synthetic Polymer Membrane:
   1) Henry Company; Air-Bloc 31.
   2) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
   3) Tremco Incorporated, an RPM company; ExoAir 230.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Vapor Permeance: Minimum 5.5 perms; ASTM E 96/E 96M.
c. Ultimate Elongation: Minimum 400 percent; ASTM D 412, Die C.

2.3 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Sealant: a moisture cure, medium modulus polymer modified sealing compound compatible with sheet air barrier, roofing and waterproofing membranes and substrate.

C. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

D. Primers: Water based, low VOC as provided by the manufacturer.

E. Transition Flashing: 40 mil SBS modified bitumen self-adhering membrane with a cross-laminated polyethylene film for window and door sill flashing, door openings, inside and outside corners and other transitions as provided by the manufacturer.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

3.2 INSTALLATION

A. General: Install fluid-applied membrane air-barrier using spray equipment and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install air-barrier assembly on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Sequence Work so that detailing of self-adhered membrane flashing is completed prior to the installation of the fluid applied membrane.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Joint Treatments:

1. Seal joints ¼ inch and less between panels of exterior grade gypsum, DensGlass Gold, plywood, OSB or cementitious panels with joint treatment sealant.
2. Seal gaps and voids or irregular joints greater than ¼ inch between panels of exterior grade gypsum, DensGlass Gold, plywood, OSB or cementitious panels with a strip of self-adhering air/vapor barrier transition membrane lapped a minimum of 1 1/2 inches on both sides of the joint.
3. Alternately, joints not exceeding 1/8 inch can be sealed with yellow open weave glass fabric.

D. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and

window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

E. At end of each working day, seal top edge of air barrier to substrate with termination mastic.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions and flashing so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

G. Seal air-barrier assembly around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams. Slit and flatten fishmouths and blisters. Extend patches 6 inches beyond repaired areas.

K. Fluid-Applied Membrane Material: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

1. Vapor-Permeable Membrane Air Barrier: Total 45-mil dry film thickness, applied in one or more equal coats with spray equipment recommended by the manufacturer.

L. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.

C. Tests: As determined by Owner's testing agency from among the following tests:
1. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E 783.
2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

G. Remove masking materials after installation.

END OF SECTION 072726

SECTION 07 32 13 - CLAY ROOF TILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section Includes:

   1. Clay roof tiles.
   2. Underlayment.

B. Related Sections:
   1. Section 07 72 00 "Roof Accessories" for ridge vents.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals (Project Authorized for LEED certification only):

   1. Product Test Reports for Credit SS 7.2: For clay roof tiles, documentation indicating compliance with Solar Reflectance Index requirement.

C. Samples for Initial Selection: For each type of clay roof tile and accessory tile indicated.

   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:

   1. Clay Roof Tile: Full size.
   2. Accessory Tile: Full size, each type.

3. Fastenings: Wire-tie system components, 12 inches long.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each type of clay roof tile.

B. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Clay Roof Tiles: 100 sq. ft. of each type, in unbroken bundles.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain clay roof tiles and accessory tiles from single source from single manufacturer.

1. Exterior Fire-Test Exposure: Class A ; UL 790 or ASTM E 108, for application and roof slopes indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for clay roof tiles including related roofing materials.

a. Size: 48 inches long by 48 inches wide .

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

C. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.11 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.

1. Materials-Only Warranty Period: 50 years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's Warranty, on warranty form at end of this Section, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CLAY ROOF TILES

A. Clay Roof Tiles: ASTM C 1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Gladding, McBean; a division of PABCO Building Products, LLC.
   b. Ludowici Roof Tile.
   c. Substitutions: See Section 01 25 00 – Substitution Procedures.

3. Durability: Grade 2 .
4. High-Profile Shape: Type I, Spanish or "S" .
5. Finish and Texture: Match existing campus buildings.
6. Color: Match existing campus buildings.
7. High -Profile-Shape Accessory Tiles: Ridge ridge end hip and hip starter header course roll rake edge starter end band terminal eave closure and top fixture units, in color matching clay roof tiles.

2.2 ACCESSORIES

A. Elastomeric Sealant: ASTM C 920, elastomeric silicone-based joint sealant; Type M or Type S, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.

B. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Section 06 10 53 "Miscellaneous Rough Carpentry."

C. Mesh Fabric: 18-by-14 mesh of PVC-coated, glass-fiber thread.

2.3 FASTENERS

A. Roofing Nails: ASTM F 1667, stainless steel, 0.135-inch- diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch diameter head; of sufficient length to penetrate 3/4 inch into roof-deck sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

B. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

C. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.

D. Wire Ties: Stainless steel, 0.083-inch minimum diameter.

E. Hook Nails: One-piece wind lock and clay roof tile fastener system, minimum 0.135-inch-diameter 304 stainless steel wire, for direct deck nailing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.
c. Substitutions: See Section 01 25 00 – Substitution Procedures.

F. Tile Locks: Stainless-steel , 0.1-inch- diameter wire device designed to secure butt edges of overlaid clay roof tiles.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.

c. Substitutions: See Section 01 25 00 – Substitution Procedures.

G. Storm Clips: Stainless-steel strap-type, 0.04-by-1/2-inch, L-shaped retainer clips designed to secure side edges of clay roof tiles. Provide with two fastener holes in base flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.
c. Substitutions: See Section 01 25 00 – Substitution Procedures.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Grace, W. R. & Co. - Conn.
   b. Henry Company.
   c. Johns Manville.
   d. Owens Corning.
   e. Substitutions: See Section 01 25 00 – Substitution Procedures.

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."

1. Sheet Metal: Stainless steel.

B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

1. Apron Flashings: Fabricate with lower flange extending a minimum of 6 inches over and 4 inches beyond each side of downslope tile roofing and 6 inches up the vertical surface.
2. Step Flashings: Fabricate with a head lap of 3 inches and a minimum extension of 6 inches up the vertical surface.
3. Channel Flashings: Fabricate with vertical surface extending a minimum of 6 inches above the clay roof tile and 6 inches beneath the tile roofing, with a 2 inch high vertical return to form a runoff channel.

4. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches beneath the tile roofing, with a 2 inch high vertical return to form a runoff channel.
5. Cricket Flashings: Fabricate with concealed flange extending a minimum of 24 inches beneath upslope tile roofing, 6 inches beyond each side of projection, and 6 inches above the roof plane.
6. Closed -Valley Flashings: Fabricate in lengths not exceeding 10 feet , with 1-inch- high, inverted-V profile at center of valley and with equal flange widths of 12 inches .
7. Drip Edges: Fabricate in lengths not exceeding 10 feet , with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

C. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.

B. 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 UNDERLAYMENT INSTALLATION

A. General: Comply with clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Cover ridge wood nailers with underlayment strips.

B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.

1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.

C. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches in shingle fashion. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.

1. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches in direction to shed water.

D. Double-Layer Felt/Roll Roofing Underlayment:

1. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.
2. Install roll roofing underlayment, in parallel courses, in same direction as felt underlayment. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches.

    a. Mechanically fasten over felt underlayment.
    b. Adhere to felt underlayment with uniform coating of asphalt roofing cement.

3. Terminate felt underlayment extended up not less than 4 inches against chimneys, sidewalls, curbs, and other projections.

E. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover underlayment within seven days.

1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
2. Extend self-adhering sheet underlayment over entire roof deck.

F. Double-Layer Felt/Self-Adhering Sheet Underlayment:

1. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.
2. Install self-adhering sheet underlayment, wrinkle free, on felt underlayment. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap sides not less than 3-1/2 inches in direction to shed water. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover underlayment within seven days.

G. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends

of each layer at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.

1. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."

1. Install metal flashings according to clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.

C. Step Flashings: Install with a head lap of 3 inches and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

D. Cricket Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.

E. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.

1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.

F. Channel Flashings: Install over underlayment and fasten to roof deck.

G. Rake Pan Flashings: Install over underlayment and fasten to roof deck.

H. Rake Drip Edges: Install over underlayment and fasten to roof deck.

I. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.

J. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

K. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to clay roof tile with elastomeric sealant.

1. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.

3.4 WOOD NAILERS AND BATTENS

A. Install wood nailers at ridges and securely fasten to roof deck.

B. Install beveled wood cant at eaves and securely fasten to roof deck.

C. Install nominal 1-by-2-inch wood battens horizontally over 1/2-inch- high, pressure-preservative-treated wood lath strips in 48-inch lengths with ends separated by 1/2 inch, at spacing required by clay roof tile manufacturer, and securely fasten to roof deck.

3.5 CLAY ROOF TILE INSTALLATION

A. General: Install clay roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
2. Extend tiles 2 inches over eave fasciae.
3. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.

    a. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
4. Install storm clips to capture edges of longitudinal sides of clay roof tiles and securely fasten to roof deck.
5. Install clay roof tile locks to support and lock overlying tile butts to underlying tiles.
6. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
7. Install clay roof tiles with color blend approved by Architect.

B. Flat Shingle Clay Roof Tile Installation:

1. Maintain 2-inch head lap between succeeding courses of clay roof tiles.
2. Offset joints by half the clay roof tile width in succeeding courses.
3. Extend clay roof tiles 1 inch over fasciae at rakes.
4. Install ridge tiles in saddle configuration with laps facing away from prevailing wind. Seal laps with elastomeric sealant.

    a. Close voids where ridge tiles meet clay roof tiles with ridge closure tiles .

5. Install hip tiles in saddle configuration. Seal laps with elastomeric sealant.

    a. Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

    b. Close voids where ridge tiles meet clay roof tiles with ridge closure tiles .

6. Install hip tiles in saddle configuration. Seal laps with elastomeric sealant.

    a. Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

C. Low-Profile, Interlocking Clay Roof Tile Installation:

1. Provide minimum 3-inch lap between succeeding courses of clay roof tiles.
2. Install L-shaped rake tiles.
3. Install ridge tiles with laps facing away from prevailing wind. Seal laps with elastomeric sealant.

D. High-Profile Clay Roof Tile Installation:

1. Install tile eave closure.
2. Provide minimum 3-inch lap between succeeding courses of clay roof tiles.
3. Install L-shaped rake tiles.
4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with elastomeric sealant.

E. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley from highest to lowest point.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

F. Closed Valleys: Cut clay roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch .

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

3.6 ADJUSTING AND CLEANING

A. Remove and replace damaged or broken clay roof tiles.

B. Remove excess clay roof tiles and debris from Project site.

END OF SECTION 07 32 13

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section includes standing-seam metal roof panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review structural loading limitations of deck purlins and rafters during and after roofing.
   6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
   7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   8. Review temporary protection requirements for metal panel systems during and after installation.
   9. Review procedures for repair of metal panels damaged after installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. LEED Submittals (Projects authorized for LEED certification only):

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

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

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show 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: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
1. Wind Loads: UL-580 Class 90 wind uplift, or as indicated on Drawings.
2. Impact Resistance: UL 2218 rated.

C. Air Infiltration: Air Leakage of not more than 0.06 cfm/sq. ft. (0.3L/ sq. m) when tested according to ASTM E 1680 or ASTM E 283 at the following test pressure difference:
1. Test Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test pressure difference:
1. Test Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Wind Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind uplift resistance class indicated.
1. Uplift Rating: UL Class 90.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Design is based on UC-3 Double-Lock Seam, Standing Seam roofing system, roll formed steelMetal Roof Panels : Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Petersen Aluminum Corporation.
   b. Architectural Building Components.
   c. ATAS International, Inc.
   d. Substitutions: See Section 01 25 00 – Substitution Procedures.

3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 0.0239 inch .
   b. Texture: Smooth.
   c. Color: As selected by Architect from manufacturer's full range .
   d. Length: Full length of roof slope, without lapped horizontal joints.
   e. Width: Maximum panel coverage of 20 inches (508 mm).
   f. Profile: Standing seam, with minimum 1.5 inch (38 mm) seam height; concealed fastener system lapped seam in standing seam profile.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 36 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Roll Width: 36 inches.
4. Roll Length: 75 feet.
5. Products: Subject to compliance with requirements, provide the following :
   a. Grace Construction Products, a unit of W. R. Grace & Co.; Grace Ice and Water Shield HT .
   b. Substitutions: See Section 01 25 00 – Substitution Procedures.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50

coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch- thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations

in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below , wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

   1. Apply over the entire roof surface.

2. Apply over the roof area indicated below:
   a. Valleys, from lowest point to highest point, for a distance on each side of 18 inches . Overlap ends of sheets not less than 6 inches.
   b. Hips and ridges for a distance on each side of 12 inches .

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
4. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

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

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. 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 weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Connect downspouts to underground drainage system indicated.

K. Roof Curbs: Install flashing around bases where they meet metal roof panels.

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

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.16

SECTION 07 42 13.13 - FORMED METAL WALL PANELS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review of procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. LEED Submittals (Projects authorized for LEED certification only):

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

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

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces .

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Architectural Building Components.
   b. CENTRIA Architectural Systems.
   c. Substitutions: See Section 01 25 00 – Substitution Procedures.
   d. Petersen Aluminum Corporation.

3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 0.022 inch .
   b. Exterior Finish: Three-coat fluoropolymer .
   c. Color: As selected by Architect from manufacturer's full range .

C. Reveal-Joint, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and a flat pan between panel edges; with narrow reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. CENTRIA Architectural Systems.
   b. Petersen Aluminum Corporation.
   c. Substitutions: See Section 01 25 00 – Substitution Procedures.

3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 0.022 inch .
   b. Exterior Finish: Three-coat fluoropolymer .
   c. Color: As selected by Architect from manufacturer's full range .

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets,

fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

C. Steel Panels and Accessories:
1. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
4. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar

items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. 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 waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.13

Confirm this meets 2012 energy Conservation code

SECTION 075216

STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING (TORCH APPLIED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. RELATED SECTIONS
1. Division 06 10 53 Miscellaneous Rough Carpentry: Wood nailers, curbs and cant strips
2. Division 07 62 00 Sheet Metal Flashing and Trim
3. Division 07 71 00 Roof Specialties: Copings, flashing and counterflashing
4. Division 07 72 00 Roof Accessories: Roof curbs and roof hatches
5. Division 22 40 00 Floor, Area and Roof Drains
6. Division 26 41 13 Lightning Protection for Structures: Lightning protection systems devices and connectors

1.2 SUMMARY

A. Section Includes:

1. Modified bituminous membrane roofing fully adhered with torch.

2. Roof Insulation.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Roofing Systems Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers", and herein called "manufacturer".

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall

withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system. Roofing system must meet the design intent and wind uplift capabilities associated with the uplift rating requirements listed in this specification and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-120.

2. Hail Resistance Rating: SH.

3. Clear Lake Campus to meet the requirements of the Texas Windstorm Act.

D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency. Provide roofing membrane to meet applicable local Building Department requirements and initial solar reflectance not less than 0.70 and thermal emittance not less than 0.75 when tested according to one of the test methods listed below. A coated cap sheet is not allowed.

1. Solar Reflectance Test Methods: ASTM C1549, ASTM E903, ASTM E1175, or ASTM E1918.

2. Thermal Emittance Test Methods: ASTM C835, ASTM C1371, or ASTM E408.

E. Insulation R Value: Minimum R-20 Long Term Thermal Resistance (LTTR) as determined in accordance with CAN/ULC-S770 **(Specifier to choose R value to meet HVAC demands with R-20 minimum per city code or as directed by Architect/Owner)**

F. Roof Assembly must meet the current version of ASHRAE 90.1

1.5 SUBMITTALS

A. Product Data: Roofing-system manufacturer’s literature, including written instructions for evaluating, preparing, and treating substrate; technical data including tested physical and performance properties; and application instructions.

1. Provide for membrane and base flashing materials, and roofing cement, asphalt, primer, mastic sealant, and fasteners.

B. Include temperature ranges for storage and application of materials, and special cold weather application requirements or limitations.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work. Include manufacturer's reviewed and approved details that are project specific. Manufacturer's generic details will not be accepted.

1. Base flashings and membrane terminations.

2. Tapered insulation layout including, crickets, saddles, and tapered edge strips, including amount and direction of slopes.

3. Roof Layout Plan identifying location and dimensions of all roof field, perimeter, and corner areas.

4. Base sheet/Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

5. Walkway pad plan and detail

6. Proposed temporary, watertight, tie-off details for each substrate type.

7. Interface with sheet metal components (per Section 07 62 00), including but not limited to:

a. Counterflashing
b. Stack flashing assemblies
c. Edge and fascia sections
d. Interface with coping cap assemblies (per Section 07 62 00)
e. Interface with roofing accessories including but not limited to:
f. Equipment curbs
g. Roof hatches
h. Expansion joints assemblies

D. Samples for Verification: For the following products:

1. Sheet roofing materials, including membrane cap sheet, of color specified.

2. Roof insulation.

3. Insulation cover board.

4. Walkway pads or rolls.

5. Six insulation fasteners of each type, length, and finish.

E. Installer's Certificate

1. Signed by roofing-system manufacturer, certifying that Roofing Installer complies with manufacturer's requirements to install specified, warranted, roofing system.

2. Submit evidence that Installer's existing company has minimum of 5 years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:

a. Project name.
b. Owner's name.
c. Owner's Representative name, address, and telephone number.
d. Description of work.
e. Modified-bitumen materials used.
f. Project supervisor.
g. Total cost of roofing work and total cost of project.
h. Completion date.

F. Manufacturer Certificate: Signed by roofing-system manufacturer, certifying that roofing system complies with specified requirements.

1. Written approval by membrane manufacturer for use and performance of membrane over specified board insulation, including that materials supplied for project comply with requirements of cited ASTM standards. Approval should also indicate materials are suitable for ASTM E 108, Class 1A roof and meet specified wind uplift classification.

2. Submit evidence of meeting performance requirements including applicable FMG assembly number or approved testing agency.

3. Include all methods of attachment and attachment spacing for insulation and membrane system.

G. CERTA Program Certificates for all workers who may use open flame torches.

H. Certify that materials are free of asbestos.

I. Sample Warranty: Copy of roofing-system manufacturer's warranty, stating obligations, remedies, limitations, and exclusions. Submitted with bid.

J. Maintenance Data: For roofing system to include in maintenance manuals.

K. Prior to installation of the roof system, provide a written report with fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

L. Following completion of Work, submit roofing-system manufacturer's inspection report of completed roofing installation and completed warranty; submit

Installer's completed warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project with a minimum of 10 years of documented experience.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Must have installations of specified materials in the local area in use for a minimum of 5 years.

C. Source Limitations: Obtain components including **[roof insulation] [fasteners] <Insert products>** for membrane roofing system **[from same manufacturer as membrane roofing] [or] [approved by membrane roofing manufacturer].**

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Testing: At Owners cost, Owner reserves the right to perform wind uplift testing of installed roof system per FM 1-52. Locations and quantities to be determined by Architect/Engineer. Initial test will be paid for by Owner, any additional testing required due to a failed test will be paid for by the Contractor.

G. Pre-Installation Testing: Provide fastener withdrawal testing at metal deck, lightweight insulating concrete deck (or any other type of deck where the roof system is mechanically attached to the deck) areas per the latest version of ANSI/SPRI FX-1 testing procedures to verify fastener withdrawal resistance and identify fastener quantity and spacing

H. Open Flame or Torch Operator Certification

I. All personnel or operators of open flame torches must be certified by the local municipality fire department through an approved training course or the Midwest Roofing Contractors Association CERTA Program. (Or Owners approved equal)

J. The Contractor must submit the torch applicator certifications with the submittals for the project. No workers may use open flame torches without approved certifications submitted in advance.

K. Fumes And Environmental Considerations

1. Air Intake: The contractor will coordinate with the Roof Engineer and Owner to create a schedule for all rooftop air handler intake protection during the project.

2. Rooftop Air Intakes - The Owner will close or otherwise adjust rooftop air intakes for minimum attraction of roofing material fumes from rooftop work.

3. Vent Covers - Contractor will furnish plastic, charcoal, or other suitable covers for air intake vents, and shall install and remove such covers where requested to do so by the Owner

L. Pre-installation Roofing Conference: Conduct conference at Project site. Contractor's site foreman, roofing-system manufacturer's technical representative, Roofing Installer, Owner's Representative, Architect/Engineer shall attend.

1. Site use, access, staging, and set-up location limitations.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions. Including, but not limited to, the following: forecast weather conditions, storage and protection of materials prior to installation, surface preparation and pretreatment, environmental conditions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system and surrounding work during and after installation.

9. Review roof observation and repair procedures after roofing installation.

10. Reporting procedures.

11. Related project details and interfaces with adjacent work.

12. Testing and inspection requirements.

13. Notification procedures for inspections.

14. Documentation of modifications and repairs for project record.

15. Documentation required for manufacturer’s warranty.

16. Governing regulations and requirements for insurance and certificates if applicable.

17. Quality control and quality assurance plans.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components. Material storage procedures will be constantly monitored and strictly enforced.

B. Use canvas tarps for protection of moisture-sensitive roofing materials. If plastic coverings are used, venting of each package is required. Roofing-system manufacturer’s standard packaging and covering is not considered adequate weather protection.

C. Select and operate material handling equipment in a safe manner, guarding against damage to existing construction or newly applied roofing and conforming to manufacturer's recommendations of handling and storage.

D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

E. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Manufacturer's packaging is not considered adequate protection from moisture.

F. Handle and store materials and equipment on structures to safe loading of structure at time and to avoid permanent deflection of deck. Conspicuously mark wet or damaged materials and promptly remove from Site. Materials, having been determined by the owner/owner's representative to be damaged, shall be immediately removed from the construction site and replaced at no cost to the owner.

G. Store rolled asphalt based materials on ends only, unless otherwise required by

roofing-system manufacturer's written instructions. Discard rolls that have been flattened, creased, or otherwise damaged.

H. Do not store materials at locations where new roofing materials have been installed.

I. Remove and replace materials that cannot be applied within stated shelf life.

J. Flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow all precautions as outlined in manufacturer's Material Safety Data Sheets.

1.8 PROJECT CONDITIONS

A. Safety

1. Take all necessary precautions regarding worker health and safety when using solvents and adhesives.

2. Store flammable liquid and materials away from open sparks, flames and extreme heat.

3. Take necessary precautions when using solvents and adhesives near fresh air intakes.

4. Comply with all OSHA requirements for construction.

B. Daily site cleanup shall be performed to minimize debris and hazardous congestion

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions e.g. extreme temperature, high winds, high humidity and moisture, permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

D. Verify existing dimensions and details prior to installation of materials. Notify Architect/Engineer of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.

E. Comply with Owner's limitations and restrictions for site use and accessibility.

F. Install materials in strict accordance with safety requirements required by roofing manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

G. Protection

1. Schedule installation sequence to limit access and utilization of the newly installed membrane for material storage, construction staging, mechanical

and/or excessive foot traffic.

2. Protect roofing membrane, building surfaces, paving, and landscaping from traffic and roofing equipment. Provide temporary walkways constructed of plywood and set on protective material in traffic and construction areas.

3. Restore or replace all work or materials damaged by the roofing operation.

4. Remove protection materials upon completion of work.

5. Adverse weather could have a detrimental effect on adhesives, general production efforts or the quality of the finished installation. Contact manufacturer for recommendations and acceptable tolerances.

H. Daily seal: Ensure that moisture does not penetrate beneath any completed sections of the roof by sealing temporary roof terminations at the end of each work day and prior to the arrival of inclement weather. Inspect existing components for moisture intrusion along the temporary terminations at temporary cut-offs, tie-ins, and night seals after opening the seal on the next workday. Remove any wet, damp or moisture-damaged materials.

I. All construction debris shall be removed from the construction site and legally dispose of offsite.

1.9 WARRANTY

A. Special NDL Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, fasteners, stacks, drains, wall flashings, metal flashings and other components of membrane roofing system. Warranty shall include Wind Rider for wind speeds up to 72 MPH.

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

C. Maintenance: Along with the issuance of the warranty, a set of instructions shall be included detailing preventative maintenance and noting a list of harmful substances which may damage the roofing membrane.

1.10 COORDINATION

A. Prior to installation of materials, a pre-roofing conference should be held with the roofing contractor, and owner/owner's representative(s) to discuss the specified roofing system coordinate its proper application and the expectations of all parties involved. The authorized roofing contractor and the owner/owner's representative shall notify all parties a minimum of fourteen days prior to the meeting.

B. Plan and coordinate the installation of the roofing system with other trades in such a manner to avoid membrane damage, keeping the complete installation weather tight and in accordance with all approved details and warranty requirements.

C. Manufacturer shall be available to make recommendations necessary to ensure compliance with project specifications and specification alternatives due to unforeseen job conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products and components for the roofing system shall be supplied by the roofing system manufacturer.

B. Components other than those manufactured and/or supplied by the roofing system manufacturer shall be submitted for review, prior to ordering. Any product(s) not specifically authorized in writing for the project by the roofing system manufacturer, shall be considered unacceptable and their performance excluded from the warranty.

C. Roofing membranes may be installed over or adhered directly to pre-approved insulation, cover board, decking or composites thereof. Contact manufacturer for additional information regarding compatible substrates.

2.2 MODIFIED ASPHALT-SHEET MATERIALS

A. Modified Bituminous Membrane Roofing: Manufacturers: Subject to compliance with requirements, provide products by one of the following only, no substitutions:

a. Siplast Incorporated:
Cap Sheet: Paradiene 40 CR FR TG

b. Soprema Roofing and Waterproofing.
Cap Sheet: Sopralene Flam 180 FR GR (SG)

c. Johns Manville

DynaWeld Cap 250 FR CR G

2.3 BASE-SHEET MATERIALS

A. Base Sheet: Manufacturers heavy duty, modified, asphalt-impregnated and -coated sheet, with glass-fiber and/or polyester reinforcing mat, dusted with fine mineral surfacing on both sides.

1. Siplast Incorporated:
Base Sheet: Paradiene 20 HV TG

2. Soprema Roofing and Waterproofing
Base Sheet: Sopralene FLAM 180

3. Johns Manville
Base Sheet: DynaWeld 180S

B. Vented Base Sheet: Over lightweight insulating concrete deck, use manufacturers recommended vented base sheet mechanically attached to substrate.

C. Vented Base Sheet: Over existing or new structural concrete deck, use manufacturers recommended vented base sheet torch applied to the substrate.

2.4 BASE AND PENETRATION FLASHING SHEET MATERIALS

A. Smooth Surfaced Base Sheet and Cap Sheet as follows:

1. Siplast Incorporated:
Base Sheet: Paradiene 20 TG
Cap Sheet: Veral Aluminum

2. Soprema Roofing and Waterproofing
Base Sheet: Sopralene FLAM 180
Cap Sheet: Sopralast 50 TV ALU

3. Johns Manville
Base Sheet: DynaWeld 180S
Cap Sheet: DynaClad Aluminum

2.5 Liquid Flashing Systems: PMMA flashing system by the roofing manufacturer.

1. Siplast Inc.: Parapro

2. Soprema Roofing and Waterproofing: Alsan RS 230

3. Johns Manville: Seam Free PMMA

2.6 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

4. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

5. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. Non membrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.

B. Asphalt Primer: ASTM D 41.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen; non hardening, non migrating, non skinning, and nondrying.

D. Flashing Cement: ASTM D 4586, asbestos free, of consistency required by roofing-system manufacturer for application. Use for sealing laps in membrane or base flashing, surface or stripping flashing at equipment penetrations and drains, or repairs to membrane or flashing.

E. Low-rise urethane adhesive: Used to adhere insulation and cover board within the roof assembly, as acceptable to roofing system manufacturer.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

G. Metal Flashing Sheet: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

H. Lead flashing for roof drains: 4-pound lead.

I. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.

J. Termination Bar: Roofing-system manufacturer’s standard; aluminum bars,

approximately 1-inch wide by 1/8-inch thick; with predrilled holes 6 inches on center.

K. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.7 ROOF INSULATION

General:

A. Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. For insulation that will be placed using low rise foam adhesive, board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

C. Polyisocyanurate Flat Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2, non-organic glass-fiber mat facer on both major surfaces; 20-pounds-per-square-inch-minimum compressive strength in accordance with ASTM D1621; and meet flame spread requirements of ASTM E84.

D. Polyisocyanurate Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated. Drainage crickets and saddles will have a minimum thickness of 1/2” and a minimum slope of 1/2” per foot. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

E. Cover Boards: ASTM C 1177; water-resistant, gypsum substrate, 4’ by 4’ in size. Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

F. Acceptable Products:

1. 1/2 inch Securock Gypsum Fiber Roof Board as manufactured by USG.

2. 1/2 inch DensDeck Prime (or as required by the roofing manufacturer) as manufactured by GP.

G. Fire Resistance:

a. Flame spread 0, smoke developed 0, when tested in accordance with ASTM E 84. Noncombustible when tested in accordance with ASTM E 136.

2.8 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Adhesive: Manufacturer's standard low rise foam adhesive formulated to adhere roof insulation to concrete substrates and subsequent layers of insulation and cover board to each other.

D. Wood Nailer Strips: Comply with requirements in Division 06 Section **"[Rough Carpentry] [Miscellaneous Rough Carpentry]."**

E. Tapered Edge and Cant Strip: Fiber tapered edge strip, ½" to 0 by 6". Cant strip and/or tapered edge to be mineral aggregate meeting HH-I-529B.

2.9 WALKWAYS

A. Walkway Pads: Same granulated cap sheet product as used in the field area of the roof and as follows: Granule Color: **Gray or White**.

1. Size: As standard with manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. The "Authorized" roofing contractor is responsible for ensuring appropriate system specific addendums from manufacturer.
B. The roofing contractor is responsible for providing a suitable substrate surface for the proper installation of the Roofing System, roof insulation and specified components.

C. Application of the roofing system constitutes an agreement that the roofing contractor has inspected and found the substrate suitable for the installation of the Roofing System.

D. The roofing contractor is responsible for coordinating the installation to ensure that the system remains watertight at the end of each working day.

3.2 SUBSTRATE EXAMINATION

A. The roofing contractor is responsible for verifying that the deck condition and/or existing roof construction is suitable for the specified installation of the Roofing

System.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. At a minimum, test for capillary moisture by plastic sheet method according to ASTM D 4263-83. Additional testing may be required.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

7. The application of adhesives directly to structural concrete; existing smooth and/or granular BUR materials may require sealing or priming with an accepted asphalt primer prior to application.

8. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

9. Examine surfaces for low areas that will not drain properly, foreign material, ice, wet insulation, unevenness or any other defect which would prevent the proper execution and quality application of the Roofing System as specified

C. Prepared substrate shall be smooth, dry, and free of debris and/or any other irregularities which would interfere with the proper installation of the Roofing System. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Installer and roofing-system manufacturer’s representative shall examine substrate to ensure that it is properly prepared and ready to receive roofing system. Roofing-system manufacturer’s representative shall report in writing to Installer and Architect/Engineer conditions which will adversely affect roofing-system installation or performance. Do not proceed with roofing-system installation until these conditions have been corrected and reviewed by

Architect/Engineer.

E. Provide fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

3.3 COORDINATION

A. Coordinate Work to ensure that new insulation and roofing materials and building interior are kept continuously dry and that continuous, watertight, new roofing system is provided. Coordinate:

1. With Owner's Representative.

2. With other trades to avoid or minimize work on, or in immediate vicinity of, installation in progress and completed new roofing.

3. To avoid or minimize adverse effects on completed new roofing.

4. Ensure that drains are operational at end of each workday or if precipitation is forecast.

3.4 SUBSTRATE PREPARATION **(New Construction) (SPECIFIER TO CHOOSE DECK TYPE)**

A. Steel Deck

1. Steel decking should conform to Factory Mutual (FM) guidelines for Class-1 insulated steel deck construction.

2. Steel decking should be constructed of a minimum 22 gauge cold rolled steel sheets with factory G-90 galvanized coating.

3. Panel profiles, (ribs) shall be formed to minimize deflection and provide suitable strength and integrity to support anticipated structural live and dead loads.

4. Steel decking shall be installed in compliance with specified design criteria and local building code requirements.

B. Concrete (Poured and/or Pre-cast)

1. Decking shall be installed in strict conformance with industry standards, practices and/or pre-cast panel manufacturer's installation requirements.

2. Decking shall be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

3. Finished decking shall be properly cured and dry, prior to the installation of approved insulation.

4. Finished surface(s) to receive new roof system shall be smooth and level without significant surface depressions or irregularities. Camber differentials greater than 3/16 inch must be leveled using a cementitious grout.

5. Finished surfaces shall be free of moisture, dust, loose debris and any other irregularity that may hinder the proper performance of the new Roofing System.

6. Verify that concrete substrate is visibly dry and free of moisture. At a minimum, test for capillary moisture by plastic sheet method according to ASTM D 4263-83. Additional testing may be required.

7. Prime and torch apply vented base sheet to the deck.

3.5 SUBSTRATE PREPARATION **(Re-Roofing) (SPECIFIER TO CHOOSE DECK TYPE)**

A. General

1. Roofing Contractor shall be responsible for informing the building owner/owner representative of any issues in regard to the condition and structural integrity of the existing decking.

2. The building owner/owner representative shall make and be responsible for the determination as to the proper method of treatment and/or replacement.

3. Re-roofing applications require fastener withdrawal tests to substantiate proposed attachment patterns for the new mechanically fastened insulation systems and/or membranes.

4. Re-roofing applications that require modification to the deck and/or insulation system should be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

5. All terminations of the Roofing System must be constructed to prevent water from penetrating behind or beneath the new Roofing System. This includes water from above, beside, below and beneath the new system.

B. Removal of Existing Roof System(s)

1. Remove all existing roofing material(s), insulation, flashing, metal and deteriorated wood blocking and legally dispose off-site.

2. Remove only enough roofing to accommodate the day's work and ensure the exposed area can be made 100% watertight at the end of the day or first sign of inclement weather.

C. Steel Decks

1. All rotted and/or deteriorated decking shall be removed and replaced with like kind.

2. Areas of structurally acceptable steel decking exhibiting slight surface rust shall be properly cleaned, primed and painted prior to installing the approved insulation.

3. All decking shall be inspected for proper attachment and excessive deflection that would compromise the uplift performance of the new Roofing System.

4. Attachment and deflection deficiencies shall be repaired and brought into compliance with current, local building code requirements.

D. Concrete

1. Deteriorated decking shall be repaired and/or replaced with appropriate materials according to standard industry regulations and practices.

2. Repair any depressions and/or areas where reinforcing has become exposed.

3. When new insulation system is to be installed using hot asphalt or an approved adhesive:

   a. Cracks and or camber differentials greater than 3/16 inch shall be repaired using an appropriate cementitious grout or fill, and feathered to promote a smooth transition.
   b. Joints between pre-stressed panel units and over bulb-tees shall be taped, stripped or grouted with an appropriate cementitious fill.
   c. All surface irregularities shall be leveled to ensure complete contact with the decking for insulation bonded in hot asphalt or approved adhesives.

4. Where insulation is to be mechanically attached or ballasted, camber differentials and/or surface irregularities of up to 1/2 inch shall be acceptable.

5. Verify that concrete substrate is visibly dry and free of moisture. At a minimum, test for capillary moisture by plastic sheet method according to ASTM D 4263-83. Additional testing may be required.

6. Prime and torch apply vented base sheet to the deck.

E. Lightweight "Insulating" Concrete **(FOR USE OVER EXISTING DECKS IN A RE-ROOF SITUATION ONLY).**

1. All wet lightweight shall be removed and replaced with appropriate and/or compatible material.

2. Surface to receive new Roofing System shall be smooth and free of ridges, depressions and other irregularities.

3. Repair any depressions, irregularities and/or excessive deflection with

compatible material.

4. Mechanically attach vented base sheet to the deck.

3.4 ROOFING SYSTEM INSTALLATION

A. Install roofing membrane and base flashings according to roofing-system manufacturer's written instructions and applicable recommendations of NRCA/ARMA Quality Control Guidelines for Application of Polymer Modified Bitumen Roofing.

B. Install materials in strict accordance with safety requirements required by roofing-system manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

C. Follow safety procedures of OSHA and other applicable governing agencies. Assume responsibility for Work area safety at all times.

D. Provide fully-charged fire extinguishers, appropriately sized and rated, and water within 50 feet of open flame.

E. Torch Safety for areas where torches are approved for use by Owner' Representative and Architect/Engineer.

F. Do not use wood-fiber cant strips or insulation.

G. Install continuous, glass-fiber, base sheet over combustible substrates.

H. Install metal flashings at penetrations, or protect with tight-fitting felt collar before torching.

I. Torches to have safety lever (pilot only or self-igniting). Do not use full-time torches.

J. Maintain fully-charged fire extinguishers, appropriately sized and rated, within 50 feet of torch work locations.

K. Walk job every day at least 1 hour after torches are out for fire watch.

L. Maintain adequate ventilation during installation of roofing materials. Notify Owner's Representative at least 1 week in advance of Work with materials with noxious vapors. Review application schedule and venting precautions with Owner's Representative prior to beginning application.

M. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing-system components or adjacent building construction.

N. Coordinate installing roofing-system components so insulation and roofing membrane sheets are not exposed to precipitation, or left exposed at end of

workday or when rain is forecast.

O. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

P. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

Q. Remove and discard temporary seals before beginning work on adjoining roofing.

R. Prohibit foot traffic and equipment movement over roofing system until adhesive has cured. Minimize foot traffic and equipment movement over base ply prior to installation of membrane top ply/cap sheet.

S. Cooperate with Architect/Engineer in performing inspections and testing of roofing system.

3.7 ROOF INSULATION INSTALLATION

A. General

1. Roof insulation shall be installed where by the long dimension of the board(s) run in parallel alignment and the short dimensions are staggered.

2. Insulation shall be installed with minimum joint dimensions and shall be tightly butted where possible. Maximum joint widths shall be 3/8 inch. Damaged corners shall be cut out and replaced with an insulation piece a minimum of 12 inch x 12 inch Pieces which are cut from larger panels and are smaller than one square foot are not acceptable.

3. Install no more than can be covered during the same working day.

4. Taper roof insulation to drain sumps using tapered edge strips. If an insulation layer is 1-1/2 inch or less, taper 12 inch from the drain bowl. If insulation thickness exceeds 1-1/2 inch, taper 18 inch from the drain bowl. All taper boards or pieces must be adhered or mechanically fastened with a minimum of two fasteners per board.

5. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the cover board.

6. When a cover board and/or multiple layers are installed each layer should be offset from the previous layer a minimum of 12 inch on center.

7. At the end of each working day, provide a watertight cover on all unused insulation as to avoid moisture penetration.

B. Insulation Installation

1. Comply with roofing system manufacturer's written instructions for installing roof insulation.

(Retain first paragraph below if mechanically fastening base sheet to substrate before adhering first layer of insulation.)

2. Over nailable substrate, install one lapped vented base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

(For Steep slope applications, slopes 1 in 12 or greater) Use Nailer Strips: Mechanically fasten 4-inch nominal- width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:

3. 16 feet apart for roof slopes steeper than 1 inch per 12 inches but less than 3 inches per 12 inches.

4. 48 inches apart for roof slopes steeper than 3 inches per 12 inches.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

D. Mechanically Fastened Insulation: For metal roof decks, install the base layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

E. Adhered Insulation:

1. Board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

2. For insulation that will be installed using adhesive (not mechanically attached), provide adequate temporary ballast on insulation boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/8 inch with insulation.

F. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and non composite insulation in two or more layers, install non composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

I. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the coverboard.

J. Cover Board Installation: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.

1. Adhere cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3. Apply low-rise foam adhesive to underside, and bond cover board to substrate.

4. Provide adequate temporary ballast on cover boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3.5 ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

1. Install roofing system according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and to requirements in this Section.

2. Deck Type: I (insulated).

3. Adhering Method: T (torched).

4. Number of Modified Asphalt Sheets: Two.

5. Surfacing Type: M (mineral-granule-surfaced cap sheet).

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

1. Back nail roofing membrane sheets to substrate according to roofing system manufacturer's written instructions.

D. Cooperate with testing agencies engaged or required to perform services for installing roofing system.

E. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Modified-Bitumen Membrane Installation: Install roofing membrane base ply and cap sheet.

B. Install all roofing membrane and flashing systems, and all accessory components in accordance with the Drawings and Specifications; unless the manufacturers printed instructions are more restrictive. Request for clarification shall be submitted in writing to the Engineer.

C. Unroll sheets and allow to relax before installing.

D. Cut out factory splices in top ply. Alternately, cover splice with full-width section of top-ply membrane that extends at least 6 inches beyond sides of splice.

E. Accurately align sheets without stretching, and maintain uniform side and end laps of minimum dimensions required by roofing-system manufacturer for selvage and non-selvage laps.

F. Start at low point of roof deck and shingle side laps with slope of deck where possible.

G. Stagger end laps at least 3 feet.

H. Extend sheets over and terminate about 1 inch above top of cants.

I. Torch apply base ply and totally adhere to substrate without breaks or voids.

J. End Laps - All end laps shall be lapped a minimum of 6", or as specified by the manufacturer, and all membrane laps shall show a "bleed-out" between 1/4" and 1/2". Corners of the end laps are to be rounded.

K. Torch apply top ply and totally adhere to substrate without breaks or void.

L. Broom or roll seams as required by the manufacturer to be free of wrinkles, creases, fish mouths, or air pockets.

M. Cut out wrinkles and fishmouths, and repair with same number of plies removed.

N. Prepare and prime non-selvage laps as recommended by roofing-system manufacturer.

O. Continuously bond and seal laps, leaving no voids.

P. Repair wrinkles and voids in lapped seams.

Q. No Foot Traffic on New Membrane - Set up points, charge points, debris chutes, asphalt filling points, drinking water containers and all other destination facilities shall be located in such a way as to preclude traffic over the newly installed membrane. No workers shall walk on the newly completed membrane for at least thirty minutes after installation to allow for cooling of the asphalt to prevent compression and displacement of asphalt due to point loading or concentration of weight due to a person's foot or equipment.

R. Embed loose cool roof granules in bleed out or cool roof reflective coating, in accordance with the membrane manufacturer’s recommendations, at side and end laps which and at minor asphalt, primer, or adhesive spillage on finished membrane surfaces.

S. At locations where asphalt, primer, or adhesive spillage on finished membrane surfaces exceeds 1 square foot, install additional top ply of membrane.

T. Install modified bituminous roofing membrane cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants.

1. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

U. Laps: Accurately align roofing membrane sheets, without stretching, and

maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Seal all laps per manufacturer's recommendations.

2. Repair tears and voids in laps and lapped seams not completely sealed.

3. Apply roofing granules to cover exuded bead at laps while bead is hot.

V. Install roofing membrane sheets so side and end laps shed water.

3.7 FLASHING AND STRIPPING INSTALLATION

A. General: Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrate according to roofing-system manufacturer's written instructions.

B. Base Flashing:

C. Accurately align base flashing sheets without stretching, and maintain uniform side and end laps required by roofing-system manufacturer for selvage and non-selvage laps.

D. Start wall and curb base flashing at low point of roof deck and shingle with slope of deck.

E. Flashing Plies not to exceed 39 inches in width. Extend base flashing plies to top of curbs, to within 1 inch of counterflashing reglets, at least 8 inches above finished surface of roofing system, and 4 inches onto field of roofing membrane. At locations where height of wall exceeds height acceptable to roofing-system manufacturer, comply with recommendations of roofing-system manufacturer for flashing high walls. Recommendations include flashing in two stages: bottom half to recommended maximum height preceded by top half over remainder of wall.

F. Bond and seal laps, leaving no voids. Repair wrinkles and voids in laps and lapped seams. Prepare and prime non-selvage laps as recommended by roofing-system manufacturer.

G. Install at least one ply of base flashing membrane same day that roofing membrane is installed to provide temporary watertight seal.

1. Flashing Sheet Application: Adhere flashing sheet to substrate in solid coating of flashing cement. Press sheet firmly into place to ensure continuous adhesion to substrate with no voids, wrinkles, or un-adhered base flashing.

2. Cut sheets off end of roll and install vertically, working to selvage edge.

3. For sheets without selvage edges or where selvage edge cannot be provided, limit length of sheets to 5 feet maximum. Prepare and prime non-

selvage edges as recommended by roofing-system manufacturer.

4. Stagger end lap seams in top ply at least 6 inches from lap seams in bottom plies.

H. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

I. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing using termination bar.

1. Seal termination bar with a 3 course application of fiberglass mesh and flashing cement.

J. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

K. Roof Drains:

1. Sump insulation a minimum of 24 inches in each direction as measure from the center of the drain.

2. Install membrane bottom plies. Extend 1 inch beyond inside edge of drain bowl flange.

3. Apply primer to both sides of 30-inch-by-30-inch, lead flashing, and allow to dry. Center lead flashing over drain and set in continuous application of modified-bitumen mastic. Trim lead flashing to extend 1 inch beyond inside edge of drain bowl flange.

4. Install additional 40-inch-by-40-inch, base-flashing, backer sheet or bottom ply over lead flashing.

5. Install membrane cap sheet over base flashing. Extend 1 inch beyond inside edge of drain bowl flange.

6. Trim flashing as necessary to 1 inch from inside edge of drain bowl flange.

7. Install clamping ring and drain strainer.

8. Install clamping ring same day that base flashing installed to prevent water back-up under membrane.

9. Remove and reinstall clamping ring when membrane top-ply installed, if installed at later time.

10. Securely fasten clamping ring to provide continuous compression of drain flashings.

11. Install strainer dome.

12. At end of project, test drains for watertightness and ensure that drains flow freely.

3.8 EQUIMENT AND EXPANSION JOINT CURBS

A. Refer to general base flashing installation requirements and the following additional procedures.

B. At wood curbs for equipment and expansion joint assemblies, extend base ply of flashing membrane up and over top of curb, and secure with nails to blocking.

C. Extend cap flashing membrane sheet up vertical surface of curb and terminate at top edge as shown on Drawings. For expansion joint locations, seal top edge of cap sheet with mastic. Securement shall be by fasteners that attach expansion joint assembly to curbs.

D. For curbs where integral sheet metal flashing is used but not attached to face of curb, install termination bar through cap sheet as shown on Drawings with fasteners at 6” on center

E. Equipment Penetrations. Flash per Drawing details or per roofing-system manufacturer’s recommendations.

F. Prime flange of sheet-metal flashing, allow to dry, and set in modified-bitumen adhesive..

G. Apply sealant at base flashing termination on sheet metal flashing.

3.9 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

1. Fully adhere or torch apply walkway pads.

B. Use only full-size units, except partial units at corners if necessary to provide neat, finished appearance.

C. Provide 2 inches minimum between adjacent units. Extend walkway 6 inches minimum beyond edges of equipment or supports.

D. Sweep loose surfacing material from walkway locations.

E. Cap Sheet Strips: Set strips, in lengths not exceeding 10 feet, in heavy application of asphalt mastic or same bitumen used to install roofing system, in accordance with recommendations of walkway and roofing-system

manufacturers. Walkways shall be fully adhered to roofing cap sheet.

3.10 FIELD QUALITY CONTROL

A. Roof cement shall not be incorporated into the roof membrane or flashing system.

B. Architect/Engineer will inspect roofing system at various stages of construction and at completion.

C. Testing Agency: A qualified testing agency shall be engaged to perform tests and inspections and to prepare test reports.

D. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.

2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

E. Infrared Survey: If roofing cap sheet is not installed immediately after the smooth surfaced base sheet is installed (Phased Construction), contractor shall provide an infra-red survey of entire roof area. Survey shall be performed by organization that is approved by the Architect. Infra-red survey and subsequent report shall be performed prior to the installation of the roofing cap sheet.

F. Manufacturer’s Inspections: Arrange for the roofing systems manufacturer to provide qualified technical personnel for onsite observation and instruction full time at beginning of membrane installation to establish project standard and thereafter as the manufacturer deems necessary, but not less than 1 time every two weeks when roofing membrane and related work is being performed. A field observation report from each visit will be generated and submitted to the Engineer within 48 hours of the visit.

G. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

H. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

2. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Accompany the manufacturer’s technical inspector, and assist with equipment and workmen if necessary to provide access to the roof. Correct all defects noted during the inspection.

3.15 TEMPORARY SEALS

A. At the end of each working day or at the sign of rain, install temporary, 100% watertight seal(s) where the completed new roofing adjoins the uncovered deck or existing roof surface.

B. The authorized roofing contractor shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new and/or existing roof system.

C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

D. If water is allowed to enter beneath the newly completed roofing, the affected area(s) shall be removed and replaced at no additional expense to the building owner.

E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation, roof cement or sealant and properly dispose off site.

3.16 LIGHTNING PROTECTION

A. The installation of lightning protection must be coordinated with the authorized roofing contractor, certified lightning contractor and the building owner.

B. The lightning protection must be installed in such a manner that base plates, air terminals and cables do not penetrate the roofing membrane without the use of pre-approved flashing details.

C. Cables and air terminals may be attached to the membrane using base plates and an approved construction adhesive or by welding intermittent strips of membrane over the base plates and cables to the roofing. Contact manufacturer for specific adhesive recommendations.

D. Recommendations regarding the selection of adhesives or alternative affixing of lightning protection systems to the membrane does not in any way imply a warranty covering their performance or ability of the adhesives to remain affixed to the membrane.

3.17 COMPLETION

A. Remove any and all debris, excess materials and scrap of any kind from the roof and surrounding premises prior to demobilization.

B. Inspect all field welds, detailing and terminations to ensure a 100% the watertight installation.

3.18 WARRANTY INSPECTION

A. Upon completion of the project, the authorized roofing contractor shall complete and submit the Project Completion Notice to manufacturer.

B. Upon receipt of the notice of completion, a manufacturer’s representative will schedule an inspection with a representative of the authorized roofing contractor to thoroughly review the installation and verify compliance with the manufacturer’s requirements.

C. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.

D. Upon completion of all punch list items and final acceptance of the installation, a warranty as authorized by the approved manufacturer Notice of Award and Warranty Request Form will be issued.

3.19 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.

2. Address: <Insert address>.

3. Building Name/Type: <Insert information>.

4. Address: <Insert address>.

5. Area of Work: <Insert information>.

6. Acceptance Date: <Insert date>.

7. Warranty Period: <Insert time>.

8. Expiration Date: <Insert date>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. lightning;
b. peak gust wind speed exceeding <Insert wind speed> mph;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer

and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.

2. Name: <Insert name>.

3. Title: <Insert title>.

END OF SECTION 075216

SECTION 075216.20

STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING (HOT ASPHALT APPLIED, UTILITARIAN GRADE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. RELATED SECTIONS
1. Division 06 10 53 Miscellaneous Rough Carpentry: Wood nailers, curbs and cant strips
2. Division 07 71 00 Roof Specialties: Copings, flashing and counterflashing
3. Division 07 72 00 Roof Accessories: Roof curbs and roof hatches
4. Division 22 40 00 Floor, Area and Roof Drains
5. Division 26 41 13 Lightning Protection for Structures: Lightning protection systems devices and connectors

1.2 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing fully adhered in hot asphalt.

2. Roof Insulation.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Roofing Systems Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers", and herein called "manufacturer".

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure

to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system. Roofing system must meet the design intent and wind uplift capabilities associated with the uplift rating requirements listed in this specification and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-120.

2. Hail Resistance Rating: SH.

3. Clear Lake Campus to meet the requirements of the Texas Windstorm Act.

D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency. Provide roofing membrane to meet applicable local Building Department requirements and initial solar reflectance not less than 0.70 and thermal emittance not less than 0.75 when tested according to one of the test methods listed below.

1. Solar Reflectance Test Methods: ASTM C1549, ASTM E903, ASTM E1175, or ASTM E1918.

2. Thermal Emittance Test Methods: ASTM C835, ASTM C1371, or ASTM E408.

E. Insulation R Value: Minimum R-19 Long Term Thermal Resistance (LTTR) as determined in accordance with CAN/ULC-S770 F. Roof Assembly must meet the current version of ASHRAE 90.1

1.5 SUBMITTALS

A. Product Data: Roofing-system manufacturer’s literature, including written instructions for evaluating, preparing, and treating substrate; technical data including tested physical and performance properties; and application instructions.

1. Provide for membrane and base flashing materials, and roofing cement, asphalt, primer, mastic sealant, and fasteners.

B. Include temperature ranges for storage and application of materials, and special

cold weather application requirements or limitations.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work. Include manufacturer's reviewed and approved details that are project specific. Manufacturer's generic details will not be accepted.

1. Base flashings and membrane terminations.

2. Tapered insulation layout including, crickets, saddles, and tapered edge strips, including amount and direction of slopes.

3. Dimensions and locations of all roof field, perimeter, and corners areas.

4. Base sheet/Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

5. Walkway pad plan and detail

6. Proposed temporary, watertight, tie-off details for each substrate type.

7. Interface with sheet metal components (per Section 07 62 00), including but not limited to:

a. Counterflashing
b. Stack flashing assemblies
c. Edge and fascia sections
d. Interface with coping cap assemblies (per Section 07 62 00)
e. Interface with roofing accessories including but not limited to:
f. Equipment curbs
g. Roof hatches
h. Expansion joints assemblies

D. Samples for Verification: For the following products:

1. Sheet roofing materials, including membrane cap sheet, of color specified.

2. Roof insulation.

3. Insulation cover board.

4. Walkway pads or rolls.

5. Six insulation fasteners of each type, length, and finish.

E. Installer's Certificate

1. Signed by roofing-system manufacturer, certifying that Roofing Installer complies with manufacturer's requirements to install specified, warranted, roofing system.

2. Submit evidence that Installer's existing company has minimum of 5 years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:

    a. Project name.
    b. Owner's name.
    c. Owner's Representative name, address, and telephone number.
    d. Description of work.
    e. SBS-modified-bitumen materials used.
    f. Project supervisor.
    g. Total cost of roofing work and total cost of project.
    h. Completion date.

F. Manufacturer Certificate: Signed by roofing-system manufacturer, certifying that roofing system complies with specified requirements.

1. Written approval by membrane manufacturer for use and performance of membrane over specified board insulation, including that materials supplied for project comply with requirements of cited ASTM standards. Approval should also indicate materials are suitable for ASTM E 108, Class 1A roof and meet specified wind uplift classification.

2. Submit evidence of meeting performance requirements including applicable FMG assembly number.

3. Include all methods of attachment and attachment spacing for insulation and membrane system.

G. Certify that materials are free of asbestos.

H. Sample Warranty: Copy of roofing-system manufacturer's warranty, stating obligations, remedies, limitations, and exclusions. Submitted with bid.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Prior to installation of the roof system, provide a written report with fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

K. Following completion of Work, submit roofing-system manufacturer's inspection report of completed roofing installation and completed warranty; submit Installer's completed warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project with a minimum of 10 years of documented experience.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Must have installations of specified materials in the local area in use for a minimum of 5 years.

C. Source Limitations: Obtain components including for membrane roofing system

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Testing: At Owners cost, Owner reserves the right to perform wind uplift testing of installed roof system per FM 1-52. Locations and quantities to be determined by Architect/Engineer.

G. Pre-Installation Testing: Provide fastener withdrawal testing at metal deck and lightweight insulating concrete deck areas per the latest version of ANSI/SPRI FX-1 testing procedures to verify fastener withdrawal resistance and identify fastener quantity and spacing

H. Fumes And Environmental Considerations (Note: Contractor may provide either Fume Recovery or Afterburner System depending on environmental concerns.)

1. Fume Recovery - Provide for the use of a Fume Recovery System to capture and filter bituminous fumes from the roofing kettle on the ground. The following Fume Recovery System is approved for work on this project:

   a. FRS-6000 Fume Recovery System as manufactured by National Tool & Equipment, Inc., 60 Boardman, OH 44512, 1-800-558-TOOL.
   b. Cleasby Eliminator Fume Emissions System as manufactured by Cleasby Mfg. Co., Inc., 1414 Bancroft Ave., San Francisco, CA 94124, 800-CLEASBY.

2. Afterburner: Provide for the use of a Fume Reduction System to reduce fumes and odors from the roofing kettle on the ground. The following fume reduction system is approved for work on this project:

   a. Reeves Afterburner/Safety Loader System as manufactured by Reeves Roofing Equipment Company, Inc., P.O. Box 720, Helotes, TX 78023, (210) 695-3567.
   b. Garlock FumeGuard Asphalt Fume Elimination System - Garlock FumeGuard as manufactured by Garlock Equipment Company, 2601 Niagara Lane, Minneapolis, MN 55447, (612) 553-1935.

c. Similar systems submitted for approval must be certified by the Environmental Protection Agency to remove 95% of odors and fumes.

3. Proper Usage: The Contractor shall ensure through training and proper supervision that the fume protection device is used correctly and maintained in good working order throughout the job. Doors, vents, and exhausts shall be kept closed to prevent smoke and fume escape. Operators failing to use the devices properly shall be dismissed from the job and replaced by a worker satisfactory to the Engineer.

4. Air Intake: The contractor will coordinate with the Roof Engineer and Owner to create a schedule for all rooftop air handler intake protection during the project.

5. Rooftop Air Intakes - The Owner will close or otherwise adjust rooftop air intakes for minimum attraction of roofing material fumes from rooftop work.

6. Vent Covers - Contractor will furnish plastic, charcoal, or other suitable covers for air intake vents, and shall install and remove such covers where requested to do so by the Owner

I. Pre-installation Roofing Conference: Conduct conference at Project site. Contractor's site foreman, roofing-system manufacturer's technical representative, Roofing Installer, Owner's Representative, Architect/Engineer shall attend.

1. Site use, access, staging, and set-up location limitations.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions. Including, but not limited to, the following: forecast weather conditions, storage and protection of materials prior to installation, surface preparation and pretreatment, environmental conditions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system and surrounding work during and after installation.

9. Review roof observation and repair procedures after roofing installation.

10. Reporting procedures.

11. Related project details and interfaces with adjacent work.

12. Testing and inspection requirements.

13. Notification procedures for inspections.

14. Documentation of modifications and repairs for project record.

15. Documentation required for manufacturer’s warranty.

16. Governing regulations and requirements for insurance and certificates if applicable.

17. Quality control and quality assurance plans.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components. Material storage procedures will be constantly monitored and strictly enforced.

B. Use canvas tarps for protection of moisture-sensitive roofing materials. If plastic coverings are used, venting of each package is required. Roofing-system manufacturer’s standard packaging and covering is not considered adequate weather protection.

C. Select and operate material handling equipment in a safe manner, guarding against damage to existing construction or newly applied roofing and conforming to manufacturer's recommendations of handling and storage.

D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

E. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Manufacturer's packaging is not considered

adequate protection from moisture.

F. Handle and store materials and equipment on structures to safe loading of structure at time and to avoid permanent deflection of deck. Conspicuously mark wet or damaged materials and promptly remove from Site. Materials, having been determined by the owner/owner's representative to be damaged, shall be immediately removed from the construction site and replaced at no cost to the owner.

G. Store rolled asphalt based materials on ends only, unless otherwise required by roofing-system manufacturer’s written instructions. Discard rolls that have been flattened, creased, or otherwise damaged.

H. Do not store materials at locations where new roofing materials have been installed.

I. Remove and replace materials that cannot be applied within stated shelf life.

J. Flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow all precautions as outlined in manufacturer's Material Safety Data Sheets.

1.8 PROJECT CONDITIONS

A. Safety

1. Take all necessary precautions regarding worker health and safety when using solvents, adhesives and hot asphalt.

2. Store flammable liquid and materials away from open sparks, flames and extreme heat.

3. Take necessary precautions when using solvents and adhesives near fresh air intakes.

4. Comply with all OSHA requirements for construction.

B. Daily site cleanup shall be performed to minimize debris and hazardous congestion

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions e.g. extreme temperature, high winds, high humidity and moisture, permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

D. Verify existing dimensions and details prior to installation of materials. Notify Architect/Engineer of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.

E. Comply with Owner's limitations and restrictions for site use and accessibility.

F. Install materials in strict accordance with safety requirements required by roofing manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

G. Protection

1. Schedule installation sequence to limit access and utilization of the newly installed membrane for material storage, construction staging, mechanical and/or excessive foot traffic.

2. Protect roofing membrane, building surfaces, paving, and landscaping from traffic and roofing equipment. Provide temporary walkways constructed of plywood and set on protective material in traffic and construction areas.

3. Restore or replace all work or materials damaged by the roofing operation.

4. Remove protection materials upon completion of work.

5. Adverse weather could have a detrimental effect on adhesives, general production efforts or the quality of the finished installation. Contact manufacturer for recommendations and acceptable tolerances.

H. Daily seal: Ensure that moisture does not penetrate beneath any completed sections of the roof by sealing temporary roof terminations at the end of each work day and prior to the arrival of inclement weather. Inspect existing components for moisture intrusion along the temporary terminations at temporary cut-offs, tie-ins, and night seals after opening the seal on the next workday. Remove any wet, damp or moisture-damaged materials.

I. All construction debris shall be removed from the construction site and legally dispose of offsite.

1.9 WARRANTY

A. Special NDL Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, fasteners, stacks, drains, wall flashings, metal flashings and other components of membrane roofing system. Warranty shall cover wind speeds up to 74 MPH.

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section,

including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

C. Maintenance: Along with the issuance of the warranty, a set of instructions shall be included detailing preventative maintenance and noting a list of harmful substances which may damage the roofing membrane.

1.10 COORDINATION

A. Prior to installation of materials, a pre-roofing conference should be held with the roofing contractor, and owner/owner's representative(s) to discuss the specified roofing system coordinate its proper application and the expectations of all parties involved. The authorized roofing contractor and the owner/owner's representative shall notify all parties a minimum of fourteen days prior to the meeting.

B. Plan and coordinate the installation of the roofing system with other trades in such a manner to avoid membrane damage, keeping the complete installation weather tight and in accordance with all approved details and warranty requirements.

C. Manufacturer shall be available to make recommendations necessary to ensure compliance with project specifications and specification alternatives due to unforeseen job conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products and components for the roofing system shall be supplied by the roofing system manufacturer.

B. Components other than those manufactured and/or supplied by the roofing system manufacturer shall be submitted for review, prior to ordering. Any product(s) not specifically authorized in writing for the project by the roofing system manufacturer, shall be considered unacceptable and their performance excluded from the warranty.

C. Roofing membranes may be installed over or adhered directly to pre-approved insulation, cover board, decking or composites thereof. Contact manufacturer for additional information regarding compatible substrates.

2.2 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. SBS-Modified Bituminous Membrane Roofing: Manufacturers: Subject to compliance with requirements, provide products by one of the following, no

substitutions:

a. GAF Materials Corporation.
Cap Sheet: Ruberoid Energy Cap SBS 30 FR

b. CertainTeed Corporation:
Cap Sheet: Flintlastic FR Cap 30 Coolstar

c. Firestone Building Products
Cap Sheet. SBS FR UltraWhite Cap

2.3 BASE-SHEET MATERIALS

A. Base Sheet: Manufacturers heavy duty, SBS-modified, asphalt-impregnated and -coated sheet, with glass-fiber and/or polyester reinforcing mat, dusted with fine mineral surfacing on both sides.

1. GAF Materials Corporation
Base Sheet: Ruberoid Dual Smooth Base Sheet

2. CertainTeed Corporation
Base Sheet: Flintlastic® Ultra Poly SMS Base Sheet

3. Firestone Building Products
Base Sheet: SBS Smooth Base Sheet

B. Vented Base Sheet: Over lightweight insulating concrete deck, use manufacturers recommended vented base sheet mechanically attached to substrate.

2.4 BASE FLASHING SHEET MATERIALS

A. Smooth Surfaced Flashing Sheet. Same product as used in the field area of the roof and as follows:

1. GAF Materials Corporation
Base Sheet: Ruberoid Dual Smooth Base Sheet

2. CertainTeed Corporation
Base Sheet: Flintlastic® Ultra Poly SMS Base Sheet

3. Firestone Building Products
Base Sheet: SBS Smooth Base Sheet

B. Granule-Surfaced Flashing Sheet: Same product as used in the field area of the roof and as follows: Granule Color: High Reflectance White.

1. GAF Materials Corporation Cap Sheet: Ruberoid Energy Cap SBS 30 FR

2. CertainTeed Corporation

Cap Sheet: Flintlastic FR Cap 30 Coolstar

3. Firestone Building Products
Cap Sheet. SBS FR UltraWhite Cap

2.5 PENETRATION FLASHING SYSTEMS: use same membranes as installed in field of roof.

2.6 Liquid Flashing Systems: PMMA flashing system by the roofing manufacturer.

1. CertainTeed Corporation: Approved Liquid Flashing System
2. GAF: Topcoat Matrix MajorSeal
3. Firestone: UltraFlash

2.7 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. Non membrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.

B. Asphalt Primer: ASTM D 41.

C. Roofing Asphalt: ASTM D 312, Type IV.

D. Mastic Sealant: Polyisobutylene, plain or modified bitumen; non hardening, non migrating, non skinning, and nondrying.

E. Flashing Cement: ASTM D 4586, asbestos free, of consistency required by roofing-system manufacturer for application. Use for sealing laps in membrane or base flashing, surface or stripping flashing at equipment penetrations and

drains, or repairs to membrane or flashing.

F. Low-rise urethane adhesive: Used to adhere insulation and cover board within the roof assembly, as acceptable to roofing system manufacturer.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

H. Metal Flashing Sheet: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

I. Lead flashing for roof drains: 4-pound lead.

J. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.

K. Termination Bar: Roofing-system manufacturer’s standard; aluminum bars, approximately 1-inch wide by 1/8-inch thick; with predrilled holes 6 inches on center.

L. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.8 ROOF INSULATION

General:

A. Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. For insulation that will be placed using adhesive, board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

C. Polyisocyanurate Flat Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces; 20-pounds-per-square-inch-minimum compressive strength in accordance with ASTM D1621; and meet flame spread requirements of ASTM E84.

D. Polyisocyanurate Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated. Drainage crickets and saddles will have a minimum thickness of 1/2” and a minimum slope of 1/2” per foot. Provide preformed saddles, crickets, tapered

edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. . Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

E. Cover Boards: ASTM C 1177; water-resistant, gypsum substrate, 4’ by 4’ in size. Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

F. Acceptable Products:

1. 3/8 inch Securock as manufactured by USG.

2. ½ inch DensDeck DuraGuard® Roof Board as manufactured by GP.

G. Fire Resistance:

a. Flame spread 0, smoke developed 0, when tested in accordance with ASTM E 84. Noncombustible when tested in accordance with ASTM E 136.

2.9 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Adhesive: Manufacturer’s standard adhesive formulated to adhere roof insulation to concrete substrate and subsequent layers of insulation and cover board to each other.

D. Wood Nailer Strips: Comply with requirements in Division 06 Section E.
Tapered Edge and Cant Strip: Fiber tapered edge strip, ½” to 0 by 6”. Cant strip and/or tapered edge to be mineral aggregate meeting HH-I-529B.

2.10 WALKWAYS

A. Walkway Pads: Same granulated cap sheet product as used in the field area of the roof and as follows: Granule Color:

1. Size: As standard with manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. The “Authorized” roofing contractor is responsible for ensuring appropriate system specific addendums from manufacturer.

B. The roofing contractor is responsible for providing a suitable substrate surface for the proper installation of the Roofing System, roof insulation and specified components.

C. Application of the roofing system constitutes an agreement that the roofing contractor has inspected and found the substrate suitable for the installation of the Roofing System.

D. The roofing contractor is responsible for coordinating the installation to ensure that the system remains watertight at the end of each working day

3.2 SUBSTRATE EXAMINATION

A. The roofing contractor is responsible for verifying that the deck condition and/or existing roof construction is suitable for the specified installation of the Roofing System.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

   a. Test for moisture by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

7. The application of adhesives or hot asphalt directly to structural concrete; existing smooth and/or granular BUR materials may require sealing or priming with an accepted asphalt primer prior to application.

8. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

9. Examine surfaces for low areas that will not drain properly, foreign material, ice, wet insulation, unevenness or any other defect which would prevent the proper execution and quality application of the Roofing System as specified

C. Prepared substrate shall be smooth, dry, and free of debris and/or any other irregularities which would interfere with the proper installation of the Roofing System. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Installer and roofing-system manufacturer's representative shall examine substrate to ensure that it is properly prepared and ready to receive roofing system. Roofing-system manufacturer's representative shall report in writing to Installer and Architect/Engineer conditions which will adversely affect roofing-system installation or performance. Do not proceed with roofing-system installation until these conditions have been corrected and reviewed by Architect/Engineer.

E. Provide fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

3.3 COORDINATION

A. Coordinate Work to ensure that new insulation and roofing materials and building interior are kept continuously dry and that continuous, watertight, new roofing system is provided. Coordinate:

1. With Owner's Representative.

2. With other trades to avoid or minimize work on, or in immediate vicinity of, installation in progress and completed new roofing.

3. To avoid or minimize adverse effects on completed new roofing.

4. Ensure that drains are operational at end of each workday or if precipitation is forecast.

3.4 SUBSTRATE PREPARATION

A. Steel Deck

1. Steel decking should conform to Factory Mutual (FM) guidelines for Class-1 insulated steel deck construction.

2. Steel decking should be constructed of a minimum 22 gauge cold rolled steel sheets with factory G-90 galvanized coating.

3. Panel profiles, (ribs) shall be formed to minimize deflection and provide suitable strength and integrity to support anticipated structural live and dead loads.

4. Steel decking shall be installed in compliance with specified design criteria and local building code requirements.

B. Concrete (Poured and/or Pre-cast)

1. Decking shall be installed in strict conformance with industry standards, practices and/or pre-cast panel manufacturer's installation requirements.

2. Decking shall be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

3. Finished decking shall be properly cured and dry, prior to the installation of approved insulation.

4. Finished surface(s) to receive new roof system shall be smooth and level without significant surface depressions or irregularities. Camber differentials greater than 3/16 inch must be leveled using a cementitious grout.

5. Finished surfaces shall be free of moisture, dust, loose debris and any other irregularity that may hinder the proper performance of the new Roofing System.

6. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3.5 SUBSTRATE PREPARATION

A. General

1. Roofing Contractor shall be responsible for informing the building owner/owner representative of any issues in regard to the condition and structural integrity of the existing decking.

2. The building owner/owner representative shall make and be responsible for the determination as to the proper method of treatment and/or replacement.

3. Re-roofing applications require fastener withdrawal tests to substantiate proposed attachment patterns for the new mechanically fastened insulation systems and/or membranes.

4. Re-roofing applications that require modification to the deck and/or insulation system should be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

5. All terminations of the Roofing System must be constructed to prevent water from penetrating behind or beneath the new Roofing System. This includes water from above, beside, below and beneath the new system.

B. Removal of Existing Roof System(s)

1. Remove all existing roofing material(s), insulation, flashing, metal and deteriorated wood blocking and legally dispose off-site.

2. Remove only enough roofing to accommodate the day's work and ensure the exposed area can be made 100% watertight at the end of the day or first sign of inclement weather.

C. Steel Decks

1. All rotted and/or deteriorated decking shall be removed and replaced with like kind.

2. Areas of structurally acceptable steel decking exhibiting slight surface rust shall be properly cleaned, primed and painted prior to installing the approved insulation.

3. All decking shall be inspected for proper attachment and excessive deflection that would compromise the uplift performance of the new Roofing System.

4. Attachment and deflection deficiencies shall be repaired and brought into compliance with current, local building code requirements.

D. Concrete

1. Deteriorated decking shall be repaired and/or replaced with appropriate materials according to standard industry regulations and practices.

2. Repair any depressions and/or areas where reinforcing has become exposed.

3. When new insulation system is to be installed using hot asphalt or an approved adhesive:

   a. Cracks and or camber differentials greater than 3/16 inch shall be repaired using an appropriate cementitious grout or fill, and feathered to promote a smooth transition.
   b. Joints between pre-stressed panel units and over bulb-tees shall be taped, stripped or grouted with an appropriate cementitious fill.
   c. All surface irregularities shall be leveled to ensure complete contact with the decking for insulation bonded in hot asphalt or approved adhesives.

4. Where insulation is to be mechanically attached or ballasted, camber differentials and/or surface irregularities of up to 1/2 inch shall be acceptable.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

E. Lightweight "Insulating" Concrete All wet lightweight shall be removed and replaced with appropriate and/or compatible material.

2. Surface to receive new Roofing System shall be smooth and free of ridges, depressions and other irregularities.

3. Repair any depressions, irregularities and/or excessive deflection with compatible material.

3.6 ROOFING SYSTEM INSTALLATION

A. Install roofing membrane and base flashings according to roofing-system manufacturer's written instructions and applicable recommendations of NRCA/ARMA Quality Control Guidelines for Application of Polymer Modified Bitumen Roofing.

B. Install materials in strict accordance with safety requirements required by roofing-system manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

C. Follow safety procedures of OSHA and other applicable governing agencies. Assume responsibility for Work area safety at all times.

D. Provide fully-charged fire extinguishers, appropriately sized and rated, and water within 50 feet of open flame.

E. Torch Safety for areas where torches are approved for use by Owner' Representative and Architect/Engineer.

F. Do not use wood-fiber cant strips or insulation.

G. Install continuous, glass-fiber, base sheet over combustible substrates.

H. Install metal flashings at penetrations, or protect with tight-fitting felt collar before torching.

I. Torches to have safety lever (pilot only or self-igniting). Do not use full-time torches.

J. Maintain fully-charged fire extinguishers, appropriately sized and rated, within 50 feet of torch work locations.

K. Walk job every day at least 1 hour after torches are out for fire watch.

L. Bitumen Heating:

1. Good Working Kettle - The roofing kettle shall be in safe working order with a working thermometer and thermostatic controls. Set up shall be in accordance with OSHA standards, and the surface upon which it rests shall be protected with sand, plywood, or a suitable tarp. All asphalt remaining on the

surface where the kettle was set up shall be cleaned up at the completion of the job. The kettle shall be cleaned prior to the commencement of this job.

2. Experienced Kettle Operator - The operator of the kettle shall be thoroughly trained in the safe operation and maintenance of the kettle, and he shall be dressed in safe protective clothing with proper safety equipment within easy reach at all times. The kettle operator shall wear a hard hat and face mask at all times in accordance with OSHA standards and standard industry practice.

3. Heating Practice - Under no circumstances shall asphalt be heated to or above its flash point. Application temperatures shall not be more than 25 degrees F. more or less than the equiviscous temperature (EVT). EVT information must be furnished by the asphalt manufacturer prior to commencement of work. In the absence of authoritative EVT certification for the specific batch of asphalt produced, the asphalt shall be heated to 475 to 500 degrees F. at the kettle, but not above 525 degrees F. Asphalt shall be applied as near the EVT temperature as possible.

4. Maintain adequate ventilation during installation of roofing materials. Notify Owner's Representative at least 1 week in advance of Work with materials with noxious vapors. Review application schedule and venting precautions with Owner's Representative prior to beginning application.

M. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing-system components or adjacent building construction.

N. Coordinate installing roofing-system components so insulation and roofing membrane sheets are not exposed to precipitation, or left exposed at end of workday or when rain is forecast.

O. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

P. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

Q. Remove and discard temporary seals before beginning work on adjoining roofing.

R. Prohibit foot traffic and equipment movement over roofing system until adhesive has cured. Minimize foot traffic and equipment movement over base ply prior to installation of membrane top ply/cap sheet.

S. Cooperate with Architect/Engineer in performing inspections and testing of roofing system.

3.7 ROOF INSULATION INSTALLATION

A. General

1. Roof insulation shall be installed where by the long dimension of the board(s) run in parallel alignment and the short dimensions are staggered.

2. Insulation shall be installed with minimum joint dimensions and shall be tightly butted where possible. Maximum joint widths shall be 3/8 inch. Damaged corners shall be cut out and replaced with an insulation piece a minimum of 12 inch x 12 inch Pieces which are cut from larger panels and are smaller than one square foot are not acceptable.

3. Install no more than can be covered during the same working day.

4. Taper roof insulation to drain sumps using tapered edge strips. If an insulation layer is 1-1/2 inch or less, taper 12 inch from the drain bowl. If insulation thickness exceeds 1-1/2 inch, taper 18 inch from the drain bowl. All taper boards or pieces must be adhered or mechanically fastened with a minimum of two fasteners per board.

5. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the cover board.

6. When a cover board and/or multiple layers are installed each layer should be offset from the previous layer a minimum of 12 inch on center.

7. At the end of each working day, provide a watertight cover on all unused insulation as to avoid moisture penetration.

B. Insulation Installation

1. Comply with roofing system manufacturer's written instructions for installing roof insulation.

2. Over nailable substrate, install one lapped vented base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

(89-mm actual-) 16 feet apart for roof slopes steeper than 1 inch per 12 inches but less than 3 inches per 12 inches.

4. 48 inches apart for roof slopes steeper than 3 inches per 12 inches.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

D. Mechanically Fastened Insulation: For metal roof decks, install the base layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

E. Adhered Insulation:

1. Board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

2. For insulation that will be installed using adhesive (not mechanically attached), provide adequate temporary ballast on insulation boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/8 inch with insulation.

F. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and non composite insulation in two or more layers, install non composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

I. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the coverboard.

J. Cover Board Installation: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.

1. Adhere cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3. Apply low-rise foam adhesive to underside, and bond cover board to

substrate.

4. Provide adequate temporary ballast on cover boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3.7 ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

1. Install roofing system according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and to requirements in this Section.

B. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:

1. Deck Type: I (insulated).

2. Adhering Method: M (mopped).

3. Number of SBS-Modified Asphalt Sheets: Two.

4. Surfacing Type: M (mineral-granule-surfaced cap sheet).

C. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

D. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

1. Back nail roofing membrane sheets to substrate according to roofing system manufacturer's written instructions.

E. Cooperate with testing agencies engaged or required to perform services for installing roofing system.

F. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

G. Asphalt Heating: Heat and apply roofing asphalt according to roofing system manufacturer's written instructions.

H. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.8 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. SBS-Modified-Bitumen Membrane Installation: Install roofing membrane base ply and cap sheet.

B. Install all roofing membrane and flashing systems, and all accessory components in accordance with the Drawings and Specifications; unless the manufacturers printed instructions are more restrictive. Request for clarification shall be submitted in writing to the Engineer.

C. Unroll sheets and allow to relax before installing.

D. Cut out factory splices in top ply. Alternately, cover splice with full-width section of top-ply membrane that extends at least 6 inches beyond sides of splice.

E. Accurately align sheets without stretching, and maintain uniform side and end laps of minimum dimensions required by roofing-system manufacturer for selvage and non-selvage laps.

F. Start at low point of roof deck and shingle side laps with slope of deck where possible.

G. Stagger end laps at least 3 feet.

H. Extend sheets over and terminate about 1 inch above top of cants.

I. Embed base ply, and adhere to substrate, in a continuous coating of hot asphalt without breaks or voids.

J. End Laps - All end laps shall be lapped a minimum of 6", or as specified by the manufacturer, and all membrane laps shall show a "bleed-out" of between 1/4" and 1/2". Corners of the end laps are to be rounded.

K. Adhere top ply according to manufacturer’s recommendations with cold process adhesive or heat welded.

L. Broom each ply immediately to firmly embed into adhesive, free of wrinkles, creases, fish mouths, or air pockets.

M. Cut out wrinkles and fishmouths, and repair with same number of plies removed.

N. Prepare and prime non-selvage laps as recommended by roofing-system manufacturer.

O. Continuously bond and seal laps, leaving no voids.

P. Repair wrinkles and voids in lapped seams.

Q. No Foot Traffic on New Membrane - Set up points, charge points, debris chutes, asphalt filling points, drinking water containers and all other destination facilities shall be located in such a way as to preclude traffic over the newly installed membrane. No workers shall walk on the newly completed membrane for at least thirty minutes after installation to allow for cooling of the asphalt to prevent compression and displacement of asphalt due to point loading or concentration of weight due to a person's foot or equipment.

R. Embed loose cool roof granules in bleed out or cool roof reflective coating, in accordance with the membrane manufacturer's recommendations, at side and end laps which and at minor asphalt, primer, or adhesive spillage on finished membrane surfaces.

S. At locations where asphalt, primer, or adhesive spillage on finished membrane surfaces exceeds 1 square foot, install additional top ply of membrane.

T. Install modified bituminous roofing membrane cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F.

2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

U. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

2. Apply roofing granules to cover exuded bead at laps while bead is hot.

V. Install roofing membrane sheets so side and end laps shed water.

3.9 FLASHING AND STRIPPING INSTALLATION

A. General: Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrate according to roofing-system manufacturer's written instructions.

B. Base Flashing:

C. Accurately align base flashing sheets without stretching, and maintain uniform side and end laps required by roofing-system manufacturer for selvage and non-selvage laps.

D. Start wall and curb base flashing at low point of roof deck and shingle with slope of deck.

E. Flashing Plies not to exceed 39 inches in width. Extend base flashing plies to top of curbs, to within 1 inch of counterflashing reglets, at least 8 inches above finished surface of roofing system, and 4 inches onto field of roofing membrane. At locations where height of wall exceeds height acceptable to roofing-system manufacturer, comply with recommendations of roofing-system manufacturer for flashing high walls. Recommendations include flashing in two stages: bottom half to recommended maximum height preceded by top half over remainder of wall.

F. Bond and seal laps, leaving no voids. Repair wrinkles and voids in laps and lapped seams. Prepare and prime non-selvage laps as recommended by roofing-system manufacturer.

G. Install at least one ply of base flashing membrane same day that roofing membrane is installed to provide temporary watertight seal.

1. Flashing Sheet Application: Adhere flashing sheet to substrate in solid coating of flashing cement. Press sheet firmly into place to ensure continuous adhesion to substrate with no voids, wrinkles, or un-adhered base flashing.

2. Cut sheets off end of roll and install vertically, working to selvage edge.

3. For sheets without selvage edges or where selvage edge cannot be provided, limit length of sheets to 5 feet maximum. Prepare and prime non-selvage edges as recommended by roofing-system manufacturer.

4. Stagger end lap seams in top ply at least 6 inches from lap seams in bottom plies.

H. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

I. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing using termination bar.

1. Seal termination bar with a 3 course application of fiberglass mesh and flashing cement.

J. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

K. Roof Drains:

1. Sump insulation a minimum of 24 inches in each direction as measure from the center of the drain.

2. Install membrane bottom plies. Extend 1 inch beyond inside edge of drain bowl flange.

3. Apply primer to both sides of 30-inch-by-30-inch, lead flashing, and allow to dry. Center lead flashing over drain and set in continuous application of modified-bitumen mastic. Trim lead flashing to extend 1 inch beyond inside edge of drain bowl flange.

4. Install additional 40-inch-by-40-inch, base-flashing, backer sheet or bottom ply over lead flashing.

5. Install membrane cap sheet over base flashing. Extend 1 inch beyond inside edge of drain bowl flange.

6. Trim flashing as necessary to 1 inch from inside edge of drain bowl flange.

7. Install clamping ring and drain strainer.

8. Install clamping ring same day that base flashing installed to prevent water back-up under membrane.

9. Remove and reinstall clamping ring when membrane top-ply installed, if installed at later time.

10. Securely fasten clamping ring to provide continuous compression of drain flashings.

11. Install strainer dome.

12. At end of project, test drains for watertightness and ensure that drains flow freely.

3.10 EQUIMENT AND EXPANSION JOINT CURBS

A. Refer to general base flashing installation requirements and the following additional procedures.

B. At wood curbs for equipment and expansion joint assemblies, extend base ply of flashing membrane up and over top of curb, and secure with nails to blocking.

C. Extend cap flashing membrane sheet up vertical surface of curb and terminate at top edge as shown on Drawings. For expansion joint locations, seal top edge of cap sheet with mastic. Securement shall be by fasteners that attach expansion joint assembly to curbs.

D. For curbs where integral sheet metal flashing is used but not attached to face of curb, install termination bar through cap sheet as shown on Drawings with fasteners at 6” on center

E. Equipment Penetrations. Flash per Drawing details or per roofing-system manufacturer’s recommendations.

F. Prime flange of sheet-metal flashing, allow to dry, and set in modified-bitumen mastic.

G. Apply sealant at base flashing termination on sheet metal flashing.

3.11 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

1. Fully adhere walkway pads in cold-applied adhesive.

B. Use only full-size units, except partial units at corners if necessary to provide neat, finished appearance.

C. Provide 2 inches minimum between adjacent units. Extend walkway 6 inches minimum beyond edges of equipment or supports.

D. Sweep loose surfacing material from walkway locations.

E. Cap Sheet Strips: Set strips, in lengths not exceeding 10 feet, in heavy application of asphalt mastic or same bitumen used to install roofing system, in accordance with recommendations of walkway and roofing-system manufacturers. Walkways shall be fully adhered to roofing cap sheet.

3.12 FIELD QUALITY CONTROL

A. Roof cement shall not be incorporated into the roof membrane or flashing system.

B. Architect/Engineer will inspect roofing system at various stages of construction and at completion.

C. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to prepare test reports.

D. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.

2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

E. Infrared Survey: If roofing cap sheet is not installed immediately after the smooth surfaced base sheet is installed (Phased Construction), contractor shall provide an infra-red survey of entire roof area. Survey shall be performed by organization that is approved by the Architect. Infra-red survey and subsequent report shall be performed prior to the installation of the roofing cap sheet.

F. Manufacturer’s Inspections: Arrange for the roofing systems manufacturer to provide qualified technical personnel for onsite observation and instruction full time at beginning of membrane installation to establish project standard and thereafter as the manufacturer deems necessary, but not less than 1 time every two weeks when roofing membrane and related work is being performed. A field observation report from each visit will be generated and submitted to the Engineer within 48 hours of the visit.

G. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

H. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

2. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.13 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Accompany the manufacturer's technical inspector, and assist with equipment and workmen if necessary to provide access to the roof. Correct all defects noted during the inspection.

3.15 TEMPORARY SEALS

A. At the end of each working day or at the sign of rain, install temporary, 100% watertight seal(s) where the completed new roofing adjoins the uncovered deck or existing roof surface.

B. The authorized roofing contractor shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new and/or existing roof system.

C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

D. If water is allowed to enter beneath the newly completed roofing, the affected area(s) shall be removed and replaced at no additional expense to the building owner.

E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation, roof cement or sealant and properly dispose off site.

3.16 LIGHTNING PROTECTION

A. The installation of lightning protection must be coordinated with the authorized roofing contractor, certified lightning contractor and the building owner.

B. The lightning protection must be installed in such a manner that base plates, air terminals and cables do not penetrate the roofing membrane without the use of pre-approved flashing details.

C. Cables and air terminals may be attached to the membrane using base plates and an approved construction adhesive or by welding intermittent strips of membrane over the base plates and cables to the roofing. Contact manufacturer for specific adhesive recommendations.

D. Recommendations regarding the selection of adhesives or alternative affixing of lightning protection systems to the membrane does not in any way imply a warranty covering their performance or ability of the adhesives to remain affixed to the membrane.

3.17 COMPLETION

A. Remove any and all debris, excess materials and scrap of any kind from the roof and surrounding premises prior to demobilization.

B. Inspect all field welds, detailing and terminations to ensure a 100% the watertight installation.

3.18 WARRANTY INSPECTION

A. Upon completion of the project, the authorized roofing contractor shall complete and submit the Project Completion Notice to manufacturer.

B. Upon receipt of the notice of completion, a manufacturer's representative will schedule an inspection with a representative of the authorized roofing contractor to thoroughly review the installation and verify compliance with the manufacturer's requirements.

C. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.

D. Upon completion of all punch list items and final acceptance of the installation, a warranty as authorized by the approved manufacturer Notice of Award and Warranty Request Form will be issued.

3.19 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.

2. Address: <Insert address>.

3. Building Name/Type: <Insert information>.

4. Address: <Insert address>.

5. Area of Work: <Insert information>.

6. Acceptance Date: <Insert date>.

7. Warranty Period: <Insert time>.

8. Expiration Date: <Insert date>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or

indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <Insert wind speed> mph;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe

than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.

2. Name: <Insert name>.

3. Title: <Insert title>.

END OF SECTION 075216

SECTION 075419

Hybrid Fully Adhered Single Ply Roofing Systems

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including, General and Supplementary Conditions and Division 01 Specification Sections, apply to this
Section.

B. RELATED SECTIONS

1. Division 06 10 53 Miscellaneous Rough Carpentry: Wood nailers, curbs and cant strips
2. Division 07 71 00 Roof Specialties: Copings, flashing and counterflashing
3. Division 07 72 00 Roof Accessories: Roof curbs and roof hatches
4. Division 22 40 00 Floor, Area and Roof Drains
5. Division 26 41 13 Lightning Protection for Structures: Lightning protection systems devices and connectors

1.2 SUMMARY

A. Section Includes:

1. A nominal 45-mil KEE ethylene interpolymer (EIP) Elvaloy membrane, reinforced with knitted polyester fabric, and having a heat bonded 6 oz. polyester backing and fully adhered in hot asphalt over 2 plies of type VI glass felt. Membrane manufactured by The Seaman Corporation.

   OR

2. A nominal 60 mil KEE ethylene interpolymer (EIP) Elvaloy membrane, reinforced with knitted polyester fabric, and having a heat bonded 6 oz. polyester backing and fully adhered in hot asphalt over 2 plies of type VI glass felt. Membrane manufactured by Johns Manville Corporation.

3. Roof Insulation.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Roofing Systems Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers", and herein called "manufacturer".

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system. Roofing system must meet the design intent and wind uplift capabilities associated with the uplift rating requirements listed in this specification and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-120

2. Hail Resistance Rating: SH

3. Clear Lake Campus to meet the requirements of the Texas Windstorm Act.

D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing

agency. Provide roofing membrane to meet applicable local Building Department requirements and initial solar reflectance not less than 0.70 and thermal emittance not less than 0.75 when tested according to one of the test methods listed below.

1. Solar Reflectance Test Methods: ASTM C1549, ASTM E903, ASTM E1175, or ASTM E1918.

2. Thermal Emittance Test Methods: ASTM C835, ASTM C1371, or ASTM E408.

E. Insulation R Value: Minimum R-19 Long Term Thermal Resistance (LTTR) as determined in accordance with CAN/ULC-S770 **(Specifier to choose R value to meet HVAC demands with R-15 minimum per city code)**

F. Roof Assembly must meet the current version of ASHRAE 90.1.

1.5 SUBMITTALS

A. Product Data: Roofing-system manufacturer's literature, including written instructions for evaluating, preparing, and treating substrate; technical data including tested physical and performance properties; and application instructions.

1. Provide for membrane and base flashing materials, and roofing cement, asphalt, primer, mastic sealant, and fasteners.

B. Include temperature ranges for storage and application of materials, and special cold weather application requirements or limitations.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work. Include manufacturer's reviewed and approved details that are project specific. Manufacturer's generic details will not be accepted.

1. Base flashings and membrane terminations.

2. Tapered insulation layout including, crickets, saddles, and tapered edge strips, including amount and direction of slopes.

3. Dimensions and locations of all roof field, perimeter, and corners areas.

4. Base sheet/Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

5. Walkway pad plan and detail

6. Proposed temporary, watertight, tie-off details for each substrate type.

7. Interface with sheet metal components (per Section 07 62 00), including but not limited to:

    a. Counterflashing
    b. Stack flashing assemblies
    c. Edge and fascia sections
    d. Interface with coping cap assemblies (per Section 07 62 00)
    e. Interface with roofing accessories including but not limited to:
    f. Equipment curbs
    g. Roof hatches
    h. Expansion joints assemblies

D. Samples for Verification: For the following products:

1. Sheet roofing materials, including membrane cap sheet, of color specified.

2. Roof insulation.

3. Insulation cover board.

4. Walkway pads or rolls.

5. Six insulation fasteners of each type, length, and finish.

E. Installer's Certificate

1. Signed by roofing-system manufacturer, certifying that Roofing Installer complies with manufacturer's requirements to install specified, warranted, roofing system.

2. Submit evidence that Installer's existing company has minimum of 5 years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:

    a. Project name.
    b. Owner's name.
    c. Owner's Representative name, address, and telephone number.
    d. Description of work.

e. SBS-modified-bitumen materials used.
f. Project supervisor.
g. Total cost of roofing work and total cost of project.
h. Completion date.

F. Manufacturer Certificate: Signed by roofing-system manufacturer, certifying that roofing system complies with specified requirements.

1. Written approval by membrane manufacturer for use and performance of membrane over specified board insulation, including that materials supplied for project comply with requirements of cited ASTM standards. Approval should also indicate materials are suitable for ASTM E 108, Class 1A roof and meet specified wind uplift classification.

2. Submit evidence of meeting performance requirements including applicable FMG assembly number.

3. Include all methods of attachment and attachment spacing for insulation and membrane system.

G. Certify that materials are free of asbestos.

H. Sample Warranty: Copy of roofing-system manufacturer's warranty, stating obligations, remedies, limitations, and exclusions. Submitted with bid.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Prior to installation of the roof system, provide a written report with fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

K. Following completion of Work, submit roofing-system manufacturer's inspection report of completed roofing installation and completed warranty; submit Installer's completed warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project with a minimum of 10 years of documented experience.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Must have installations of specified materials in the local area in use for a minimum of 5 years.

C. Source Limitations: Obtain components including **[roof insulation] [fasteners] <Insert products>** for membrane roofing system **[from same manufacturer as membrane roofing] [or] [approved by membrane roofing manufacturer].**

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Testing: At Owners cost, Owner reserves the right to perform wind uplift testing of installed roof system per FM 1-52. Locations and quantities to be determined by Architect/Engineer.

G. Pre-Installation Testing: Provide fastener withdrawal testing at metal deck and lightweight insulating concrete deck areas per the latest version of ANSI/SPRI FX-1 testing procedures to verify fastener withdrawal resistance and identify fastener quantity and spacing.

H. Fumes And Environmental Considerations (Note: Contractor may provide either Fume Recovery or Afterburner System depending on environmental concerns.)

1. Fume Recovery - Provide for the use of a Fume Recovery System to capture and filter bituminous fumes from the roofing kettle on the ground. The following Fume Recovery System is approved for work on this project:

a. FRS-6000 Fume Recovery System as manufactured by National Tool & Equipment, Inc., 60 Boardman, OH 44512, 1-800-558-TOOL.
b. Cleasby Eliminator Fume Emissions System as manufactured by Cleasby Mfg. Co., Inc., 1414 Bancroft Ave., San Francisco, CA 94124, 800-CLEASBY.

2. Afterburner: Provide for the use of a Fume Reduction System to reduce fumes and odors from the roofing kettle on the ground. The following fume reduction system is approved for work on this project:

    a. Reeves Afterburner/Safety Loader System as manufactured by Reeves Roofing Equipment Company, Inc., P.O. Box 720, Helotes, TX 78023, (210) 695-3567.
    b. Garlock FumeGuard Asphalt Fume Elimination System - Garlock FumeGuard as manufactured by Garlock Equipment Company, 2601 Niagara Lane, Minneapolis, MN 55447, (612) 553-1935.
    c. Similar systems submitted for approval must be certified by the Environmental Protection Agency to remove 95% of odors and fumes.

3. Proper Usage: The Contractor shall ensure through training and proper supervision that the fume protection device is used correctly and maintained in good working order throughout the job. Doors, vents, and exhausts shall be kept closed to prevent smoke and fume escape. Operators failing to use the devices properly shall be dismissed from the job and replaced by a worker satisfactory to the Engineer.

4. Air Intake: The contractor will coordinate with the Roof Engineer and Owner to create a schedule for all rooftop air handler intake protection during the project.

5. Rooftop Air Intakes - The Owner will close or otherwise adjust rooftop air intakes for minimum attraction of roofing material fumes from rooftop work.

6. Vent Covers - Contractor will furnish plastic, charcoal, or other suitable covers for air intake vents, and shall install and remove such covers where requested to do so by the Owner

I. Pre-installation Roofing Conference: Conduct conference at Project site. Contractor’s site foreman, roofing-system manufacturer’s technical representative, Roofing Installer, Owner’s Representative, Architect/Engineer shall attend.

1. Site use, access, staging, and set-up location limitations.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions. Including, but not limited to, the following: forecast weather conditions, storage and

protection of materials prior to installation, surface preparation and pretreatment, environmental conditions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system and surrounding work during and after installation.

9. Review roof observation and repair procedures after roofing installation.

10. Reporting procedures.

11. Related project details and interfaces with adjacent work.

12. Testing and inspection requirements.

13. Notification procedures for inspections.

14. Documentation of modifications and repairs for project record.

15. Documentation required for manufacturer’s warranty.

16. Governing regulations and requirements for insurance and certificates if applicable.

17. Quality control and quality assurance plans.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components. Material storage procedures will be constantly monitored and strictly enforced.

B. Use canvas tarps for protection of moisture-sensitive roofing materials. If plastic coverings are used, venting of each package is required. Roofing-system manufacturer’s standard packaging and covering is not considered adequate weather protection.

C. Select and operate material handling equipment in a safe manner, guarding against damage to existing construction or newly applied roofing and conforming to manufacturer's recommendations of handling and storage.

D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

E. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Manufacturer's packaging is not considered adequate protection from moisture.

F. Handle and store materials and equipment on structures to safe loading of structure at time and to avoid permanent deflection of deck. Conspicuously mark wet or damaged materials and promptly remove from Site. Materials, having been determined by the owner/owner's representative to be damaged, shall be immediately removed from the construction site and replaced at no cost to the owner.

G. Store rolled asphalt based materials on ends only, unless otherwise required by roofing-system manufacturer’s written instructions. Discard rolls that have been flattened, creased, or otherwise damaged. All rolls of single ply membrane shall be stored, lying down, elevated above the roof deck and completely protected from moisture with tarpaulins.

H. Do not store materials at locations where new roofing materials have been installed.

I. Remove and replace materials that cannot be applied within stated shelf life.

J. Flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow all precautions as outlined in manufacturer's Material Safety Data Sheets.

1.8 PROJECT CONDITIONS

A. Safety

1. Take all necessary precautions regarding worker health and safety when using solvents, adhesives and hot asphalt.

2. Store flammable liquid and materials away from open sparks, flames and extreme heat.

3. Take necessary precautions when using solvents and adhesives near fresh air intakes.

4. Comply with all OSHA requirements for construction.

B. Daily site cleanup shall be performed to minimize debris and hazardous congestion

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions e.g. extreme temperature, high winds, high humidity and moisture, permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

D. Verify existing dimensions and details prior to installation of materials. Notify Architect/Engineer of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.

E. Comply with Owner’s limitations and restrictions for site use and accessibility.

F. Install materials in strict accordance with safety requirements required by roofing manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

G. Protection

1. Schedule installation sequence to limit access and utilization of the newly installed membrane for material storage, construction staging, mechanical and/or excessive foot traffic.

2. Protect roofing membrane, building surfaces, paving, and landscaping from traffic and roofing equipment. Provide temporary walkways constructed of plywood and set on protective material in traffic and construction areas.

3. Restore or replace all work or materials damaged by the roofing operation.

4. Remove protection materials upon completion of work.

5. Adverse weather could have a detrimental effect on adhesives, general production efforts or the quality of the finished installation. Contact manufacturer for recommendations and acceptable tolerances.

H. Daily seal: Ensure that moisture does not penetrate beneath any completed sections of the roof by sealing temporary roof terminations at the end of each work day and prior to the arrival of inclement weather. Inspect existing components for moisture intrusion along the temporary terminations at temporary cut-offs, tie-ins, and night seals after opening the seal on the next workday. Remove any wet, damp or moisture-damaged materials.

I. All construction debris shall be removed from the construction site and legally dispose of offsite

1.9 WARRANTY

A. Special NDL Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, fasteners, insulation, coated metal, drains and other components of membrane roofing system. Warranty shall include wind speeds up to 74 MPH.

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

C. Maintenance: Along with the issuance of the warranty, a set of instructions shall be included detailing preventative maintenance and noting a list of harmful substances which may damage the roofing membrane.

1.10 COORDINATION

A. Prior to installation of materials, a pre-roofing conference should be held with the roofing contractor, and owner/owner's representative(s) to discuss the specified roofing system coordinate its proper application and the expectations of all parties involved. The authorized roofing contractor and the owner/owner's representative shall notify all parties a minimum of fourteen days prior to the meeting.

B. Plan and coordinate the installation of the roofing system with other trades in such a manner to avoid membrane damage, keeping the complete installation weather tight and in accordance with all approved details and warranty requirements.

C. Manufacturer shall be available to make recommendations necessary to ensure compliance with project specifications and specification alternatives due to unforeseen job conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products and components for the roofing system shall be supplied by the roofing system manufacturer.

B. Components other than those manufactured and/or supplied by the roofing system manufacturer shall be submitted for review, prior to ordering. Any product(s) not specifically authorized in writing for the project by the roofing system manufacturer, shall be considered unacceptable and their performance excluded from the warranty.

C. Roofing membranes may be installed over or adhered directly to pre-approved insulation, cover board, decking or composites thereof. Contact manufacturer for additional information regarding compatible substrates.

2.2 MATERIALS

A. Fiberglass Ply Sheets

1. Asphalt impregnated, glass ply sheet meeting the requirements for UL Type G1 BUR and ASTM D2178, Type VI.

B. Fiberglass Ply Sheets Adhered with Hot Asphalt

1. Hot asphalt shall be applied only to properly prepared and pre-approved substrates, free of any debris, dirt, grease, oil or moisture.

2. Two (2) plies of fiberglass ply sheets shall be embedded into a fluid, continuous application of hot ASTM D-312 Type III steep asphalt at a minimum application rate of 25 lbs. per 100 ft². Ply sheets shall be fully bonded to the cover board substrate.

C. FiberTite-FB Membrane

1. FiberTite-FB is a nominal 45-mil KEE ethylene interpolymer (EIP) membrane, reinforced with knitted polyester fabric, and having a heat bonded 6 oz. polyester backing, as manufactured by Seaman Corporation, under the trade name FiberTite-FB. FiberTite-FB shall be embedded into a fluid, continuous application of hot ASTM D-312 Type III steep asphalt at a minimum application rate of 25 lbs. per 100 ft². FiberTite-FB shall be fully bonded to the fiberglass ply sheets.

D. Johns Manville – 60 mil FB PVC Membrane

1. Johns Manville – PVC FB is a nominal 60-mil KEE ethylene interpolymer (EIP) membrane, reinforced with knitted polyester fabric, and having a heat bonded 6 oz. polyester backing, as manufactured by Johns Manville shall be embedded into a fluid, continuous application of hot ASTM D-312 Type III steep asphalt at a minimum application rate of 25 lbs. per 100 ft². Johns Manville 60 FB PVC membrane shall be fully bonded to the fiberglass ply sheets.

E. Flashing Membrane

1. Nominal 45-mil FiberTite-SM membrane or Johns Manville 60 FB PVC,

shall be used for all flashing requirements to match the field membrane and warranty expectations selected for the roofing system.

F. Acceptable substrate(s) **(SPECIFIER TO CHOOSE)**

1. Authorized rigid insulation and cover board.

2. Structural Concrete, insulated or non-insulated.*

3. Insulated Steel Decking.

2.3 MEMBRANE RELATED MATERIALS

A. FiberTite and Johns Manville Adhesives

1. Adhesives, supplied by Seaman Corporation and Johns Manville, Inc. that have been specially formulated for FiberTite and Johns Manville PVC Roofing Systems. Application technique and coverage rates will vary according to substrate and environmental conditions.

2. FTR-190e Bonding Adhesive or Johns Manville PVC Membrane Adhesive solvent base, contact (two sided) bonding adhesive, designed for bonding non-fleece back KEE membranes to properly prepared and pre-authorized horizontal and vertical substrates.

B. FTR-101 Sealant or Johns Manville PVC Polyurethane Caulk

1. A one-component gun-grade polyurethane sealant to seal flashing termination.

C. FTR-SL1 Sealant or Johns Manville PVC Pourable Sealer

1. A one-component pourable, self leveling, polyurethane sealant to fill "pitch pans".

D. FiberClad Metal or Johns Manville PVC-Coated Metal

1. To fabricate metal flashing, 4' x 10' sheets of 24 gauge hot dipped G-90 steel, or 0.040 thick 3003H14 aluminum, laminated with a 0.020 mil polymeric coating.

E. FTR-Pre-Molded Flashing(s) or Johns Manville-Pre-Molded PVC Flashing(s)

1. Injection molded vent stack and inside/outside corner flashing using

EIP compound.

F. FTR Non-Reinforced Membrane or Johns Manville Detail Membrane

1. Field fabrication membrane, 0.060 mil non-reinforced EIP membrane.

G. FTR-Tuff Track Walk Way & Protection Pads or Johns Manville – PVC Walk Pads.

1. High grade walk way/protection material with "slip resistant" design.

H. FTR-Fasteners

1. FiberTite HD or Johns Manville #14 All Purpose fasteners to secure insulation to steel, wood and structural concrete decks. A #14-13, heavy duty threaded steel #3 Phillips truss, self tapping corrosion resistant fastener.

2. FiberTite BS Fasteners or Johns Manville (LWC) base sheet fastener to secure base sheet to gypsum and cellular lightweight insulating concrete decks.

3. FiberTite Purlin Fasteners or Johns Manville High Load Fasteners to secure membrane to the existing metal roofing systems structural members.

I. FTR-Sand Dollar Insulation Stress Plates or Johns Manville UltraFast Plates.

1. Used to secure insulation to steel, wood and structural concrete decking. Manufactured from high density polyethylene, 3 inch in diameter, designed with a self locking mechanism to secure the head of the FTR fasteners into the plate.

J. FTR-Termination Bar or Johns Manville Termination Bar

1. Membrane flashing(s) restraint/termination seals, nominal 1/8 inch x 1 inch x 10' 6060-T5 extruded aluminum bar with pre-punched slots, 8 inch on center.

K. FTR-601 Insulation Adhesive or Johns Manville Urethane Insulation Adhesive

1. Dual component, single bead (ribbon applied) urethane insulation adhesive. Adhesive is a non-solvent, elastomeric, urethane adhesive, specifically designed for bonding roof insulation and insulation

composites to structural roof decks, base sheets, and smooth surfaced BUR.

2.4 ROOF INSULATION

General:

A. Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. For insulation that will be placed using adhesive, board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

C. Polyisocyanurate Flat Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces; 20-pounds-per-square-inch-minimum compressive strength in accordance with ASTM D1621; and meet flame spread requirements of ASTM E84.

Polyisocyanurate Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated. Drainage crickets and saddles will have a minimum thickness of 1/2” and a minimum slope of 1/2” per foot. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

D. Tapered Edge and Cant Strip: Fiber tapered edge strip, ½” to 0 by 6”. Cant strip and/or tapered edge to be mineral aggregate meeting HH-I-529B.

E. Cover Boards: ASTM C 1177; water-resistant, gypsum substrate, 4’ by 4’ in size, without fiberglass facers. . Edges of material that are ½ inch or taller will require the use of tapered edge strips to taper edge to zero inches.

1. 3/8 inch Securock as manufactured by USG or pre-approved equal.

2. ½ inch DensDeck DuraGuard® Roof Board as manufactured by GP.

3. Fire Resistance:

    a. Flame spread 0, smoke developed 0, when tested in accordance with ASTM E 84. Noncombustible when tested in accordance with ASTM E 136.

2.5 OTHER RELATED MATERIALS

A. Wood Nailers

1. Wood shall be No. 2 or better construction grade lumber.

2. Creosote or asphaltic type preservatives are not acceptable.

3. Minimum top nailer thickness shall be 1.5 inch nominal.

B. Vapor Retarder

1. The decision regarding the inclusion of a vapor retarder within the roof system shall fall within the responsibility of the design professional. Consult N.R.C.A. or other technical resource for appropriate guidelines.

2. Vapor retarder for use in a roof system shall comply with identifiable code and/or insurance requirements.

3. The vapor retarder manufacturer shall certify, in writing, that the specified vapor retarder meets identifiable code requirements and is approved for its intended use.

C. Adhesives for Insulation Attachment

1. Polyurethane used to Adhere Polyisocyanurate Insulation

    a. Adhesive shall be either a dual or single component polyurethane adhesive, dispensed from a portable pressurized container or traditional foam equipment.
    b. Pre-Approved Products
        1. FTR-601
        2. Insta-Stik; Dow Chemical Company
        3. OlyBond; Olympic Manufacturing Group
        4. Tite-Set, PolyFoam Products, Inc.
        5. Johns Manville Urethane Insulation Adhesive

2. Polyurethane used to adhere cover board to base layer of insulation

c. Adhesive shall be either a dual or single component polyurethane adhesive, dispensed from a portable pressurized container or traditional foam equipment.
d. Pre-Approved Products
1. FTR-601
2. Insta-Stik; Dow Chemical Company
3. OlyBond; Olympic Manufacturing Group
4. Tite-Set, PolyFoam Products, Inc.
5. Johns Manville Urethane Insulation Adhesive

D. Fiberglass Ply Sheets

1. Pre-Approved ply sheets shall be installed, where specified and/or required, to provide a suitable surface for installation over or adhering the insulation and/or FiberTite FB or Johns Manville 60 mil PVC FB Roofing System.

2. Acceptable products must be pre-approved or approved in writing by the manufacturer and comply with the following minimal characteristics and classification(s).

PART 3 - EXECUTION

3.1 GENERAL

A. The “Authorized” roofing contractor is responsible for ensuring appropriate system specific addendums from manufacturer.

B. The roofing contractor is responsible for providing a suitable substrate surface for the proper installation of the Roofing System, roof insulation and specified components.

C. Application of the roofing system constitutes an agreement that the roofing contractor has inspected and found the substrate suitable for the installation of the Roofing System.

D. The roofing contractor is responsible for coordinating the installation to ensure that the system remains watertight at the end of each working day

3.2 SUBSTRATE EXAMINATION

A. The roofing contractor is responsible for verifying that the deck condition and/or existing roof construction is suitable for the specified installation of the Roofing System.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

7. The application of adhesives directly to structural concrete; existing smooth and/or granular BUR materials may require sealing or priming with an accepted primer prior to application.

8. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

9. Examine surfaces for low areas that will not drain properly, foreign material, ice, wet insulation, unevenness or any other defect which would prevent the proper execution and quality application of the Roofing System as specified

C. Prepared substrate shall be smooth, dry, and free of debris and/or any

other irregularities which would interfere with the proper installation of the Roofing System. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Installer and roofing-system manufacturer's representative shall examine substrate to ensure that it is properly prepared and ready to receive roofing system. Roofing-system manufacturer's representative shall report in writing to Installer and Architect/Engineer conditions which will adversely affect roofing-system installation or performance. Do not proceed with roofing-system installation until these conditions have been corrected and reviewed by Architect/Engineer.

E. Provide fastener withdrawal values (pull out tests) per ANSI SPRI FX-1 on all projects to verify the suitability of decking to accept a mechanically fastened insulation and/or membrane roofing system.

3.3 COORDINATION

A. Coordinate Work to ensure that new insulation and roofing materials and building interior are kept continuously dry and that continuous, watertight, new roofing system is provided. Coordinate:

1. With Owner's Representative.

2. With other trades to avoid or minimize work on, or in immediate vicinity of, installation in progress and completed new roofing.

3. To avoid or minimize adverse effects on completed new roofing.

4. Ensure that drains are operational at end of each workday or if precipitation is forecast.

3.4 SUBSTRATE PREPARATION (New Construction) **(SPECIFIER TO CHOOSE DECK TYPE)**

A. Steel Deck

1. Steel decking should conform to Factory Mutual (FM) guidelines for Class-1 insulated steel deck construction.

2. Steel decking should be constructed of a minimum 22 gauge cold rolled steel sheets with factory G-90 galvanized coating.

3. Panel profiles, (ribs) shall be formed to minimize deflection and

provide suitable strength and integrity to support anticipated structural live and dead loads.

4. Steel decking shall be installed in compliance with specified design criteria and local building code requirements.

B. Concrete (Poured and/or Pre-cast)

1. Decking shall be installed in strict conformance with industry standards, practices and/or pre-cast panel manufacturer's installation requirements.

2. Decking shall be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

3. Finished decking shall be properly cured and dry, prior to the installation of approved insulation.

4. Finished surface(s) to receive new roof system shall be smooth and level without significant surface depressions or irregularities. Camber differentials greater than 3/16 inch must be leveled using a cementitious grout.

5. Finished surfaces shall be free of moisture, dust, loose debris and any other irregularity that may hinder the proper performance of the new Roofing System.

6. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3.5 SUBSTRATE PREPARATION (Re-Roofing) **(SPECIFIER TO CHOOSE DECK TYPE)**

A. General

1. Roofing Contractor shall be responsible for informing the building owner/owner representative of any issues in regard to the condition and structural integrity of the existing decking.

2. The building owner/owner representative shall make and be responsible for the determination as to the proper method of treatment and/or replacement.

3. Re-roofing applications require fastener withdrawal tests to substantiate proposed attachment patterns for the new mechanically

fastened insulation systems and/or membranes.

4. Re-roofing applications that require modification to the deck and/or insulation system should be installed to provide positive slope and subsequent positive drainage of the new Roofing System.

5. All terminations of the Roofing System must be constructed to prevent water from penetrating behind or beneath the new Roofing System. This includes water from above, beside, below and beneath the new system.

B. Removal of Existing Roof System(s)

1. Remove all existing roofing material(s), insulation, flashing, metal and deteriorated wood blocking and legally dispose off-site.

2. Remove only enough roofing to accommodate the day's work and ensure the exposed area can be made 100% watertight at the end of the day or first sign of inclement weather.

C. Steel Decks

1. All rotted and/or deteriorated decking shall be removed and replaced with like kind.

2. Areas of structurally acceptable steel decking exhibiting slight surface rust shall be properly cleaned, primed and painted prior to installing the approved insulation.

3. All decking shall be inspected for proper attachment and excessive deflection that would compromise the uplift performance of the new Roofing System.

4. Attachment and deflection deficiencies shall be repaired and brought into compliance with current, local building code requirements.

D. Concrete

1. Deteriorated decking shall be repaired and/or replaced with appropriate materials according to standard industry regulations and practices.

2. Repair any depressions and/or areas where reinforcing has become exposed.

3. When new insulation system is to be installed using an approved adhesive:

    a. Cracks and or camber differentials greater than 3/16 inch shall be repaired using an appropriate cementitious grout or fill, and feathered to promote a smooth transition.
    b. Joints between pre-stressed panel units and over bulb-tees shall be taped, stripped or grouted with an appropriate cementitious fill.
    c. All surface irregularities shall be leveled to ensure complete contact with the decking for insulation bonded in hot asphalt or approved adhesives.

4. Where insulation is to be mechanically attached or ballasted, camber differentials and/or surface irregularities of up to 1/2 inch shall be acceptable.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

E. Lightweight "Insulating" Concrete **(FOR USE OVER EXISTING DECKS IN A RE-ROOF SITUATION.)**

1. All wet lightweight shall be removed and replaced with appropriate and/or compatible material.

2. Surface to receive new Roofing System shall be smooth and free of ridges, depressions and other irregularities.

3. Repair any depressions, irregularities and/or excessive deflection with compatible material.

3.6 ROOFING SYSTEM INSTALLATION

A. Install roofing membrane and base flashings according to roofing-system manufacturer’s written instructions and applicable recommendations of NRCA/SPRI Quality Control Guidelines for Application of PVC fleece backed membranes.

B. Install materials in strict accordance with safety requirements required by roofing-system manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

C. Follow safety procedures of OSHA and other applicable governing

agencies. Assume responsibility for Work area safety at all times.

D. Provide fully-charged fire extinguishers, appropriately sized and rated, and water within 50 feet of open flame.

E. Do not use wood-fiber cant strips or insulation.

F. Bitumen Heating:

G. Good Working Kettle - The roofing kettle shall be in safe working order with a working thermometer and thermostatic controls. Set up shall be in accordance with OSHA standards, and the surface upon which it rests shall be protected with sand, plywood, or a suitable tarp. All asphalt remaining on the surface where the kettle was set up shall be cleaned up at the completion of the job. The kettle shall be cleaned prior to the commencement of this job.

H. Experienced Kettle Operator - The operator of the kettle shall be thoroughly trained in the safe operation and maintenance of the kettle, and he shall be dressed in safe protective clothing with proper safety equipment within easy reach at all times. The kettle operator shall wear a hard hat and face mask at all times in accordance with OSHA standards and standard industry practice.

I. Heating Practice - Under no circumstances shall asphalt be heated to or above its flash point. Application temperatures shall not be more than 25 degrees F. more or less than the equiviscous temperature (EVT). EVT information must be furnished by the asphalt manufacturer prior to commencement of work. In the absence of authoritative EVT certification for the specific batch of asphalt produced, the asphalt shall be heated to 475 to 500 degrees F. at the kettle, but not above 525 degrees F. Asphalt shall be applied as near the EVT temperature as possible.

J. Maintain adequate ventilation during installation of roofing materials. Notify Owner’s Representative at least 1 week in advance of Work with materials with noxious vapors. Review application schedule and venting precautions with Owner’s Representative prior to beginning application.

K. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing-system components or adjacent building construction.

L. Coordinate installing roofing-system components so insulation and roofing membrane sheets are not exposed to precipitation, or left

exposed at end of workday or when rain is forecast.

M. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

N. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

O. Remove and discard temporary seals before beginning work on adjoining roofing.

P. Prohibit foot traffic and equipment movement over roofing system until adhesive has cured. Minimize foot traffic and equipment movement over base ply prior to installation of membrane top ply/cap sheet.

Q. Cooperate with Architect/Engineer in performing inspections and testing of roofing system.

3.7 ROOF INSULATION INSTALLATION

A. General

1. Roof insulation shall be installed where by the long dimension of the board(s) run in parallel alignment and the short dimensions are staggered.

2. Insulation shall be installed with minimum joint dimensions and shall be tightly butted where possible. Maximum joint widths shall be 3/8 inch. Damaged corners shall be cut out and replaced with an insulation piece a minimum of 12 inch x 12 inch Pieces which are cut from larger panels and are smaller than one square foot are not acceptable.

3. Install no more than can be covered during the same working day.

4. Taper roof insulation to drain sumps using tapered edge strips. If an insulation layer is 1-1/2 inch or less, taper 12 inch from the drain bowl. If insulation thickness exceeds 1-1/2 inch, taper 18 inch from the drain bowl. All taper boards or pieces must be adhered or mechanically fastened with a minimum of two fasteners per board.

5. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the cover board.

6. When a cover board and/or multiple layers are installed each layer should be offset from the previous layer a minimum of 12 inch on center.

7. At the end of each working day, provide a watertight cover on all unused insulation as to avoid moisture penetration.

B. Insulation Installation

1. Comply with roofing system manufacturer's written instructions for installing roof insulation.

(Retain first paragraph below if mechanically fastening base sheet to substrate before adhering first layer of insulation.)

2. Over nailable substrate, install one lapped vented base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

(For Steep slope applications, slopes 1 in 12 or greater) Use Nailer Strips: Mechanically fasten 4-inch nominal- width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:

3. 16 feet apart for roof slopes steeper than 1 inch per 12 inches but less than 3 inches per 12 inches.

4. 48 inches apart for roof slopes steeper than 3 inches per 12 inches.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

D. Mechanically Fastened Insulation: For metal roof decks, install the base layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

E. Adhered Insulation:

1. Board sizes shall not exceed 4 ft. by 4 ft. maximum. Largest appropriate sized approaching, but not exceeding 4 ft. by 4 ft. as appropriate, shall be installed where possible. Using multiple smaller sized sections of insulation where larger sections would be more appropriate shall not be allowed.

2. For insulation that will be installed using adhesive (not mechanically attached), provide adequate temporary ballast on insulation boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/8 inch with insulation.

F. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and non composite insulation in two or more layers, install non composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

I. Tapered Edge Strip: Install tapered edge strip at the leading edge of the tapered insulation panels to provide a solid substrate for the cover board.

J. Cover Board Installation: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.

1. Adhere cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3. Apply low-rise foam adhesive to underside, and bond cover board to substrate.

4. Provide adequate temporary ballast on cover boards that is sufficient to fully compress each board into the adhesive until adhesive has set.

3.8 ROOFING MEMBRANE INSTALLATION

A. Quality Control

1. It will be the responsibility of the roofing contractor to initiate and maintain a QC program to govern all aspects of the installation of the Roofing System.

2. The project foreman and or supervisor will be responsible for the daily execution of the QC program which will include but is not limited to the supervision, inspection and probing of all heat welding incorporated within the Roofing System.

3. If inconsistencies in the quality of the application of the composite, membrane and/or welds are found, all work shall cease until corrective actions are taken to ensure the continuity the installation.

B. General

1. Work shall be coordinated to ensure that sequencing of the installation promotes a 100% watertight installation at the end of each day.

2. All Roofing Systems or sections shall be designed utilizing and determined to be in compliance with the procedures outlined within the current publication of ASCE Standard 7. Alternative designs may be determined using the criteria within Factory Mutual Research Loss Prevention Data.

3. A FiberTite Roofing System may utilize either conventional "roll goods" or pre-fabricated custom rolls or a combination of both. Custom Rolls must be utilized for ballast and metal recover applications. (Custom rolls of variable width and length are available upon request.)

4. Restrictions regarding outside ambient air temperature are relative only to the exposure limits of the workers and/or adhesives.

5. When using adhesives outside ambient air temperature should be above 40°. Curing or drying time of the adhesive will be affected by

ambient temperatures and must be taken into consideration when determining flashing lengths.

6. Roofing Systems shall only be installed over properly prepared and sound substrates, free from excessive surface roughness, dirt, debris and moisture.

C. Hot Asphalt Adhered Roofing Systems

1. For fleece-backed (FB) membranes - Un-roll approximately 30 feet of the FB membrane and position the roll over the properly installed/prepared substrate. Pull the tail back over the roll to expose a workable area (approx. 30') of substrate. (Do not utilize the “butterfly method).

2. Apply a 100% continuous coat of adhesive to the substrate.

3. Correct Equiviscous Temperature (EVT) must be maintained at point of application. Type III steep asphalt shall be applied within 25°F of the asphalt manufacturer’s recommended EVT. If the manufacturer does not supply the EVT, Seaman Corporation recommends a temperature of 425° F for mopping and 450° F for mechanical spreaders.

4. Asphalt is to be applied by either mopping or mechanical spreaders.

5. Adhesive must be spread to ensure a smooth, even 100% coverage of the substrate with no voids, skips, globs, puddles, or similar irregularities.

6. Do not allow asphalt to contaminate the lap "seam" areas of the membrane. Contaminated areas will inhibit proper welding of the seams.

7. Carefully maneuver the membrane into the adhesive on the substrate surface, avoiding any wrinkles or air pockets.

8. Broom the adhered portion of the membrane to ensure full contact and complete the bonding process by firmly pressing the bonded membrane into place with a weighted, foam-covered, lawn roller.

9. Repeat the process for the remaining un-bonded portion of the membrane, lapping subsequent, adjacent rolls of membrane a minimum of 3 inches, ensuring proper shingling of the membrane to shed water along the laps.

10. No adhesive shall be applied to the lap "seam" areas of the membrane. Areas contaminated with adhesive are difficult to clean, will impair proper welding of the seams and require a membrane patch.

11. Do not use bad or marginal adhesives. Contact MANUFACTURER if the quality of the adhesive is suspect.

D. Peel Stops for Adhered Roofing Systems

1. Membrane manufacturer's standard Terms and Conditions for commercial warranties list 60-mph wind velocity as the first exclusion for wind events. Perimeter "assurance" or restraint must be provided for any modification to the standard commercial warranty.

2. Assurance or restraint is accomplished using rows of fasteners, installed parallel to exterior roof edges at a prescribed interval and fastener spacing to create a "peel stop" during a significant wind event.

3. Peel stops must be mechanically attached into or through the structural decking with rows of Magnum stress plates and fasteners, (or authorized alternate) @ 12 inches on center. The peel stop is sealed by heat welding a nominal 6-inch strip of membrane over the fasteners.

4. Lightweight insulating concrete is generally not considered a structural component and peel stop fastening must penetrate through the lightweight into the structural component. Peel Stop(s) are required on adhered projects with a field design uplift pressure of -45 psf (FM 1-90) or above. Peel stop intervals are based upon the field pressure and are as follows:

a. Buildings with Design Velocity Pressure less than: -45 psf (FM 1-90).

1. No peel stop required.

b. Buildings with Design Velocity Pressure greater than: -45 psf (FM 1-90) but less than or equal to -52.5 (FM 1-105).

1. One peel stop at three feet from all edges.

c. Buildings with Design Velocity Pressure greater than: -52.5 (FM 1-105) but less than or equal to -60 psf (FM 1-120).

1. One peel stop at three feet from all edges and

2. The second peel stop at six feet from all edges.

d. Buildings with Design Velocity Pressure greater than: -60 (FM 1-120 but less than or equal to -67.5 psf (FM 1-135).

1. One peel stop at three feet from all edges and

2. The second peel stop at six feet from all edges and

3. The third peel stop at nine feet from all edges.

e. Buildings with Non Class 1 decking, i.e. lightweight, wood, gypsum, and cementitious wood fiber do not default to the above requirements and require additional evaluation and engineering review by manufacturer.

E. Hot Air Welding

1. General

a. All field seams exceeding 10 feet in length shall be welded with an approved automatic welder.
b. All field seams must be clean and dry prior to initiating any field welding.
c. Remove foreign materials from the seams (dirt, oils, etc.) with Acetone or authorized alternative. Use CLEAN WHITE COTTON cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. **Do not use denim or synthetic rags for cleaning**.
d. All welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld.
e. Contaminated areas within a seam will inhibit proper welding and will require a membrane patch.

2. Hand Welding

a. The lap or seam area of the membrane should be intermittently tack welded to hold the membrane in place.

b. The back "interior" edge of the membrane shall be welded first, with a thin, continuous weld to concentrate heat along the exterior edge of the lap during the final welding pass.
c. The nozzle of the hand held hot air welder shall be inserted into the lap at a 45° angle to the lap. Once the polymer on the material begins to flow, a hand roller shall be use to apply pressure at a right angle to the tip of the hand welder. Properly welded seams shall utilize a 1-1/2 inch wide nozzle, to create a homogeneous weld, a minimum of 1-1/2 inches in width.
d. Smaller nozzles may be used for corners, and other field detailing, maintaining a minimum 1 inch weld.

3. Automatic Machine Welding

a. Proper welding of the Membrane can be achieved with a variety of automatic welding equipment. Contact manufacturer's MANUFACTURER for specific recommendations.
b. Follow all manufacturers' instructions for the safe operation of the automatic welder.
c. Follow local code requirements for electric supply, grounding and surge protection.
d. The use of a dedicated, portable generator is highly recommended to ensure a consistent electrical supply, without fluctuations that can interfere with weld consistency.
e. Properly welded seams shall utilize a 1-1/2 inch wide nozzle, to create a homogeneous weld, a minimum of 1-1/2 inches in width.

F. Inspection

1. The job foreman and/or supervisor shall initiate daily inspections of all completed work which shall include, but is not limited to the probing of all field welding with a dull pointed instrument to assure the quality of the application and ensure that any equipment or operator deficiencies are immediately resolved.

2. Ensure that all aspects of the installation (sheet layout, attachment, welding, flashing details, etc.) are in strict accordance with the most current Roofing Systems Specifications and Details.

3. Excessive patching of field seams because of inexperienced or poor workmanship will not be accepted at time of FINAL INSPECTION FOR WARRANTY ACCEPTANCE.

4. Any deviation from pre-approved specifications and/or details requires written authorization from the MANUFACTURER prior to

application to avoid any warranty disqualification.

5. It is the contractor, job foreman, and supervisor and/or quality control personnel to perform a final “self” inspection on all seams prior to requesting the inspection for warranty issuance by the manufacturer’s warranty.

3.9 FLASHING

A. Clean all vents, pipes, conduits, tubes, walls, and stacks to bare metal. All protrusions must be properly secured to the roof deck with approved fasteners. Remove and discard all lead, pipes and drain flashing. Flash all penetrations according to approved details.

B. Remove all loose and/or deteriorated cant strips and flashing.

C. Flash all curbs, parapets and interior walls in strict accordance with approved details.

D. All flashing shall be adhered to properly prepared, approved substrate(s) with either FTR- 190e Adhesive or FTR-201 mastic or Johns Manville PVC Membrane Adhesive applied in sufficient quantity to ensure total adhesion. Specific projects may require the use of FTR-490 or Johns Manville PVC Membrane Adhesive as a bonding adhesive for FiberTite-SM and Johns Manville PVC Membrane Adhesive. Contact manufacturer’s MANUFACTURER prior to this application.

E. The base flange of all membrane flashing shall extend out on to the plane of the deck, beyond the wood nailers to a maximum width of 8 inches.

F. Vertical flashing shall be terminated no less than 8 inch above the plane of the deck with an approved termination bar and counter-flashing or metal cap flashing.

G. When using FTR-201 or FTR-490 or Johns Manville PVC Membrane Adhesive, vertical wall flashing termination shall not exceed 30 inches without supplemental mechanical attachment of the flashing between the deck and the termination point of the flashing.

H. Complete all inside and outside corner flashing details with manufacturer’s pre-formed corners or an approved field fabrication detail.

I. Probe all seams with a dull, pointed probe to ensure the weld has created a homogeneous bond.

J. Install penetration accessories in strict accordance with approved details. Ensure penetration accessories have not impeded in any way the working specification. (Refer to the related trade for the technical specification).

3.10 METAL FLASHING

A. All perimeter edge details are to be fabricated from membrane-clad metal or utilize a prefabricated membrane manufacturer's Fascia System.

B. Ensure all fascia extend a minimum of 2 inch lower than the bottom of the wood nailers.

C. Fasten all metal flashing to wood nailers or approved substrate with approved fasteners 8 inches on center.

D. Break and install membrane-clad metal in accordance with approved details, ensuring proper attachment, maintaining 1/2 inch expansion joints and the installation of a minimum 2 inch bond breaker tape prior to sealing the joint.

E. Roof Drains

1. Flash all roof drains in accordance with manufacturer's roof drain details.

2. Replace all worn or broken parts that may cut the membrane or prevent a watertight seal. This includes the clamping ring and strainer basket.

3. Replace all drain bolts or clamps used to hold the drain compression ring to the drain bowl.

4. Non-reinforced 60 mil membrane shall be used for flashing the drain assembly. Drain assemblies and basins or "sumps" must be free of any asphalt or coal tar pitch residue prior to installation.

5. The drain target sheet should be sized and installed to provide for a minimum of 12 inch of exposed 60 mil on all sides of the drain.

F. Pitch Pans

1. **REASONABLE effort shall be made to eliminate the need for pitch pans including the removal of all existing pans. Contact manufacturer for specific design alternatives and recommendations**.

2. In the event of no alternative, fabricate pitch pans from membrane-clad metal, installed in accordance with manufacturer's details, ensuring proper attachment, maintaining a minimum of 2 inch clearance around the penetration.

3. Pitch Pans shall be filled with non-shrinking grout to within 1 inch of the top of the pan. Allow the grout to dry and fill remainder of the pan with FTR-SL1 pour able sealant or Johns Manville PVC Pourable Sealer and covered with a stainless steel weather bonnet and compressible clamp or welded to penetration.

4. Pitch Pans and the sealant will require periodic maintenance by the building owner's maintenance personnel.

3.11 EXPANSION JOINTS

A. Flash all expansion joints in accordance with authorized details. Fasten all expansion joint material according to manufacturer's specifications. Ensure the expansion material has sufficient material to expand to the widest point in expansion without causing undue stress on the expansion joint material.

B. If the expansion joint is a "pre-formed" system, the manufacturer, description and a drawing illustrating the method of installation must be included when submitted.

3.12 WALKWAYS

A. Manufacturer's walkways and protection pads shall be installed at staging areas for roof top equipment maintenance or areas subject to regular foot traffic.

B. Walkway Installation

1. Roofing membrane to receive walkway material shall be clean and dry.

2. Cut and position the walkway material as directed by the specifications or agreement.

3. Hot air weld the entire perimeter of the walk way to the previously cleaned roofing membrane. Avoid excessive heating of the walk way material to prevent scorching the underlying roofing membrane.

C. Protection Pad Installation

1. Roofing membrane to receive protection pad material shall be clean and dry.

2. Prior to installing the protection pads (1/4 inch x 2' x 4’), weld a 6 inch x 6 inch strip of membrane to each of the four corners of the back side of the pad. Position the strips in such a way that they overhang the edge of the pad a minimum of two inches around the 90° corner.

3. Position the protection pads as directed by the specifications or agreement and weld the visible portion of the previously applied stripping to the roofing membrane.

3.13 FIELD QUALITY CONTROL

A. Roof cement shall not be incorporated into the roof membrane or flashing system.

B. Architect/Engineer will inspect roofing system at various stages of construction and at completion.

C. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to prepare test reports.

D. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.

2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

E. Infrared Survey: If roofing fleece backed cap sheet is not installed

immediately after the ply sheets are installed (Phased Construction), contractor shall provide an infra-red survey of entire roof area. Survey shall be performed by organization that is approved by the Architect. Infra-red survey and subsequent report shall be performed prior to the installation of the roofing cap sheet.

F. Manufacturer's Inspections: Arrange for the roofing systems manufacturer to provide qualified technical personnel for onsite observation and instruction full time at beginning of membrane installation to establish project standard and thereafter as the manufacturer deems necessary, but not less than 1 time every two weeks when roofing membrane and related work is being performed. A field observation report from each visit will be generated and submitted to the Engineer within 48 hours of the visit.

G. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

H. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

2. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Accompany the manufacturer's technical inspector, and assist with equipment and workmen if necessary to provide access to the roof. Correct all defects noted during the inspection.

3.15 SEALANTS

A. Apply authorized sealant(s) to all surface mounted reglets and per project requirements. Sealant(s) are to shed water. Follow all manufacturer's instructions and installation guides.

B. Use primer when recommended by the manufacturer.

C. Sealants will require periodic maintenance by the building owner's maintenance personnel.

3.16 TEMPORARY SEALS

A. At the end of each working day or at the sign of rain, install temporary, 100% watertight seal(s) where the completed new roofing adjoins the uncovered deck or existing roof surface.

B. The authorized roofing contractor shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new and/or existing roof system.

C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

D. If water is allowed to enter beneath the newly completed roofing, the affected area(s) shall be removed and replaced at no additional expense to the building owner.

E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation, roof cement or sealant and properly dispose off site.

3.17 LIGHTNING PROTECTION

A. The installation of lightning protection must be coordinated with the authorized roofing contractor, certified lightning contractor and the building owner.

B. The lightning protection must be installed in such a manner that base plates, air terminals and cables do not penetrate the roofing membrane without the use of pre-approved flashing details.

C. Cables and air terminals may be attached to the membrane using base plates and an approved construction adhesive or by welding intermittent strips of membrane over the base plates and cables to the roofing. Contact manufacturer for specific adhesive recommendations.

D. Recommendations regarding the selection of adhesives or alternative affixing of lightning protection systems to the membrane does not in any way imply a warranty covering their performance or ability of the adhesives to remain affixed to the membrane.

3.18 COMPLETION

A. Remove any and all debris, excess materials and scrap of any kind from the roof and surrounding premises prior to demobilization.

B. Inspect all field welds, detailing and terminations to ensure a 100% the watertight installation.

3.19 WARRANTY INSPECTION

A. Upon completion of the project, the authorized roofing contractor shall complete and submit the Project Completion Notice to manufacturer.

B. Upon receipt of the notice of completion, a manufacturer's representative will schedule an inspection with a representative of the authorized roofing contractor to thoroughly review the installation and verify compliance with the manufacturer's requirements.

C. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.

D. Upon completion of all punch list items and final acceptance of the installation, a warranty as authorized by the approved manufacturer Notice of Award and Warranty Request Form will be issued.

3.19 ROOFING INSTALLER'S WARRANTY

E. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.

2. Address: <Insert address>.

3. Building Name/Type: <Insert information>.

4. Address: <Insert address>.

5. Area of Work: <Insert information>.

6. Acceptance Date: <Insert date>.

7. Warranty Period: <Insert time>.

8. Expiration Date: <Insert date>.

F. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

G. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

H. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. lightning;
b. peak gust wind speed exceeding <Insert wind speed> mph;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing

Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

I. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.

2. Name: <Insert name>.

3. Title: <Insert title>.

END OF SECTION 075419

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. RELATED SECTIONS

1. Division 06 10 53 Miscellaneous Rough Carpentry: Wood nailers, curbs and cant strips
2. Division 07 52 16 Modified Bituminous Roofing: Roof flashings and perimeters
3. Division 07 71 00 Roof Specialties: Copings, flashing and counterflashing
4. Division 07 72 00 Roof Accessories: Roof curbs and roof hatches
5. Division 22 40 00 Floor, Area and Roof Drains
6. Division 26 41 13 Lightning Protection for Structures: Lightning protection systems devices and connectors

1.2 SUMMARY

A. Section includes:

1. Formed reglets and counterflashing.
2. Formed roof drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.

1.3 DEFINITIONS

A. Sheet Metal Terminology: See Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) “Architectural Sheet Metal Manual – Sixth Edition” for definition of terms related to work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed sheet metal shall withstand specified uplift

pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal units shall remain watertight.

B. Material Compatibility: Provide sheet metal materials that are compatible with one another under conditions of service and application required, as demonstrated by the sheet metal manufacturer based on testing and field experience.

C. Comply with governing codes and regulations. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.

D. Clear Lake Campus to meet the requirements of the Texas Windstorm Act.

E. Reference Standards: Applicable portions of SMACNA, ANSI/SPRI ES-1, ASTM and NAAMM publications.

1.5 SUBMITTALS

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

B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop-and field-assembled work.

1. Submit the following: Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.
   a. Counterflashing at roof edges
   b. Coping and drip edge at roof edges
   c. Counterflashing at doors/windows for protection of waterproofing
   d. Receiver sections
   e. Counterflashing at elevation transitions (doors to perimeter edges)
   f. Through-wall flashing pans
   g. Roof expansion joints
   h. Penetration flashing (including rain hoods)

C. Samples: For each exposed product and for each finish specified.

D. Warranty: Sample of special warranty

E. Maintenance data.

1.6 QUALITY ASSURANCE

A. Sheet Metal flashing and Trim Standard: Comply with SMACNA’s “Architectural Sheet Metal Manual” unless more stringent requirements are specified or shown on Drawings.

B. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical sheet metal flashing conditions at either a standalone mockup or on the building that once accepted can be included in the construction of the project. Include perimeter flashings for fenestrations and through wall flashings including supporting construction cleats, seams, attachments, underlayment, and accessories.

D. Preinstallation Conference: Conduct conference at Project site.

1. Site use, access, staging, and set-up location limitations.

2. Review methods and procedures related to sheet metal installation, including manufacturer's written instructions. Including, but not limited to, the following: forecast weather conditions, storage and protection of materials prior to installation, surface preparation and pretreatment, environmental conditions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review all field conditions that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for sheet metal system and surrounding work during and after installation.

9. Review sheet metal observation and repair procedures.

10. Reporting procedures.

11. Related project details and interfaces with adjacent work.

12. Testing and inspection requirements.

13. Notification procedures for inspections.

14. Documentation of modifications and repairs for project record.

15. Documentation required for manufacturer's warranty.

16. Governing regulations and requirements for insurance and certificates if applicable.

17. Quality control and quality assurance plans

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials requiring fire resistant classifications packaged with labels intact and legible.

B. Protect existing building construction and all work in place from damage resulting from the storage, preparation, handling and application of roofing materials.

C. Keep all material dry while they are transported, stored and installed. Do not allow materials to be exposed to any moisture anywhere, at any time, during transportation, storage, handling and installation.

D. Store all materials on raised platforms with weather protective coverings. The manufacturer's standard packaging and covering is not considered adequate weather protection. Tarpaulins are preferred for protection of all roof materials. If visqueen coverings are used, venting of each package is required. Material storage procedures will be constantly monitored and strictly enforced.

E. Handle all materials to avoid damage.

F. Storage of all materials shall conform to the limitations recommended by the material manufacturer including restrictions on ambient temperatures and shelf life.

G. Materials stored on roofs shall be limited to the safe loading of structural framing, and only at locations designated and approved by the Architect and/or Owner. Storage of materials shall not be allowed at any locations where new roofing insulation or roofing membrane materials have been installed

1.8 PROJECT CONDITIONS

A. Safety

1. Take all necessary precautions regarding worker health and safety when using solvents, adhesives and primers.

2. Store flammable liquid and materials away from open sparks, flames and extreme heat.

3. Take necessary precautions when using solvents and adhesives near fresh air intakes.

4. Comply with all OSHA requirements for construction.

B. Daily site cleanup shall be performed to minimize debris and hazardous congestion

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions e.g. extreme temperature, high winds, high humidity and moisture, permit sheet metal system to be installed according to manufacturer's written instructions and warranty requirements.

D. Verify existing dimensions and details prior to installation of materials. Notify Architect/Engineer of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.

E. Comply with Owner’s limitations and restrictions for site use and accessibility.

F. Install materials in strict accordance with safety requirements required by roofing manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

G. Protection

1. Schedule installation sequence to limit access and utilization of the newly installed roofing system for material storage, construction staging, mechanical and/or excessive foot traffic.

2. Protect roofing membrane, building surfaces, paving, and landscaping from traffic and roofing equipment. Provide temporary walkways constructed of plywood and set on protective material in traffic and construction areas.

3. Restore or replace all work or materials damaged by the sheet metal operation.

4. Remove protection materials upon completion of work.

5. Adverse weather could have a detrimental effect on adhesives, general production efforts or the quality of the finished installation. Contact manufacturer for recommendations and acceptable tolerances.

H. Daily seal: Ensure that moisture does not penetrate beneath any completed sections of the sheet metal by installing temporary terminations at the end of each work day and prior to the arrival of inclement weather. Inspect existing components for moisture intrusion along the temporary terminations at temporary cut-offs, tie-ins, and night seals after opening the seal on the next workday. Remove any wet, damp or moisture-damaged materials. All construction debris shall be removed from the construction site and legally dispose of offsite.

1.9 WARRANTY

A. Manufacturer's 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 20 years from date of Substantial Completion.

B. Installer's Warranty: Submit sheet metal Installer's warranty, signed by Installer, covering the Work of this Section, including all components of sheet metal system for five years from date of Substantial Completion. Warranty shall include All materials, labor, tools and equipment necessary for repair, restoration, or replacement of all new work damaged as a result of Defects, imperfections, or faults in Materials and Workmanship

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. Exposed Coil-Coated Finishes:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

2. Color: As selected by Architect from manufacturer's full range.

D. Stainless Steel Sheet (all metal flashings except through-wall flashing pans): ASTM A167, Type 304, dull cold rolled finish.

E. Stainless-Steel Sheet (Through-wall Flashing Pans): ASTM A 240/A 240M or ASTM A 666, Type 316, dead soft, fully annealed; 2D (dull, cold rolled) finish.

F. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.

1. Surface: Manufacturer's standard clear acrylic coating on both sides.

2. 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.

3. Color: As selected by Architect from manufacturer's full range.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

2.3 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.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.

3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Solder:

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

2. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, 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.

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

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Stainless steel, 24 gauge thick.

2. Finish: Mill.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" and ANSI/SPRI ES-1 that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.

2. 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.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

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

C. 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.

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

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

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Accessories: Wire ball downspout strainer.

2. Fabricate from the following materials:

a. Aluminum: 0.032 inch thick

B. Built-in Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.

1. Accessories: Wire ball downspout strainer.

2. Fabricate from the following materials:

a. Stainless Steel: 24 gauge thick.

C. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

3. Hanger Style: Same profile as the Downspout.

4. Fabricate from the following materials:

    a. Aluminum: 0.032 inch thick.

Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:

1. Stainless Steel: 24 gauge thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim and built-in overflows. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

E. Splash Pans: Fabricate from the following materials:

1. Stainless Steel: 24 gauge thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide, joint cover plates. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

C. Base Flashing: Fabricate from the following materials:

1. Stainless Steel: 24 gauge.

D. Counterflashing and Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 24 gauge.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 24 gauge.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

B. Valley Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

C. Drip Edges: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashing to extend 6 inches beyond each side of wall openings. Form with 2-inch high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Type 316 Stainless Steel: 24 gauge.

B. Opening Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend to the sealant line of the wall openings. From head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Type 316 Stainless Steel: 24 gauge.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Type 304 Stainless Steel: 24 gauge.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

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 so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. 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.

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. Underlayment: Where installing metal flashing directly on Cementitious or wood substrates, install a course of felt underlayment and over with a slip sheet or install a course of polyethylene sheet.

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 of 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 wood sheathing not less than 1-1/4 inches for nails and not less than ¾ inch for wood screws and for 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.

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 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. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

4. 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 DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored twisted straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Built-in Gutters: Join sections with riveted and soldered or lapped joints sealed with sealant. Provide end closures and seal watertight with sealant.

1. Install self-adhering sheet underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.

2. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 48 inches o.c. in between.

E. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in adhesive material compatible with the roofing.

F. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

G. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper or gutter discharge.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4inches in direction of water flow.

3.4 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. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.

2. Anchor interior leg of coping with washers and screw fasteners through slotted holes and 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. 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.

F. 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.

3.5 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 04 2000 “Unite Masonry”.

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend to the required sealant line of wall openings.

3.6 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 and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer’s written installation instructions.

END OF SECTION 076200

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section Includes:

   1. Copings.
   2. Roof-edge flashings.
   3. Roof-edge drainage systems.

B. Related Sections:

   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
   3. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

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

B. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:

   1. Design Pressure: As indicated on Drawings .

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
a. Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.

2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.2 MISCELLANEOUS MATERIALS

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

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

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

E. Bituminous Coating: ASTM D-312, Type IV extra steep asphalt.

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

2.3 COPINGS

A. Copings: Formed aluminum, 0.063 inch thick, shaped as indicated, including special supports spaced at 24 inches on center. Include cover plates to conceal and weather seal joints and attachment flanges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Architectural Products Company.
    b. Petersen Aluminum Corporation.
    c. Substitutions: See Section 01 25 00 – Substitution Procedures.

3. Coping-Cap Material: Formed aluminum, 0.063 inch thick thickness as required to meet performance requirements .

    a. Finish: Three-coat fluoropolymer.
    b. Color: As selected by Architect from manufacturer's full range .

B. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet , with a horizontal flange and vertical leg, drain-through fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Architectural Products Company.
    b. Petersen Aluminum Corporation.
    c. Substitutions: See Section 01 25 00 – Substitution Procedures.

2.4 GENERAL FINISH REQUIREMENTS

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

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

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

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

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

1. Coat concealed side of stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment .

3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of [**12 feet**] Insert dimension with no joints within of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

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

E. Seal joints with [**elastomeric**] [**butyl**] sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. 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. Tin edges of uncoated copper sheets using solder for copper. 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.

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements .
2. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements . Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements .

3.5 ROOF-EDGE FLASHING INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
1. Connect downspouts to underground drainage system indicated.

D. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

E. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below scupper discharge.

3.7 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

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

END OF SECTION 07 71 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section Includes:

   1. Roof curbs.
   2. Roof hatches.

B. Related Sections:

   1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   3. Section 07 71 00 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 PERFORMANCE REQUIREMENTS

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

1.4 ACTION SUBMITTALS

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

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

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

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 COORDINATION

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

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

1.8 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AES Industries, Inc.
b. Pate Company (The).
c. Roof Products, Inc.
d. Substitutions: See Section 01 25 00 – Substitution Procedures.

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

C. Material: Zinc-coated (galvanized) steel sheet, 18 gage 0.048 inch thick, complying with ASTM A 653/A 653M, SS Grade 33 (230).

1. Finish: G60 (Z180)coating designation.
2. Color: As selected by Architect from manufacturer's full range .

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Preservative treated wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
6. Fabricate curbs to minimum height of 14 inches above roof deck, 6 inches (152 mm) minimum above finished roof surface, unless otherwise indicated.
7. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
8. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
9. Security Grille: Provide where indicated.
10. On curbs adjacent to roof openings, provide curb on all sides of opening, with top of curb horizontal for equipment mounting.
11. Provide layouts and configurations as shown on the drawings.

E. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
1. Provide preservative treated wood nailers along top of rails.
2. Height Above Finished Roof Surface: 6 inches (152 mm), minimum.
3. Height Above Roof Deck: 14 inches (356 mm), minimum.

F. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches (400mm) square unless otherwise indicated.
1. Provide sliding channel welded along top edge with adjustable height steel bracket, manufactured to fit item supported.
2. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.
3. Height Above Roof Deck: 14 inches (356 mm), minimum.

2.2 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Bilco Company (The).
   b. Dur-Red Products.
   c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   d. Substitutions: See Section 01 25 00 – Substitution Procedures.

B. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.

1. Style: Provide flat metal covers unless otherwise indicated.

Retain subparagraph below if retaining either of last two options in subparagraph above.

2. Mounting: Provide frames and curbs suitable for mounting on flat roof deck .
3. Size(s): As indicated on drawings; single-leaf style unless otherwise indicated as double-leaf.
4. For Ladder Access: Single leaf; 30 by 36 inches (762 by 914 mm).
5. For Ships Ladder Access: Single leaf; 30 by 54 inches (762 by 1372 mm).
6. For Stair Access: Single leaf; 30 by 96 inches (762 by 2438 mm).

C. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.

First option in first subparagraph below applies only to zinc-coated (galvanized) steel sheet.

1. Material: Galvanized steel, 14 gage, 0.0747 inch (1.90 mm) thick.

Retain subparagraph below if retaining either of last two options in subparagraph above.

2. Finish: Factory prime paint.
3. Insulation: 1 inch (25 mm) rigid glass fiber, located on outside face of curb.
4. Curb Height: 12 inches (305 mm) from finished surface of roof, minimum.

D. Metal Covers: Flush, insulated, hollow metal construction.

First option in first subparagraph below applies only to zinc-coated (galvanized) steel sheet.

1. Capable of supporting 40 psf (1.92 kPa) live load.

Retain subparagraph below if retaining either of last two options in subparagraph above.

2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch (1.90 mm) thick, liner 22 gage, 0.03 inch (0.76 mm) thick.
3. Finish: Factory prime paint.
4. Insulation: 1 inch (25 mm) rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.

First option in first subparagraph below applies only to zinc-coated (galvanized) steel sheet.

1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.

Retain subparagraph below if retaining either of last two options in subparagraph above.

2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

2.3 GENERAL FINISH REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

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

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

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

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

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

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

E. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

F. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.
2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

G. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

H. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.

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

J. Roof Walkway Installation:

1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.
2. Remove ballast from top surface of low-slope roofing at locations of contact with roof-walkway supports.
3. Install roof walkway support pads prior to placement of roof walkway support stands onto low-slope roofing.
4. Redistribute removed ballast after installation of support pads.

K. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

L. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

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

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

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

D. Clean off excess sealants.

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

END OF SECTION 07 72 00

SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals (Projects authorized for LEED certification only):

1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For paints and coatings used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

D. Samples: For each exposed product and for each color and texture specified, [**in manufacturer's standard dimensions**] [**4 inches (102 mm) square**] <**Insert dimensions**> in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**Installer**] [**and**] [**testing agency**].

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Preconstruction Test Reports: For fireproofing.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Mockups: Build mockups [**to verify selections made under Sample submittals and to demonstrate aesthetic effects**] [**to set quality standards for materials and execution**] [**and**] [**for preconstruction testing**].

1. Build mockup of [**each type of fireproofing and different substrate**] [**and**] [**each required finish**] <**Insert description**> as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: [**Owner will engage**] [**Engage**] a qualified testing agency to perform preconstruction testing on[**field mockups of**] fireproofing.

1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is [**44 deg F (7 deg C)**] <**Insert temperature**> or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction[**.**]

E. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM <**Insert drawing designation**>: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and [**mixed with water at Project site to form a slurry or mortar before conveyance and application**] [**or**] [**conveyed in a dry state and mixed with atomized water at place of application**].

1. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:
   a. Grace, W. R. & Co. - Conn.; Grace Construction Products; Monokote Z106 .
   b. Substitutions: See Section 01 25 00 - Substitution Procedures.

2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 1000-lbf/sq. ft. (47.88-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
4. Density: Not less than 22 lb/cu. ft. (350 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
6. Combustion Characteristics: ASTM E 136.
7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 0 or less.
   b. Smoke-Developed Index: 0 or less.
8. Compressive Strength: Minimum 70 lbf/sq. in. according to ASTM E 761.
9. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 .

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

1. Product: As recommended by fireproofing manufacturer.

H. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design. As recommended by fireproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: [**Owner will engage**] [**Engage**] a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.10.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
   1. *Uniform General Conditions for Construction Contracts*, State of Texas, 2010 (UGC).
   2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 SUMMARY

A. Section Includes:

   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

B. Related Sections:

   1. Section 07 84 46 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals (Project s authorized for LEED certification only):

"Product Data for Credit IEQ 4.1" Subparagraph below applies to LEED-NC, LEED-CI, and LEED-CS; coordinate with requirements selected in Part 2.

   1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.

"Laboratory Test Reports for Credit IEQ 4" Subparagraph below applies to LEED for Schools.

   2. Laboratory Test Reports for Credit IEQ 4: For penetration firestopping sealants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard

Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

Retain subparagraph below only after verifying that authorities having jurisdiction will accept modifications handled by method in subparagraph.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
3) FM Global in its "Building Materials Approval Guide."
4) .

D. Preinstallation Conference: Conduct conference at Project site .

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Nelson Firestop Products.
5. NUCO Inc.
6. RectorSeal Corporation.
7. Specified Technologies Inc.

8. 3M Fire Protection Products.
9. Tremco, Inc.; Tremco Fire Protection Systems Group.
10. USG Corporation.
11. Substitutions: See Section 01 25 00 – Substitution Procedures.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

    a. Slag-wool-fiber or rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

END OF SECTION 07 84 13

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers all samples of materials that will contact or affect joint sealants. Use ASTM C 1087 manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. LEED Submittals (Projects authorized for LEED certification only)

1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For sealants and sealant primers used inside the weatherproofing system, documentation indicating that they comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples: For each kind and color of joint sealant required.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.

4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction compatibility and adhesion test reports.

C. Preconstruction field-adhesion test reports.

D. Field-adhesion test reports.

E. Warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period:
   a. Weather Joints, i.e., joints that if failure occurs, will allow water or air infiltration into the building interior provide 20 years from date of Substantial Completion.
   b. Cosmetic joints, provide 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

A. Neutral-Curing Silicone Joint Sealant: ASTM C 920.

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. Dow Corning Corporation.
   b. GE Advanced Materials - Silicones.
   c. Tremco Incorporated.

2. Type: Single component (S).
3. Grade: nonsag (NS).
4. Class: 50.
5. Uses Related to Exposure: Traffic (T) Nontraffic (NT).

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

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. BASF Building Systems.

b. Sika Corporation; Construction Products Division.
c. Tremco Incorporated.

2. Type: Single component (S) or multicomponent (M).
3. Grade: Pourable (P) or nonsag (NS).
4. Class: 25.
5. Uses Related to Exposure: Traffic (T).

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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. BASF Building Systems.
b. Bostik, Inc. ??
c. May National Associates, Inc. ??
d. Pecora Corporation.
e. ITW Polymers Sealants North America.
f. Tremco Incorporated.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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. Pecora Corporation .
b. USG Corporation.

2.6 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

   a. Control and expansion joints in brick pavers.
   b. Isolation and contraction joints in cast-in-place concrete slabs.
   c. Joints between plant-precast architectural concrete paving units.
   d. Joints in stone paving units, including steps.
   e. Tile control and expansion joints.
   f. Joints between different materials listed above.
   g. Other joints as indicated.

2. Joint Sealant: Silicone (Single Component, Pourable, Traffic Grade, Neutral Curing).

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Joints between plant-precast architectural concrete units.
   c. Control and expansion joints in unit masonry.
   d. Joints in dimension stone cladding.
   e. Joints in glass unit masonry assemblies.
   f. Joints in exterior insulation and finish systems.
   g. Joints between metal panels.
   h. Joints between different materials listed above.
   i. Perimeter joints between materials listed above and frames of doors windows and louvers.
   j. Control and expansion joints in ceilings and other overhead surfaces.
   k. Other joints as indicated.

2. Joint Sealant: Silicone (Single Component, Non-Sag, Neutral Curing, Class 50).

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in stone flooring.
   c. Control and expansion joints in brick flooring.
   d. Control and expansion joints in tile flooring.
   e. Other joints as indicated.

2. Joint Sealant: Urethane (Multicomponent, Non-Sag, Traffic Grade, Class 25).
3. Joint Sealant: Preformed foam.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
    e. Joints on underside of plant-precast structural concrete beams and planks.
    f. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
    g. Other joints as indicated.

2. Joint Sealant: Latex (Single Component, Non-Sag).

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated.

2. Joint Sealant: Silicone (Mildew Resistant, Single Component, Acid Curing)

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

    a. Acoustical joints where indicated.
    b. Other joints as indicated.

2. Joint Sealant: Acoustical (Single Component, Non-Sag).

END OF SECTION 079200