SECTION 075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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. Section 035216 – Lightweight Insulating Concrete

C. Section 072216 – Roof Board Insulation

D. Section 076200 – Flashing and Sheet Metal

E. Section 221400 – Facility Storm Drainage

1.2 SUMMARY

A. Roofing System No. 1 - Section includes surface preparation and the application of 60-mil TPO roof system, walkway pads, and non-penetrating roof top pipe supports.

B. Roofing System No. 2 – Section includes surface preparation and the application of fleece backed TPO membrane adhered directly to the light weight insulating concrete, walkway pads, and non-penetrating roof top pipe supports.

1.3 REFERENCE STANDARDS

A. ASTM - American Society of Testing and Materials. A society formed for the development of standards on characteristics and performance of materials, products, systems and services; and the promotion of related knowledge.

B. U L – Underwriters' Laboratories. A non-profit, independent organization which tests devices, systems and materials to determine their performance to life, fire, casualty hazards and crime prevention.

C. ANSI – American National Standards Institute. A private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States.

D. F M – Factory Mutual or Factory Mutual Research Corporation. Has a charter similar to Underwriters' Laboratories.

E. SMACNA – Sheet Metal and Air Conditioning Contractors National Association.

F. AIA – American Institute of Architects

G. NRCA – National Roofing Contractors Association.

H. SCBC – South Carolina Building Code, 2021 Edition

I. SCPC – South Carolina Plumbing Code, 2021 Edition

J. SCEBC – South Carolina Existing Building Code, 2021 Edition

K. IECC – International Energy Conservation Code, 2009 Edition

L. OSHA – Occupational Safety and Health Administration

M. NFPA – National Fire Protection Association

N. ASCE 7 – Minimum Design Loads and associated criteria for buildings and other structures; most recent edition cited by referring code or reference standard.

O. MSS SP-58 - Pipe Hangers and Supports -- Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry.

P. MSS SP-69 - Pipe Hangers and Supports -- Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. All product data shall be the manufacturer’s latest edition.

B. Safety Data: For each type of product.

C. Shop Drawings: Shall be full and complete showing all material to be installed and label fastener spacings, materials used, and measurements.
   1. Tapered Layout
   2. Membrane Adhesive Pattern
   3. Primary Drain Detail
   4. Gutter Detail
   5. Gravel Stop Detail
   6. Membrane Expansion Joint Detail
   7. Deck Expansion Joint Detail
   8. Curb Flashing Detail
   9. Deck Patch Detail
   10. Pipe Flashing Detail

D. Roof Assembly: Contractor shall provide tested assemblies approved and reference in one of the following registries, Florida Product approval, Miami-Dade N.O.A., or FMG RoofNav tested assembly, other agencies may obtain approval prior to bid. Tested assembly shall meet the below criteria.
   a. Fire Rating: UL 790 Class A
   b. Wind Uplift: Refer to Drawings

E. Certificates:
   1. Submit evidence satisfactory to Owner/Designer that the proposed applicator is currently approved by the manufacturer of the roofing materials. Submit copies of "Certificate of License" issued to roofing applicator by manufacturer.
   2. A Manufacturer's Notice of Intent to Issue Roof Warranty, prior to the use of any of the manufacturer's materials on the project.

F. Reports
1. Prior to start of installing work of this Section, and as part of the required written report on the Pre-Application Roofing Conference, submit a written and detailed step-by-step description of the methods of installation as agreed to in the Pre-Application Roofing Conference.

1.5 PROJECT MEETINGS

A. Pre-Application Roofing Conference
1. Approximately two weeks prior to scheduled commencement of roofing installation and associated work, arrange a meeting at project site with installers of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of roof-top units and other work in and around roofing which must precede or follow roofing work including mechanical and electrical work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the work. Record discussions of conference and decisions and agreements (or disagreements) reached and furnish copy of record to each party attending.
2. Review methods and procedures related to roofing work, including, but not necessarily limited to, the following:
a. Review roofing system requirements (Drawings, Specifications, and other Contract Documents) for possible conflicts and resolve.
b. Communication channels and procedures. Organization of contractor, subcontractor, and suppliers.
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and materials usage accounting procedures.
f. Field change orders and procedures
g. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
h. Construction schedule
i. Review work safety requirements.
j. Review interior protections and inspection schedule for interiors.

B. Ongoing Construction Meetings
1. Project meetings shall be conducted at a minimum of once every two-weeks.
a. Project meetings may be conducted virtually unless designer requires an onsite meeting. Only requested individuals will be required to be onsite.
b. Review construction schedule
c. Review Change Orders
d. Review quality control
e. Review problems/issues encountered, and actions taken.

1.6 QUALITY ASSURANCE

A. Coordinated installation: Except as otherwise indicated, perform roofing and flashing work as a single integrated unit of work, without division of responsibility between separate installers (single installer responsibility required).

B. Manufacturer qualifications: Obtain primary products, including roof membrane, base flashings, membrane adhesives, roof insulation boards, roof insulation fasteners and adhesives products from a single manufacturer. Manufacturer must have a minimum of 10 years of documented experience producing the specified type of membrane products. Provide secondary products recommended by the manufacturer of primary products for use with roofing system provided.

C. Installer Qualifications:
   1. A single installer (Roofing Contractor) must perform the work of this Section and have not less than 10 years of successful experience in installation of roofing systems similar to those specified for this project and which is acceptable to and approved and/or licensed by manufacturer of primary roofing materials.
   2. Obtain written certification from manufacturer of roofing system certifying that installer is approved by manufacturer for installation of specified roofing system and approved at a level capable of providing the specified warranty. Provide copy of certification to Owner prior to pre-application roofing conference.
   3. Installer must maintain full-time non-working supervisor/foreman on job site during times that roofing is in progress. Supervisor must have minimum of 10 years of experience in roofing work of similar nature and scope as specified roofing.

D. The roofing systems manufacturer shall provide qualified company personnel to attend pre-construction & in-progress meetings, and to perform periodic weekly job site visits as necessary. The manufacturer shall also provide non-sales related field auditors for the purpose of performing quality assurance inspections, both in-progress and final inspections. Provide copies of the manufacturer’s field auditor inspection report to the Contractor, Designer, and Owner.

E. Manufacturer's inspections: Provide manufacturer's inspection services of roofing application. Manufacturer's inspection services shall include inspection of installation:
   1. within 2-days of start of system installation and ONE Weekly in-progress inspection for duration of installation, immediately after completion. Inspection shall point out deficiencies in workmanship and application of materials during and after work of other trades, requiring access/traffic on finished roofing has been completed. Inspect for damage resulting from the work of other trades subsequent to the "completion of installation".

1.7 PRODUCT HANDLING

A. Delivery:
   1. Deliver materials in manufacturer's original, unopened containers with manufacturer's labels intact and legible.
   2. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.
   3. Deliver enough materials to allow continuous work.

B. Storage:
   1. Store rolled goods on end on raised platforms and protected from the weather until installed in the roofing system.
   2. Deliver, store, and handle materials in accordance with manufacturer’s printed instructions. Deliver materials in manufacturer's original wrappers, dry, and undamaged with seals and labels intact. If inside storage is not available at the job site, protect materials by covering with breathable tarpaulins.
   3. Store insulation materials on raised platforms, protected from the weather, and handled in a manner to avoid edge damage. Wet insulation shall be immediately removed from site.

4. Adhesives, flashing cements, and pail goods must be stored in original containers with lids tightly in place and protected from weather exposure, on raised platforms.
5. Unless otherwise recommended by the manufacturer, store and handle materials to protect them from:
    a. Moisture, whether due to rain, other situations or condensation.
    b. Damage by construction traffic.
    c. Temperatures over 110°F.
    d. Temperatures below 50°F.
    e. Direct sunlight.
    f. Mud, dust, sand, oil, grease, and dirt.
6. Remove products from job site immediately that show indications of moisture damage/infiltration and replace with undamaged materials.

C. Handling:
1. Select and operate materials handling equipment and store materials to keep from damaging existing construction or applied roofing.
2. Immediately remove and dispose of wet materials.
3. Comply with fire, safety, and environmental protection regulations.
4. Do not store materials on roof decks, nor position roofing installation equipment on roof decks in concentrations exceeding design live loads. Contractor shall replace any damaged roof deck caused by improper material storage or overloading of material carts.
5. Minimize traffic atop the work during all phases of installation.
6. Damaged materials shall not be installed.

1.8 PROJECT CONDITIONS

A. Existing Conditions:
1. Along with the roofing applicator and sheet metal installer, verify existing conditions, including:
    a. Roof deck conditions.
    b. Varying deck and wall thickness for length of anchoring devices required.
2. Replace or restore to original condition all materials or work damaged during construction of work of this Section.
3. Protect paving and building walls adjacent to hoists and trash chute when applicable.
    a. Lap protective materials at least 6 in.
    b. Vent plastic sheets are not allowed for purpose of covering materials.
    c. Secure protective coverings against wind.
    d. Leave protective coverings in place until roofing work has been completed.

B. Environmental Requirements:
1. Do not install roofing during rain or start roofing if rain is probable during installation.
2. Do not install roofing when there is ice, frost, surface moisture, or dampness visible on the surface to which roofing is to be applied. The relative humidity shall not be higher than 90%.
3. Do not install roofing if temperatures are 45ºF or lower, unless approved otherwise by the Owner & Manufacturer.

C. Protection:
1. Protect surfaces not intended to receive roofing materials from spillage, dripping, spotting and damage during application of the roofing. Should protection not be effective, or not be provided, restore the respective surfaces to their proper conditions by cleaning, repairing, or replacing, as applicable for the circumstances and as directed by Owner.
2. Immediately protect completed portions of roofing from damage of subsequent construction activities in accord with contract requirements. Repair, replace, or as

otherwise required to remedy any damage to roofing resulting from construction activities, for the entire duration of construction.

D. Sequencing:
1. Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials.

1.9 WARRANTY AND GUARANTY

A. Responsibility: It is the sole responsibility of Contractor to review Contract Documents, field conditions, to coordinate all requirements and conditions with roofing applicator and manufacturer for issuance of warranties and guaranties. Changes required for warranty and guaranty issuance shall be performed at no additional cost to Owner.

B. Warranty and Guaranty: Upon completion of the work of this Section, and as a condition of its acceptance, deliver to Owner the following:
1. Applicator's warranty: Written warranty, as provided at the end of this Section, signed by Contractor and an officer of roofing subcontractor's firm, agreeing to maintain the work of this Section, and its associated flashings and accessories, free from blistering and the penetration of water for a period of 5 years following the Date of Substantial Completion. None leaking blisters exclusions are not acceptable and require immediate repairs by Contractor.
2. Onsite Warranty Signage: Roof Contractor shall provide an onsite roof warranty information signage affixed to the interior space of the roof access hatch or door. The signage must be a minimum of 8.5-inches by 11-inches in size. The signage must include the following information.
a. Roof system manufacturer.
b. Warranty number.
c. Installation date.
d. Warranty expiration date.
e. Name and contact information including phone number and email address of roof installer and manufacturer.

C. MANUFACTURER'S GUARANTY:
1. Written guaranty, full systems NDL warranty to include flashing endorsement signed by an officer of roofing materials manufacturer's company, agreeing to repair or replace the roofing system and damaged roof materials, from penetration of water through the roof membrane for a period of 20 years following the Date of Substantial Completion, without additional cost to Owner. Warranty must meet roof assembly performance criteria noted on paragraph 1.010 Design and Performance Criteria.
a. Manufacturer’s Guaranty shall include, at no additional cost to the owner, a 72-mph wind rider.
2. It is the sole responsibility of the Contractor to ensure prior to bidding the project that the proposed system he is proposing meets the noted warranty requirements without exceptions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. GAF

B. Carlisle Syntec

C. Johns Manville

D. Approved alternative prior to bid.

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MATERIALS

A. Thermoplastic Polyolefin Membrane: (Roof System No. 1) ASTM D6878, Nominal 60-mil overall thickness with minimum 21 mil polymer thickness above the scrim. A minimum tearing strength of 1205 pounds as tested in accordance with ASTM D751. A minimum puncture resistance of 300 pounds as tested in accordance with FTM 101C, Method 2031.
   1. Maximum sheet width of 12-feet for fully adhered membrane.
   2. Membrane color: White.

B. Fleece-Back Thermoplastic Polyolefin Membrane: (Roof System No. 2) ASTM D6878, minimum 60 mil waterproofing thickness composed of a minimum 21 mil polymer thickness above the scrim. A minimum tearing strength of 120 pounds as tested in accordance with ASTM D751. A minimum puncture resistance of 300 pounds as tested in accordance with FTM 101C, Method 2031. Overall thickness of 115 mils with a minimum 8-ounce fleece backing.
   1. Maximum sheet width of 12-feet for fully adhered membrane.
   2. Membrane color: White.

C. Membrane Adhesive & Base Flashing Membrane Adhesive (Solvent-Based), as manufactured by the approved roofing system manufacturer.

D. Fleece-Back Membrane Adhesive: (Roofing System No. 2) Single or double low-rise polyurethane foam as manufactured by the approved roofing system manufacturer. For use to adhere roofing fleece-back membrane substrate.

E. General Purpose Sealant (to match membrane color). As manufactured by the approved roofing system manufacturer.

F. T-Joint Covers. As manufactured by the approved roofing system manufacturer.

G. Inside/Outside Molded Corners. As manufactured by the roofing system manufacturer. The use of field-fabricated inside/outside corners is not acceptable.

H. Large and Small Pipe Flashing. As manufactured by the roofing system manufacturer.

I. Universal Pipe Boot. As manufactured by the roofing system manufacturer. Pre-fabricated flashing boot shall include a draw band for securing the top of the flashing boot to the pipe.

J. Unsupported Membrane. As manufactured by the approved roofing system manufacturer. Minimum 55 mil thickness.

K. Cut Edge Sealant. As manufactured by the approved roofing system manufacturer.

L. Membrane Cleaner: As manufactured by the approved roofing system manufacturer. For use in removing foreign debris from the membrane prior to welding.

M. Membrane-Clad Metal: As manufactured by the approved roofing system manufacturer, ASTM A653, minimum 24 ga. galvanized steel clad with membrane.

N. Termination Bar. As manufactured or approved by the approved roofing system manufacturer.

O. Polyurethane Caulk: As manufactured and/or approved by the roofing system manufacturer. To be applied at those locations identified by the manufacturer.

P. Water Cut-Off Mastic: As manufactured and/or approved by the roofing system manufacturer. To be applied at those locations identified by the manufacturer.

2.3 MEMBRANE WELDING MACHINES:

A. As approved by the roofing system manufacturer. Contractor shall provide written documentation that operators have received the roofing system manufacturer's required training to operate equipment. Welders shall be maintained in good working order and shall be operated and maintained in accordance with the welding machine manufacturer's written instructions.

2.4 WALKWAY PADS:

A. As manufactured by the approved roofing system manufacturer. Nominal 30" wide.

2.5 FOAM CORE:

A. Compression tube that is a minimum of 1.5 times larger than the expansion joint opening, as approved for use by the approved roofing system manufacturer.

2.6 ROOFING NAILS:

A. With minimum 1" head, such as Simplex nails or approved equal.

2.7 FASTENERS

A. Membrane Fastener: Minimum #15 steel screw roof fastener for steel decking as approved by the approved roofing materials manufacturer to resist uplift requirements shown on plans. Minimum pull-out in new Grade C, 22 gauge decking is 640 lbs. Fasteners must pass a minimum of 15 cycles in the Kesternich SFW 2.0s DIN 50018 test with less than 15% red rust. Provide fasteners of lengths to penetrate the top of the roof deck a minimum of 1-inch and no more than 1-1/2-inch.

B. Seam Plate: Minimum 2-3/8" grooved, galvalume steel plate. As approved by the roofing materials manufacturer to use in conjunction with the specified membrane fasteners to attach thermoplastic membrane.

2.8 SEPERATOR BOARD:

A. Gypsum Fiber Board, nominal 1/4” thick, ASTM C 1177 or C1278, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E 84, nominal 900 psi minimum compressive strength, Class A, non-combustible, 4' x 8' board size. Approved for use by the roofing system manufacturer to adhere membrane flashings.

2.9 ROOF TOP PIPE SUPPORTS

A. System Description: Support piping on roof with an engineered prefabricated pipe support system designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases, made of high-density polypropylene or polycarbonate plastics with UV Protection, a HDG structural steel frame and suitable pipe hangers for the application. Nuts, threaded rods and washers shall be HDG, spring nuts and bolts for spring nuts will be electro-plated. System shall be custom designed to fit piping and conduit to be installed and the actual conditions of service.

B. Manufacturers
1. Miro Industries, 844 South 430 West Suite 100, Heber City, Utah,
2. CADDY, a registered trademark of Erico International Corporation, 31700 Solon Road, Solon, Ohio,
3. PHP Systems, 5534 Harvey Wilson Drive, Houston, Texas,
4. or approved equal prior to bid.

C. Materials
1. Support Spacing: 8 feet unless otherwise specified by the manufacturer and within 12 inches of elbows and junctures.
2. 3-RAH-12 with polycarbonate base and roller for piping up to 3” in diameter.
3. 6-RAH-12 with polycarbonate base and roller for piping up to 6” in diameter.
4. Two (2), Model 2.5-Conduit Support-2 for electrical juncture boxes.
5. Model 1.5 for condensation lines.
6. Refer to manufacturer recommendations and local code requirements for line and piping support.

D. Roof Drains and Drain Extensions – Refer to Section 221400

PART 3 - EXECUTION

3.1 INSPECTION

A. The substrate shall be clean, smooth, dry, free of debris and all foreign matter prior to installation of the roof membrane. Application of new materials shall constitute approval of the substrate by the Roofing Contractor.

B. Insulation joints with gaps greater than ¼" shall be filled with roof insulation in order to provide a smooth surface.

3.2 FULLY ADHERED ROOF MEMBRANE INSTALLATION (Roofing System No.1)

A. Unroll the membrane sheets and allow them to relax in accordance with the roofing system manufacturer's recommendations and ambient temperature at the time of this phase of the work.

B. Remove any damaged or creased membrane sections, and discard.

C. All membrane surfaces to be welded shall be clean and dry. No adhesive shall be present within the lap areas.

D. Solvent-Based Adhesive
1. Fold the sheet back evenly without wrinkles onto itself to expose the underside. Position the sheet at any field splices by overlapping the membrane approximately 5 inches, unless the manufacturer has a more stringent requirement. Once the membrane is in place, mark the bottom sheet ½" - ¾" from the edge of the top sheet every 4' - 6' with a lumber crayon or similar type marking device.
2. Sweep the substrate with a stiff broom to remove materials that will interfere with the proper installation of the membrane.
3. Apply the manufacturer's bonding adhesive to both the exposed underside of the sheet and the substrate to which it will be adhered to allow approximately the same drying time. Apply adhesive to provide an even and uniform film thickness. Care shall be taken not to apply adhesive over an area that is to be later cleaned and spliced to another sheet of flashing.
4. Allow adhesive to flash off until tacky. Touch the adhesive surface with a clean dry finger to be certain that the adhesive does not stick or string. Also push forward on the adhesive at an angle to ensure that the adhesive is ready throughout its thickness.
5. Starting at the fold, roll the previously coated portion of the sheet into the coated substrate slowly and evenly to minimize wrinkles. Compress the bonded half of the sheet to the substrate with a stiff push broom.
6. Fold the unadhered half of the membrane sheet back onto itself, and repeat the bonding procedure to complete the bonding of the sheet.

E. At eaves, the membrane shall be mechanically fastened to the eave wood blocking using membrane fasteners and plates spaced no more than 12 inches on-center. Extend an additional membrane over the wood blocking a distance to match the depth of the gutter at gutter eaves or the rake flashing at rake eaves. Extend the additional membrane a minimum of 5 inches onto the roofing past the eave membrane fasteners. Fully adhere the membrane to the wood blocking and fasten to the vertical face of the wood blocking using roofing nails spaced no more than 12 inches on-center. Fully weld the membrane to the roofing. Set the edge of the membrane in continuous multi-purpose tape.

F. Vertical Surfaces:
1. At vertical surfaces, turn the membrane up the vertical surface a minimum of 2 inches and fully adhere using the manufacturer's approved adhesive. Secure the membrane to the substrate using the roofing system manufacturer's approved termination bar or fasteners/plates, and secure in accordance with their written instructions. Fasteners shall penetrate the substrate at spacings and depths approved by the roofing system manufacturer.
2. At the base of curbs, parapets, and other vertical surfaces, the membrane shall be mechanically fastened to the metal decking using membrane fasteners and plates spaced no more than 12 inches on-center.

G. Primary Roof Drains: Where membrane laps are within 18-inches of the drain bowl, furnish and install a minimum 36" x 36" target patch centered over the roof drain and secure the exterior

edge of the membrane to the roof deck as specified. Cut an opening in the target patch at the center of the drain bowl so that the membrane extends past the interior edge of the drain bowl a minimum of 1 inch. Fully weld target patch and field membrane splices a minimum of 2 inches on all sides. Weld in accordance with this section of the specification. Apply water block between the target patch and the drain bowl prior to applying the drain clamping ring.

H. Furnish and install the roofing system manufacturer's patches at all required locations such as intersecting field seams. Apply the manufacturer's approved seam caulk, as required, at locations specified by the roofing system manufacturer.

I. Prior to final inspection, the surface of the membrane shall be cleaned of all debris, dust, and foreign material. This may require the use of water, detergents, and other cleaning agents approved by the roofing system manufacturer. Contractor will be responsible for providing the necessary items to perform this task. Do not use any abrasive pads that can score the polymer.

3.3 FLEECE-BACK ROOF MEMBRANE INSTALLATION (Roofing System No. 2)

A. Sweep the substrate with a stiff broom to remove materials that will interfere with the proper installation of the membrane.

B. Roll out membrane and allow the membrane to "relax" in accordance with manufacturer written instructions. Back roll the membrane prior to application.

C. Secure the fleece or felt back membrane to the substrate using low-rise adhesive beads at spacings in accordance with the manufacturer's requirements to resist the uplift pressures and/or ratings shown on drawings for each zone and the approved tested assembly assembly number. However, spacings shall not to exceed 6 inches on-center in the field (Zone 1), 6 inches on center for the perimeter (Zone 2), and 4 inches on center for the corner (Zone 3). Zone definition is indicated on drawings.

D. Using a water-filled, foam covered lawn roller, firmly press the membrane to ensure full contact with the adhesive layer by frequent rolling in two directions.

E. Membrane shall be smooth to the substrate, and wrinkles in the membrane shall be grounds for rejection.

F. Low-rise foam adhesive shall not be used on vertical surfaces.

G. At eaves, extend the membrane over the wood blocking a distance to match the depth of the gutter at gutter eaves or the rake flashing at rake eaves. Fully adhere the membrane to the wood blocking and fasten to the vertical face of the wood blocking using roofing nails spaced no more than 12 inches on-center. Set the edge of the membrane in continuous multi-purpose tape.

H. Vertical Surfaces:
1. At vertical surfaces, turn the membrane up the vertical surface a minimum of 2 inches and fully adhere using the manufacturer's approved adhesive. Secure the membrane to the substrate using the roofing system manufacturer's approved termination bar or fasteners/plates, and secure in accordance with their written instructions. Fasteners shall penetrate the substrate at spacings and depths approved by the roofing system manufacturer.

2. At the base of curbs, parapets, and other vertical surfaces, the membrane shall be mechanically fastened to the metal decking using membrane fasteners and plates spaced no more than 12 inches on-center.

I. At drains, end the fleece-back membrane approximately 12 inches from the center of the drain in all directions. Furnish and install new 36” x 36” membrane flashing target patch centered over the drain. Cut an opening in the membrane at the center of the drain bowl so that the membrane extends past the edge of the drain bowl a minimum of 1 inch. Apply water block between the membrane and the drain bowl prior to applying the drain clamping ring. Fully adhere the target patch to the field membrane using the membrane manufacturer bonding adhesive. Fully weld target patch splices to the field membrane a minimum of 2 inches on all sides. Cover the joint with an additional strip of membrane that extends a minimum of 3 inches from the joint in all directions. Fully weld the stripping to the roof membrane and target patch. Weld in accordance with this section of the specification. Refer to Drawings.

J. At joints in the fleece-back membrane without a selvedge edge, butt the membrane together at the splice location. Furnish and install an unsupported membrane strip over the joint and extend it past the joint a minimum of 3 inches in every direction.

K. Furnish and install the roofing system manufacturer’s patches at all required locations such as intersection field seams. Apply the manufacturer’s approved seam caulk, as required, at locations specified by the roofing system manufacturer.

3.4 BASE FLASHINGS INSTALLATION

A. Separator Board: At curbs and walls above roof level where bituminous flashings have been removed and new plywood or metal is not installed, furnish and install a new separator board over the substrate where new membrane flashings will be applied. Secure the board to the substrate using specified fasteners and insulation plates at spacings not to exceed 18 inches on-center, in every direction and a minimum of 2 rows of fasteners. Fasteners shall penetrate the substrate a minimum of 1 inch.

B. Roll out the membrane to be used for base flashings and allow to relax in accordance with the roofing system manufacturer’s written instructions.

C. Flashing pieces shall extend onto the roof a minimum 3 inches past the roof membrane fasteners at the edge of the sheet and up the vertical surface a minimum of 8 inches.

D. Fully adhere the flashing to the substrate using the roofing system manufacturer’s approved flashing adhesive.

E. Base flashing shall be smooth to the substrate, and wrinkles in base flashing shall be grounds for rejection.

F. If base flashings terminate at a corner and edges would be exposed, furnish and install new 4-inch x 4-inch L-type membrane-clad metal closures with an exterior edge caulking cove. If base flashings terminate at walls and edges would be exposed, furnish and install new 4-inch-wide L-type membrane-clad metal closures with an exterior edge caulking cove. The closure shall be set in water cut-off mastic or butyl tape, and fastened to the substrate using appropriate fasteners at spacings not to exceed 12 inches on center. Completely hot air weld the base flashings to the membrane-clad metal. Apply a non-shrinking sealant, such as NP-1 or approved equal, to the caulking cove at the exterior edge of the closure. Completely remove all residual asphalt from the substrate prior to installing any sealant or caulking.

G. At inside and outside corners of curbs and parapets, Contractor shall use the roofing system manufacturer's pre-fabricated corner pieces. The use of field-fabricated pieces is not acceptable. Pre-fabricated pieces shall be installed in accordance with the roofing system manufacturer's written instructions.

H. At locations where base flashing seam transition from vertical to horizontal, the contractor shall furnish and install new unsupported patches at these locations shall extend a minimum of 3 inches past the transition, centered over the seams in all directions.

I. Use the roofing system manufacturer's termination bar at base flashing that exceed 36 inches in height. Install rows of termination equally spaced up the wall. Fastener spacings not to exceed 8 inches on center. Set flashing in water cut-off mastic, set the bar over the edge of the base flashing, and apply caulk at the top of the flashing.

J. At a minimum, extend base flashings up and over the top horizontal surface of curbs and inside the curb a minimum of 1 inch, unless otherwise stated in specification or shown on drawings.

3.5 EXPANSION JOINTS:

A. Install new membrane expansion joints as indicated on drawings. Secure the field membrane at the base of curbs as specified herein. Form a membrane envelope that matches the depth of the curb and roof insulation. Fill envelope with batt insulation. Furnish and fully adhere continuous foam core over the opening using the membrane manufacturer's bonding adhesive. Cover the joint and foam core with the base flashings and/or additional membrane as indicated on drawings. Reinforce the seams over the expansion joint with additional membrane that shall extend a minimum of 3 inches past the expansion joint seams in every direction.

3.6 HEAT WELDING

A. Hot air weld all sheet seams using either a machine or hand-held hot air welder approved by the roofing system manufacturer. A copy of the operating instructions shall be provided to the Designer prior to the start of the project.

B. Monitor the temperature of the hot air welder so as to minimize the amount of smoke that should develop and to ensure that the material from the bottom of the sheet begins to soften and flow from the seam. Hand held welders shall insure that membrane welding is immediately followed by a hand roller to press the heated membrane surfaces together with slow, even movements.

C. All seams shall be manually probed using a blunt rounded instrument daily. Any fishmouths or other seam defects where the seam is not fully adhered shall be repaired in accordance with the roofing system manufacturer's instructions.

D. After seams have set for approximately 8 hours, the Contractor shall make a minimum of 3, 2" x 12" test cuts across the seam, with at least one of the test cuts taken from the first seam of the day. If multiple welders are used, the minimum test cuts are applicable to each welder used. Test cuts shall be repaired by the Contractor daily and shall be done at no additional cost to the Owner. In lieu of test cuts, the contractor may perform peel tests. Peel test shall be performed with two 4" x 12" pieces of membrane that shall be welded together 1-1/2 inch for the machine welder and 2 inches for hand welders. The membrane shall be pulled apart across the seam. Test shall be dated, and one test shall be performed every time a welding device is turned on. An archive of test shall be available for Designer inspection.

1. Peel-test shall only be considered successful if:
   a. there is a complete cohesion failure in a polymer layer, and/or
   b. there is an adhesion failure between a polymer layer and the scrim.
   c. Other instances as stated in writing by the membrane manufacturer.

E. Seams shall be tested in accordance with the roofing system manufacturer's instructions and evaluated for seam integrity. Seams that fail this test shall be subject to additional test cuts, as directed by the Designer and/or roofing system manufacturer, in order to further quantify the extend of the deficient condition. Repairs to deficient seams and/or test cut locations shall be performed by the Contractor at no additional cost to the Owner.

F. Seal the edges of the membrane where the reinforcing fabric is cut with the roofing system manufacturer's approved seam sealant. Such work shall be done on a daily basis.

3.7 PIPE FLASHING INSTALLATION

A. Pipe penetrations shall be flashed using pre-manufactured pipe flashings. Cut the pipe flashing so that it will fit tight to the pipe penetration. Ensure that the field membrane is secured at the base of the pipe as required herein. Fully weld the pipe flashing flange to the field membrane in accordance with membrane manufacturer written instruction. Set the pipe flashing in water block against the pipe penetration, and secure the top of the pipe flashing to the pipe using a draw-band clamp. Seal the top of the pipe flashing to the pipe penetration using NP-1 sealant, or approved equal.

B. Minimize the use of pitch pans. Install any necessary pre-molded pitch pans in accordance with manufacturer written instructions. Prior to applying pourable sealer, seal the penetration though the membrane with sealant.

3.8 WALKWAY PAD

A. Apply one row of walkway pads around all roof access hatches, at the base of roof access doors, at the top and bottom of ship ladders, and as shown on drawings. Install walkway pads in accordance with the roofing system manufacturer's written instructions. Refer to Drawings.

B. Walkway pads shall be spaced approximately 1 inch apart. Leave small opening on the downslope side of walkway pads to allow for any water beneath the pads to exit.

C. Clean the surface of the membrane to receive the walkway pads in accordance with the roofing system manufacturer's written instructions. Fully adhere the walkway pad to the membrane and hot-air weld all sides of the pads to the surface of the membrane in accordance with the roofing system manufacturer's written instructions.

3.9 ROOF TOP PIPE SUPPORTS

A. The use of wood for supporting piping is not permitted.

B. Support Spacing: 8 feet unless otherwise specified by the manufacturer and within 12 inches of elbows and junctures.

C. Furnish and install walkway protection pads. Membrane pads shall be partially adhered with manufacturers approved adhesive to the substrate. The pad shall be a minimum of 18" x 18" in size but shall be a minimum of 12 inches wider than the base.

D. Adhere support bases in the middle of walkway protection pads using continuous double-sided butyl tape on all four sides of the base. Leave a minimum 1-inch gap at each side for nominal water exit underneath base.

E. At condensation lines, secure the condensate lines to the plastic bases using steel U-clamps and nails. Extend all lines to the nearest gutter or primary roof drain. Set the plastic bases in double-sided butyl tape on a nominal 12" x 12" strip of walkway pad.

F. Once all supports are in place, adjust the height of supports so that piping is uniformly loaded.

G. Install pipe supports in accordance with manufacturer written instructions.

3.10 Roof Drains shall be at the height of the adjacent roof refer to Section 221400.

3.11 FIELD QUALITY REQUIREMENTS:

A. Manufacturer's Field Services: Upon Owner's request, provide material manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Minimum Manufacturer Inspections: Provide inspections by a Technical Representative employed by the roofing system manufacturer who shall not perform any sales functions. Contractor shall complete any necessary repairs required for issuance of warranty. Minimum schedule of material manufacturer inspections:
1. Pre-Construction Conference
2. Mock-Up Evaluation
3. 25% Completion
4. 50% Completion
5. Final Completion

C. Contractor shall provide Owner and Designer a copy of the manufacturer’s inspection report within 48-hours of each inspection.

D. Prior to final inspection, the surface of the membranes shall be cleaned of all debris, dust, and foreign material. This may require the use of water, detergents, and other cleaning agents approved by the roofing system manufacturer. Contractor will be responsible for providing the necessary items to perform this task. Do not use any abrasive pads that can score the polymer.

3.12 CLEANING AND PROTECTION

A. Remove all packaging, unused fasteners, adhesive, and other installation materials from the project site.

B. Remove adhesive from exposed surfaces of supports and bases and leave the work in clean condition.

C. Provide protection as required to leave the work in undamaged condition at the time of substantial completion.

END OF SECTION 075419