SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adhered thermoplastic polyolefin (TPO) roofing system.
   2. Roof insulation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 WORK BY OWNER

A. Asbestos testing shall be conducted by Owner.

1.4 PRECONSTRUCTION CONFERENCE

A. Prior to bid submittal, the roofing contractor shall schedule a job site inspection to observe actual conditions and verify all dimensions on the roof. The job site inspection may occur on the day of the pre-bid meeting or prior to such a meeting. Should access to the roof be necessary before or after the pre-bid meeting, the contractor must contact the owner's representative to coordinate an appropriate time.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.6 EXTENT OF WORK

A. Provide all labor, material, tools, equipment, and supervision necessary for the removal of the existing roofing system and to complete the installation of the TPO (Thermoplastic Polyolefin) reinforced membrane Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.

B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.

C. The roofing contractor shall confirm all given information and advise the building owner, prior to bid, of any conflicts that will affect their cost proposal.
1.7 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings showing layout, details of construction and identification of materials.
C. Samples for Verification: For the following products:
   1. Sheet roofing, of color required.

1.8 INFORMATIONAL SUBMITTALS
A. A sample of the manufacturer's Membrane System Warranty.
B. Certification from the membrane manufacturer indicating the membrane thickness over the reinforcing scrim (top ply membrane thickness) is nominal 15 mil or thicker.
C. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
D. Certification of the manufacturer's warranty reserve.

1.9 CLOSEOUT SUBMITTALS
A. Maintenance Data: For roofing system to include in maintenance manuals.
B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the specifier prior to the issuance of the manufacturer's warranty.
C. Manufacturer’s warranty.

1.10 QUALITY ASSURANCE
A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
B. The membrane must be manufactured by the material supplier. Manufacturer’s supplying membrane made by others are not acceptable.
C. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
D. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least five (5) years successful experience installing single-ply TPO roofing systems.
and having installed at least three (3) roofing application or several similar systems of equal or greater size within one year.

E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.

F. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer’s installation procedures must be supported by a written certification on the manufacturer’s letterhead and presented for the specifier’s consideration.

G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer’s final inspection.

1.11 TEMPORARY FACILITIES AND CONTROLS

A. Temporary Utilities:
   1. Water and power for construction purposes are available at the site and will be made available to the roofing contractor. Temporary lights, if needed shall be provided by the roofing contractor.
   2. Provide all hoses, valves and connections for water from a source designated by the owner when made available.
   3. When available, electrical power should be extended as required from the source. Provide all trailers, connections and fused disconnects.

1.12 JOB CONDITIONS, CAUTIONS AND WARNINGS

A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.

B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

C. When loading materials onto the roof, the Authorized Roofing Applicator must comply with the requirements of the structural engineer to prevent overloading and possible disturbance to the building structure.

D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
F. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

H. New roofing shall be complete and weather tight at the end of the work day.

I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

J. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application.

K. During the roofing contractor's performance of the work, the building owner will continue to occupy the existing building. The contractor shall take precautions to prevent the spread of dust and debris, particularly where such material may sift into the building. The roofing contractor shall provide labor and materials to construct, maintain and remove necessary, temporary enclosures to prevent dust or debris in the construction area(s) from entering the remainder of the building.

L. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.

M. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.

N. Store moisture susceptible materials above ground and protect with waterproof coverings.

O. Remove all traces of piled bulk material and return the job site to its original condition upon completion of the work.

1.13 WARRANTY

A. Provide manufacturer’s 20 year Total System Warranty covering both labor and material with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 90 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.

B. Pro-rated System Warranties shall not be accepted.

C. Evidence of the manufacturer’s warranty reserve shall be included as part of the project submittals for the specifier’s approval.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Carlisle SynTec Incorporated.

B. Source Limitations: Obtain components including roof insulation, fasteners, air infiltration resistance barrier, non-metal flashings, bonding adhesives, sealants, mastics, weathered membrane cleaner, sealers and pre-molded accessories for roofing system from same manufacturer as membrane roofing or accepted by the membrane manufacturer as compatible and covered by the warranty.

2.2 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

C. The specified roofing assembly must have been successfully tested by a qualified testing agency to resist the following design uplift pressures, calculated according to the International Building Code (IBC) and after multiplying the results with a safety factor of two:

2. Perimeter Uplift Pressure: 72 lbs/sq. ft.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low slope roof products.

E. Roofing system shall meet CRRC (Cool Roofing Council) requirements for reflectance and emittance. When tested in accordance with ASTM C1549 the roofing membrane shall have an initial solar reflectance of not less than 0.79 and a 3-year aged reflectance of 0.70. The material shall also have an initial emittance of no less than 0.90 and a 3-year aged emittance of no less than 0.86 when tested accordance with ASTM C1371.

F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, reinforced TPO (Thermoplastic Polyolefin) membrane as needed to complete the roofing system.
1. Subject to compliance with requirements, provide Carlisle SynTec Incorporated Sure-Weld 60-mil thick, white color. Membrane thickness over the reinforcing scrim (top-ply thickness) shall be nominal 15 mil thick or greater. Membrane sheets in rolls 12', 10' or 8' wide by 100' long

2.4 SUBSTRATE BOARDS

A. Substrate/Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

1. Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; DensDeck Prime distributed by Carlisle.

2.5 ROOF INSULATION

A. Polyisocyanurate Board, Fiber-Reinforced Paper Faced ASTM C 1289-06, faced, Type II, Class 1, Grade 2 (20 psi). FM Class 1 approval for steel roof-deck constructions (FM 4450).

1. Manufacturers: Subject to compliance with requirements, provide products by the following:


B. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to minimum 1/4” per foot slopes.

2.6 AUXILIARY ROOFING MATERIALS

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

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

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

C. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
2.7 ADHESIVES AND CLEANERS

A. Adhesives and Cleaners: All products shall be furnished by Carlisle Syntec, and specifically formulated for the intended purpose:

1. **Sure-Weld Bonding Adhesive**: A high-strength, synthetic rubber adhesive used for bonding Sure-Weld membrane to various surfaces. The adhesive is applied to both the membrane and the substrate at a coverage rate of approximately 60 square feet per gallon per finished surface (includes coverage on both surfaces).

2. **Cut-Edge Sealant**: A white or clear colored sealant used to seal cut edges of reinforced Sure-Weld membrane. A coverage rate of approximately 225 - 275 linear feet per squeeze bottle can be achieved when a 1/8" diameter bead is applied.

3. **Water Cut-Off Mastic**: Used as a mastic to prevent moisture migration at drains, compression terminations and beneath conventional metal edging (at a coverage rate of approximately 10' per tube or 100' per gallon).

4. **Universal Single-Ply Sealant**: A 100% solids, solvent free, voc free, one part polyether sealant that provides a weather tight seal to a variety of building materials. It is white in color and is used for general caulking such as above termination bars and metal counter flashings and at scuppers.

5. **Thermoplastic One-Part Pourable Sealer**: A one-part, moisture curing, elastomeric polyether sealant used to fill TPO Molded Pourable Sealant Pockets. Packaged in 4, 2-liter foil pouches inside a reusable plastic bucket. 1 pouch will fill 2 TPO Molded Pourable Sealant Pockets.

6. **Weathered Membrane Cleaner**: Used to prepare membrane for heat welding that has been exposed to the elements or to remove general construction dirt at an approximate coverage rate of 400 square feet per gallon (one surface).

7. **TPO Primer**: A solvent-based primer used to prepare the surface of Sure-Weld Membrane prior to application of Pressure-Sensitive Coverstrip and TPO Pressure-Sensitive RUSS.

8. **TPO Low VOC Primer**: A solvent-based, low solids primer used to prepare the surface of Sure-Weld Membrane prior to application of Pressure-Sensitive Coverstrip and TPO Pressure-Sensitive RUSS. This low VOC product is ideal for use in states where environmental issues are a concern.

9. **Insulation Adhesive**:
   a. **Flexible FAST Adhesive**: An elongating impact resistant two-component insulating urethane adhesive used to attach insulation.
      1) Adhesive to provide 150% elongation in conjunction with fleece backed membrane – ASTM D412.
      2) MDI content of Part A material less than 25%.
   b. **FAST Adhesive (for bonding to roof deck)**: A two-component insulating urethane adhesive used to attach insulation.
   c. **Type III or IV Asphalt**: Alternate for bonding insulation to prepared concrete deck, use full mopping.

2.8 FASTENERS AND PLATES

A. To be used for mechanical attachment of insulation and to provide additional membrane securement (verify with manufacturer most appropriate fasteners and plates for project conditions, wind speed and warranty requirements):

1. **HP- Fasteners**: a threaded, #14 fastener with a #3 phillips drive used with steel and wood roof decks.
2. **HP-X Fasteners**: A heavy duty #15 threaded fastener with a #3 phillips drive used for membrane or insulation securement into steel, wood plank or minimum 15/32 inch thick plywood when increased pullout resistance is desired.

3. **Piranha Plates**: A 2-3/8” diameter metal barbed fastening plate used with Carlisle HP-X or HP-14-10 Fasteners for membrane securement. This plate can be used for insulation securement.

4. **Insulation Fastening Plates**: a nominal 3 inch diameter plastic or metal plate used for insulation attachment.

5. **CD-10 Fasteners**: A non-threaded, hammer driven fastener used with structural concrete roof decks rated 3,000 psi or greater.

6. **HP 14-10 Fasteners**: A #14 threaded fastener with a #3 phillips drive used for minimum 3,000 psi concrete decks.

7. **HP Term Bar Nail-Ins**: A 1-1/4” long expansion anchor with a zinc plated steel drive pin used for fastening the Carlisle Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.

2.9 **METAL EDGING AND MEMBRANE TERMINATIONS**

   A. **General**: All metal edging shall be tested and meet ANSI/SPRI ES-1 standards and comply with International Building Code.

   B. **Re-use existing sheet metal flashings, if in good condition, or replace as needed to fulfill warranty requirements. Match any new flashing in profile and color to existing.**

PART 3 - EXECUTION

3.1 **ROOFING INSTALLATION, GENERAL**

   A. **Comply with the manufacturer’s published instructions for the installation of the membrane roofing system including proper substrate preparation, job site considerations and weather restrictions.**

   B. **Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.**

   C. **Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.**

3.2 **ROOF SUBSTRATE PREPARATION**

   A. **It is the roofing contractor’s responsibility for ensuring that the substrate is acceptable for the new roofing system.**

   B. **Before any tear-off of the existing built-up roofing systems, remove all gravel with a mechanical broom and mechanical vacuum.**
C. Removed materials shall become the property of the roofing contractor and shall be removed from the site. Debris and scrap shall be removed from the work area daily.

D. Protect other work from tear-off of existing roofing systems and installation of new roofing. Prevent debris and roofing materials from entering or clogging roof drains. Replace/restore other work damaged by installation of roofing system work.

E. If removal of the existing built-up roofing systems will damage the existing rigid insulation then the existing roof system shall be removed down to the structural deck. If components are discovered during installation that could be detrimental to the performance of the new roof system, they should be brought to the attention of the Architect for corrective action.

F. Where existing rigid insulation is not be removed, roofing contractor shall be responsible for assuring that all wet insulation and/or wet substrate materials are removed in a re-roofing application. The best diagnostic technique is taking and evaluating a series of roof cuts. There are three other techniques that are currently available to make this determination by indirect means. These are:
   1. Nuclear moisture detection
   2. Infrared thermography
   3. Electric capacitance
      These techniques provide measurement of factors that can be associated with the presence of moisture, which can then be verified with the use of roof core cuts to confirm the results of the non-destructive testing.

3.3 INSULATION INSTALLATION

A. Install rigid insulation over roof deck to the following requirements:
   1. Examine roof deck for suitability to receive insulation. Verify that substrate is dry, clean, and free of foreign material that will damage insulation installation.
   2. Verify that deck is structurally sound to support installers, materials, and equipment without damaging or deforming work.
   3. Verify that deck is structurally sound to support installers, materials, and equipment without damaging or deforming work.
   4. Clean surfaces thoroughly prior to installation.
   5. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   6. Install specified insulation in accordance with manufacturer's latest printed instructions.
   7. Do not leave installed insulation exposed to weather. Cover and waterproof immediately after installation. No more insulation should be installed than can be completely covered with membrane on the same day.
   8. Foam insulation products are combustible, they should be properly protected from exposure to fire during storage, transit and application.
  10. Seal exposed insulation joints at the end of each day. Remove seal when work resumes.
  11. Remove installed insulation that has become wet or damaged and replace with new solid and dry insulation material.
      a. Install insulation panels with approved mechanical fasteners. Each insulation panel must be secured to the roof deck with approved fasteners appropriate to the deck type. Approved adhesives or Type III or IV Asphalt may be used for bonding...
insulation to prepared concrete deck at portion of building where concrete roof deck occurs.

12. Remove trash and construction debris from insulation before application of roofing membrane.

13. Protect installed products until completion of project.

14. Protect installed insulation traffic by use of protective covering materials during and after installation.

B. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.4 ADHERED ROOFING INSTALLATION

A. Position roofing membrane over the acceptable substrate. Fold membrane sheet back onto itself so half the underside of the membrane is exposed.

B. Apply Bonding Adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Bonding Adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.

1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.

2. Fold back the unbonded half of the sheet and repeat the bonding procedures.

C. Position adjoining sheets to allow a minimum overlap of 2 inches to provide a minimum 1-1/2” hot air weld.

D. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

3.5 MEMBRANE HOT AIR WELDING PROCEDURES

A. Hot air weld the roofing membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's specifications. At all splice intersections, roll the seam with a silicone roller immediately after welder crossed the membrane step-off to ensure a continuous hot air welded seam. Note: When using 60-mil thick or thicker membrane, all splice intersections shall be overlaid with Sure-Weld T-joint covers or non-reinforced flashing.

B. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).

C. Repair all seam deficiencies the same day they are discovered.
D. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices.

3.6 FLASHING INSTALLATION

A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using Sure-Weld reinforced membrane. Sure-Weld non-reinforced membrane can be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of prefabricated accessories is not feasible.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.7 WALKWAY INSTALLATION

A. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated on drawings.

3.8 DAILY SEAL

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the workday, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage.

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. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

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

E. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.
END OF SECTION 075423