

## SECTION 07 54 00

**THERMOPLASTIC MEMEBRANE ROOFING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. The Section TPO sheet membrane systems.
- B. This Section also includes the following:
  - 1. Mechanically fastened sheet roofing.
  - 2. Roof insulation.
  - 3. Tapered roof insulation.
- C. Related Sections include the following:
  - 1. Division 6 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking; and wood-based, structural-use roof deck panels.

## 1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. FM Listing: Provide sheet membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.
  - 1. Roofing system shall comply with the following:
    - a. Fire/Windstorm Classification: Class 1A-60.

## 1.3 SUBMITTALS

- A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.
- B. Shop Drawings: Include plans, sections, and details of the following:
  - 1. Base flashings and membrane terminations.
  - 2. Tapered insulation, including slopes.
- C. Samples for Verification: Of the following products:
  - 1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, including T-shaped side and end lap seam.
  - 2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
  - 3. 12-by-12-inch (300-by-300-mm) square of walkway pads or rolls.
  - 4. 6 roof cover fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of meeting requirements.
- F. Manufacturer's installation rating of the roofing contractor.

- G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
- H. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.
- I. Warranty: Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
- J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product. Contractor shall have installed a minimum of 500,000 square feet and have a manufacturer's installation rating of 9.0 or better.
  - 1. Work associated with single-ply membrane roofing, including (but not limited to) insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.
- B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and slopes indicated.
- C. Preinstallation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination." Notify participants at least 5 working days before conference.
  - 1. Meet with Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  - 4. Review loading limitations of deck during and after roofing.
  - 5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
  - 6. Review governing regulations and requirements for insurance, certificates, and inspection and testing, if applicable.
  - 7. Review temporary protection requirements for roofing system during and after installation.
  - 8. Review roof observation and repair procedures after roofing installation.
  - 9. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.5 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, and directions for storing and mixing with other components.
- B. 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.

- C. 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.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

## 1.7 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. A manufacturer's sole source 15-year written Total Roofing System Warranty shall be provided with a peak gust wind speed limitation of 72 mph (measured 30 feet above the ground). Warranty shall cover both labor and materials with no dollar limitation and shall state that the Total roofing System will remain in a watertight condition. The contractor shall provide as part of the shop drawing submittal process, certification indicating that the manufacturer has reviewed and has agreed to such wind coverage indicated.
  1. Total Roofing System is defined as the following materials and provided by the roof system manufacturer: membrane, flashings, counterflashings, adhesives, sealants, insulation, fasteners, fastener plates, fastener strips, and hard rubber. Metal termination anchor bars, roof drain flashing and sealants, and any other product utilized in this system installation.
  2. The warranty shall be for fifteen (15) years starting after final acceptance of the total roofing system by the roof system manufacturer. Defective materials or installation shall be removed, properly disposed of, and replaced at the manufacturer's expense.
  3. The warranty shall provide that if within the warranty period the roofing system becomes non-watertight or if the elastomeric sheet splits, tears, or separates at the seams because of defective materials and/or materials and cost thereof shall be the responsibility of the manufacturer. Should the manufacturer or his approve applicator fail to perform repairs within 72 hours of notification, the warranty will not be voided because of work being performed by others to repair the roofing regardless of the manufacturer's warranty to the contrary.
  4. The total Roofing System shall be applied by a roofing Contractor approved by the system manufacturer. After inspection and acceptance of the installed roof system, the warranty will be issued.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Thermoplastic Polyolefin (TPO) Sheet:
    - a. Carlisle Syntec Systems; Carlisle Corp.
    - b. Stevens Roofing.
    - c. Versico, Inc.

### 2.2 THERMOPLASTIC POLYOLEFIN SHEET

- A. Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible elastomer sheet formed from a thermoplastic polyolefin, reinforced, of the following thickness, exposed face color, and physical properties:
  1. Thickness: Minimum 45 mils (1.1 mm), nominal.
  2. Exposed Face Color: Color to match existing.
  3. Physical Properties: Provide reinforced thermoplastic polyolefin sheets with the following properties as determined per ASTM test method indicated:
    - a. Breaking Strength: 225 lbf (1 kN); ASTM D 751, grab method.
    - b. Elongation at Break: 15 percent; ASTM D 751.
    - c. Tearing Strength: 55 lbf (245 N) minimum; ASTM D 751, Procedure B.

- d. Resistance to Heat Aging: No reduction in breaking strength, elongation at break, and tearing strength after 168 hours at 240 deg F (116 deg C); ASTM D 573.
- e. Ozone Resistance: No cracks after 168 hours' exposure of 50 percent elongated sample at 100 deg F (38 deg C) and 100-pphm (100-MPa) ozone; ASTM D 1149, Procedure B.
- f. Water Absorption: Less than 4 percent mass change after 168 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
- g. Weather Resistance: No cracks or crazing after 4000 hours' exposure to xenon-arc; ASTM G 26.

### 2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing material.
  - 1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
- B. TPO Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, thickness, and color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Splice Adhesive and Cleaner: Single-component butyl splicing adhesive and solvent-based splice cleaner.
- E. Splice Primer and Tape: Manufacturer's standard synthetic rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard single-component sealant.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

### 2.4 INSULATION MATERIALS

- A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thickness' indicated.
  - 1. Provide preformed, tapered insulation boards where indicated for sloping to drain. Fabricate with the following taper:
    - a. 1/4 inch per 12 inches (1:48), unless otherwise indicated.
    - b. 1/2 inch per 12 inches (1:24), where required to reverse slope of 1/4 inch per 12 inches.
  - 2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C 1289, classified by facer type as follows:
  - 1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.
  - 2. Size:
    - a. Mechanically Fastened: 4 by 8 foot.

### 2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

- C. Metal Securement System: L-shaped securement flashing and other required insulation strapping fabricated from stainless steel, a minimum of **0.031 inch (0.8 mm)** thick. Provide fasteners as recommended by insulation manufacturer.

## 2.6 ROOF DRAINS

- A. Refer to mechanical specifications.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.
- C. Verify that wood nailers are in place and secured and match thickness' of insulation required.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.3 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is **2 inches (50 mm)** or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of **6 inches (150 mm)** in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. 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 **1/4 inch (6 mm)** with insulation.
  1. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
- G. Insulation Attachment: Provide mechanical fasteners to penetrate metal decking 7/8" in pattern spacing's sufficient to resist listed wind uplift load in accordance with ASCE 7-705. Provide increased quantity of fasteners at roof perimeter and corners.

### 3.4 FULLY ADHERED SHEET INSTALLATION

## POWERPAY OFFICES PROJECT

- A. Install TPO sheet over area to receive roofing according to roofing system manufacturer's written instructions. Unroll sheet and allow to relax for a minimum of 30 minutes.
- B. Start installation of sheet in presence of roofing system manufacturer's technical personnel.
- C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Apply roofing sheet with side laps shingled with slope of roof deck. Provide full coverage of adhesive, place membrane and roll to insure full contact.
- E. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring.
- F. In-Splice Attachment: Secure one edge of the sheet using fastening plates or battens centered within the membrane splice and mechanically fasten sheet to roof deck. Field-splice seam according to "Seam Installation" Article.
- G. Under-Membrane Attachment: Place continuous-strip sheet adhesive tape, release-paper side up, over substrate. Centrally place battens over tape and mechanically fasten to roof deck.
  - 1. Apply primer to underside of sheet in strips corresponding to tape location. Remove release paper and firmly adhere sheet to the tape.

### 3.5 SEAM INSTALLATION

- A. TPO Sheet Seams: Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instructions to ensure a watertight seam installation. Weld seam as follows:
  - 1. Weld Method: Hot air.
- B. Test lap edges with probe to verify seam weld continuity. Apply seam caulk to seal cut edges of sheet membrane.
- C. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

### 3.6 FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing as recommended by manufacturer.
- D. Clean seam areas, overlap sheets, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant and seal exposed edges of sheet flashing terminations.

### 3.7 ROOF DRAIN INSTALLATION

- A. Install roof drain and accessories in strict accordance with manufacturer's written instructions, providing a permanent weather tight installation.
  - 1. Inspect and determine substrate to be in satisfactory condition, with deck fully anchored and aligned at proper location and elevation. All surfaces shall be smooth, dry, clean, free of sharp edges, and other irregularities.
  - 2. Attach deck flange securely to substrate.

3. Assemble and flash gravel stop flange into roof system per roof system and roof drain manufacturer requirements.
4. Securely attach strainer basket.

3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
  1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

3.9 PROTECTING AND CLEANING

- A. Protect sheet membrane roofing 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 that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the 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.

END OF SECTION

