

SECTION 07500

THERMOPLASTIC POLYTOLEFIN MEMBRANE (TPO) ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install Firestone TPO mechanically attached single-ply roofing system, including:
 - 1. Roofing manufacturer's requirements for the specified warranty.
 - 2. Preparation of roofing substrates.
 - 3. Wood nailers for roofing attachment.
 - 4. Insulation.
 - 5. Flashings.
 - 6. Walkway pads.
 - 7. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in a manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at <http://manual.fsbp.com>.
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
- B. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.
- C. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2004.
- D. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.
- E. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting; 2003.
- F. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2003.
- G. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams; 2003.
- H. PS 1 - Construction and Industrial Plywood; 1995.
- I. PS 20 - American Softwood Lumber Standard; 2005.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include at least the following:
 - a. Technical data sheet for roof membrane.
 - b. Technical data sheet for each insulation type.
 - c. Manufacturer's roof system specification.
 - d. Florida Product Approval
- B. Samples: Submit samples of at least the following:
 - 1. Sample of roof membrane.
 - 2. Sample of each insulation type.
- C. Specimen Warranty: Submit both manufacturer's and installer's sample warranty.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Roofing installer shall have the following:
 - 1. Current Firestone Red Shield Licensed Contractor status.
 - 2. Current approval, license, or authorization as applicator by the manufacturer.
 - 3. Fully staffed office within 100 miles of the job site.
 - 4. At least five years' experience installing specified system.
- B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
 - 1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work including General Contractor's project Manager, Job Super and Roofing manufacturer's Representative.
 - 2. Notify Architect well in advance of meeting. If possible, schedule a meeting after deck is installed and to correspond with Architect's Pay App Tour.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in the manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

1.06 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Firestone 20-year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
 - 1. Limit of Liability: No dollar limitation (NDL).
 - 2. Scope of Coverage: Repair leaks in the roofing system caused by:
 - a. Ordinary wear and tear of the elements.
 - b. Manufacturing defect in Firestone brand materials.
 - c. Defective workmanship used to install these materials.
 - d. Damage due to winds up to 100 mph (129 km/h).
 - e. Materials and labor for repairs are at no cost to Owner.
 - f. Warranty period starts at date of Substantial Completion.

- C. Insulation Warranty: Separate Firestone ISO 95+ Insulation Warranty with warranty term coinciding with Red Shield Warranty.
 - 1. Limit of Liability: No dollar limitation (NDL)
 - 2. Scope of Coverage: Provide replacement for insulation that warps, bows, or is on the point of causing a roof leak because of a manufacturing defect.
 - 3. Materials and labor for repairs are at no cost to the Owner.

- D. Installers Warranty: The installer shall repair any leak due to poor workmanship, material failure or windstorm under 101 mph for a period of 2 years from date of substantial completion with no dollar limitations and materials and labor at no cost to owner.

1.07 PERFORMANCE REQUIREMENTS

- A. Energy Performance: Provide roofing system with Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products Co., Carmel, IN.
www.firestonebpco.com.
 - 1. Or Equal.

- B. Manufacturer of Insulation: Same manufacturer as roof membrane.

2.02 ROOFING SYSTEM DESCRIPTION

- A. Roofing System:
 - 1. Membrane: Thermoplastic olefin (TPO).
 - 2. Thickness: **.060**
 - 3. Membrane Attachment: Mechanically attached. (UT-120-206)
 - 4. Comply with applicable local building code requirements.

- B. Insulation:
 - 1. Poly-isocyanurate Board Insulation
 - a. Approximate combined thickness: **3.3 inches**
 - 2. Top Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Mechanical fastening.
 - 3. Tapered Insulation: Provide tapered poly-isocyanurate insulation at roofing crickets, equipment curbs and roof drain sumps as shown on the roof plan or as otherwise may be required to provide a 1/4" per slope from ridge to drain and allow drainage to flow unimpeded with no ponding.

- C. Miscellaneous
 - 1. Provide walkway pads (carry treads) from roof hatch to and surrounding roof top equipment
 - 2. Provide walkway pad or other protection acceptable to roofing manufacturer under all pipe supports.

2.03 TPO MEMBRANE MATERIALS

- A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
 - 1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
 - 2. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
 - 3. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C 1549.
 - 4. Color: White.
 - 5. Acceptable Product: ULTRAPLY TPO by Firestone.
- B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.
- D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
 - 1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent.
 - 2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
 - 3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
 - 4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
 - 5. Color: White.
 - 6. Acceptable Product: ULTRAPLY TPO Flashing by Firestone.
- E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing by Firestone.
- F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.
- G. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.
- H. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.
- I. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.
- J. General Purpose Sealant: EPDM-based, one-part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.
- K. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

- A. Poly-isocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type I Class 1, with the following additional characteristics:
 - 1. Thickness: As indicated elsewhere.
 - 2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
 - 3. R-Value (LTTR):
 - a. 3.3-inch (83 mm) Thickness: LTTR - 20.4, minimum (R-24.1)
 - 4. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
 - 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
 - 6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
 - 7. Acceptable Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone.
- B. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

2.05 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20-dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
 - 1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 - 2. Thickness: Same as thickness of roof insulation.

PART 3 INSTALLATION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at the project site for duration of installation period.
- C. Do not start work until the Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth, and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants, and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers, and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment, and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptance of project conditions and requirements.

3.03 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease, and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 INSULATION INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

3.05 TPO MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fish mouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane mechanically attached to the substrate using Firestone Heavy Duty Fasteners and Seam Plates over the membrane and edge securement as specified.
- E. Mechanical Attachment: Install Firestone Heavy Duty Fasteners and Seam Plates over membrane, covered by membrane from next parallel sheet.
 - 1. Lay out Firestone Heavy Duty Fasteners and Seam Plates as recommended by membrane manufacturer and as indicated, whichever is most stringent.
 - 2. Fasten Firestone Heavy Duty Fasteners and Seam Plates, properly engaged in the deck with head flush with the batten strip surface.
- F. Edge Sacrament: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
 - 1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.

3.06 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- C. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
 - 1. Use the longest practical flashing pieces.
 - 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 - 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 - 4. Provide termination directly to the vertical substrate as shown on roof drawings.
- D. Roof Drains:
 - 1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
 - 2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
 - 3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
 - 4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
 - 5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

- E. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

3.07 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

3.08 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a salesperson).
- B. Perform all corrections necessary for issuance of warranty.

3.09 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION 07540