 Specifications

SECTION 07 54 23

TPO THERMOPLASTIC SINGLE-PLY ROOFING

BALLASTED MEMBRANE INSTALLATION

1. GENERAL
	1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Thermoplastic Single-Ply Roofing.
		2. Roof Insulation.
	1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 06 10 00: Rough Carpentry: Roof blocking installation and requirements.
		2. Section 07 62 00: Sheet Metal Flashing and Trim: Metal flashing and counter flashing installation and requirements.
		3. Section 22 30 00: Plumbing Specialties: roof drains, scuppers, gutters and downspout installation and requirements.
	1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards.
			1. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
			2. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
			3. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board.
			4. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
			5. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
			6. ASTM D312 - Standard Specification for Asphalt Used in Roofing.
			7. ASTM D1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
			8. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
			9. ASTM D6878 - Standard Specification for Thermoplastic Polyolefin (TPO) Sheet Roofing.
			10. ASTM D751 – Standard Test Methods for Coated Fabrics.
			11. ASTM D2137 - Standard Test Methods for Rubber Property-Brittleness Point of Flexible Polymers and Coated Fabrics.
			12. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
			13. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
			14. ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids.
			15. ASTM D1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.

\*\* NOTE TO SPECIFIER \*\* Retain the next paragraph only if CRRC Roofs are Specified.

* + - 1. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

\*\* NOTE TO SPECIFIER \*\* Retain the next paragraph only if CRRC Roofs are Specified.

* + - 1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers

\*\* NOTE TO SPECIFIER \*\* Retain the next paragraph only if ENERGYSTAR Roofs are Specified.

* + - 1. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.
		1. U.S. Green Building Council (USGBC).
		2. Leadership in Energy and Environmental Design (LEED).
		3. Factory Mutual (FM Global) - Approval Guide.
			1. Factory Mutual Standard 4470 - Approval Standard for Class 1 Roof Covers.
		4. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFU R9228).
		5. California Title 24 Energy Efficient Standards.
		6. Cool Roof Rating Council (CRRC).
		7. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet.
		8. National Roofing Contractors Association (NRCA).
		9. American Society of Civil Engineers (ASCE).
			1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
	1. DEFINITIONS
		1. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.
	2. PERFORMANCE REQUIREMENTS
		1. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
		2. Flex Membrane shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.
	3. SUBMITTALS
		1. Submit under provisions of Section 01 30 00.
		2. Product Data: Manufacturer's data sheets on each product to be used, including:
			1. Preparation instructions and recommendations.
			2. Storage and handling requirements and recommendations.
			3. Installation methods.
		3. Shop Drawings:
			1. Show outline and size of the roof, location and type of penetrations, perimeter and penetration flashing detail references to manufacture's standard. Details which do not conform to roofing manufacturer's standards shall be identified with separate approval from roofing manufacturer. Details to be employed on the project shall be approved by roofing manufacturer.

\*\* NOTE TO SPECIFIER \*\* Delete selection samples if colors have already been selected.

* + 1. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
		2. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
	1. QUALITY ASSURANCE
		1. Manufacturer Qualifications: Flex Membrane shall provide a roofing system that meets or exceeds all criteria listed in this section.
		2. Installer Minimum Qualifications:

\*\* NOTE TO SPECIFIER \*\* Delete installer classification not required.

* + - 1. Installer shall be classified as an Approved Contractor as defined and certified by Flex Membrane.
		1. Source Limitations: Components listed shall be provided by a single manufacturer or approved by the primary roofing manufacturer.
		2. Final Inspection: Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.
		3. Pre- Installation Conference:
			1. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, Flex Membrane representative and any other persons directly involved with the performance of the work.
			2. The installer shall record conference discussions to include decisions, agreements, and open issues and furnish copies of recorded discussions to each attending party. The primary purpose of the meeting is to review foreseeable methods and procedures related to roofing work.
	1. REGULATORY REQUIREMENTS
		1. Work shall be performed in a safe, professional manner, conforming to federal, state and local codes.
		2. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class rating for roof slopes indicated.

\*\* NOTE TO SPECIFIER \*\* Delete roof class rating not required.

* + - 1. UL Class A rating.
			2. UL Class B rating.
			3. UL Class C rating.
		1. Windstorm Classification: Provide a roofing system which will achieve the following Factory Mutual wind uplift rating, as listed in the current FM Approval Guide.

\*\* NOTE TO SPECIFIER \*\* Delete roof wind uplift rating not required.

* + - 1. Factory Mutual 1-60.
			2. Factory Mutual 1-75.
			3. Factory Mutual 1-90.
			4. Factory Mutual 1-120.
	1. DELIVERY, STORAGE, AND HANDLING
		1. Deliver roofing materials to the site in original containers, with factory seals intact. Products shall carry either a Flex Membrane label.
		2. Store pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.
		3. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
		4. Remove manufacturer supplied plastic covers from materials provided with such. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.
		5. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
	2. PROJECT CONDITIONS
		1. Weather:
			1. Proceed with roofing only when existing and forecasted weather conditions permit.
			2. Ambient temperatures shall be above 45 degrees F (7.2 degrees C) when applying hot asphalt or water based adhesives.
	3. WARRANTY

 \*\* NOTE TO SPECIFIER \*\* Delete warranty not required.

* + 1. Manufacturer warrants to the Building Owner, subject to the terms, limitations, and conditions for a period specified, in which the Materials and Workmanship Warranty is effective, the materials installed shall be free from defects in materials supplied and/or defective workmanship provided by the authorized applicator.
			1. The Manufacturer's Technical Service Representative shall inspect the completed roof system, and upon acceptance, the manufacturer shall issue the specified warranty commencing on the Date of Substantial Completion
			2. The Roofing System shall receive the manufacturer's standard ten (10) year, fifteen (15) year, twenty (20) year, or twenty-five (25) year guarantee of watertightness.

B.\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Sheet Metal Warranty: Materials supplied by the roofing manufacturer.
			1. Materials shall be free of defects in material and workmanship for five years after shipment. Defective materials will be repaired or replaced at manufacturer's option. Manufacturer shall not be liable for direct or consequential damages arising from the installation of materials. No other express or implied warranties apply to the products.

\*\* NOTE TO SPECIFIER \*\* FlexCap Coping System only. Delete if not required.

* + - 1. Special Performance Warranty: The FlexCap Coping System in standard sizes, when used as a part of a Flex Roofing System Installation, and installed according to manufacturer’s instructions, shall not blow off, leak, or cause membrane failure, for an identical period as that warranty for the roof system itself, or we will repair or replace the Coping Cap material.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + - 1. Decorative Finish Warranty: Pre-finished aluminum and 24 gauge (0.607 mm) galvanized steel, coated with Kynar 500 finish shall receive a limited 20 year warranty.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + - 1. Spray-applied Kynar 500 finish shall receive a limited 5 year warranty.
1. PRODUCTS
	1. MANUFACTURERS
		1. Acceptable Manufacturer: Flex Membrane International Corp., which is located at: 5103A Pottsville Pike, Reading, PA 19605 ; Toll Free Tel: 800-969-0108; Tel: 610-916-9500; Fax: 610-916-9501; Web: [www.flexroofingsystems.com](http://www.flexroofingsystems.com)
		2. Substitutions: Not permitted.

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

\*\* NOTE TO SPECIFIER \*\* Delete insulation if not required.

* 1. SYSTEM

A. Flex TPO Plus Roofing System

* + - 1. Color: White
			2. Color: Gray
			3. Color: Tan
	1. MEMBRANE
		+ - 1. Membrane: The roofing membrane shall meet or exceed the requirements of ASTM D6878 standard for Thermoplastic Polyolefin (TPO) Based Sheet Roofing.
				2. TPO Membrane:

TPO Plus 60 Mil thermoplastic single-ply

TPO Plus 80 Mil thermoplastic single-ply

* + - * 1. Fleece Back TPO Membrane:

FB TPO Plus 60 Mil thermoplastic single-ply

FB TPO Plus 80 Mil thermoplastic single-ply

* 1. INSULATION

A.\*\* NOTE TO SPECIFIER \*\* Delete roof board types not required.

\*\* NOTE TO SPECIFIER \*\* Delete insulation not required. Flex Insulation required for system warranty.
 \*\* NOTE TO SPECIFIER \*\* 1/2 inch (12 mm) thickness is susceptible to breakage during installation. Delete if not required.

* + 1. Extruded Polystyrene Boards: Federal specification HH-I-524C, Type IV minimum thickness 1 inch (25 mm), minimum density 1.6 lb/cf (26 kg/cu m).

B. Flex ISO II: A closed cell polyisocyanurate foam core laminated to black (non-asphaltic), fiber-reinforced felt facers. Manufactured in accordance with ASTM C 1289, Type II, Class 1.

* + 1. Polyisocyanurate and Polyurethane Faced Roof Boards: Federal spec. HH-I-1972/ 1&2 Class 1-3, minimum thickness 1 inch (25 mm) nominal.
		2. Tapered Edge Strip: Factory fabricated rigid perlite strip cut at angles to provide a smooth transition between differences in elevation
	1. ACCESSORY MATERIALS:
1. Adhesives:
	1. Flex TPO Bonding Adhesive: Solvent-based Bonding Adhesive: Solvent based adhesive for use with Flex TPO membranes.
	2. Flex TPO Low VOC Bonding Adhesive: Low VOC solvent-based Bonding Adhesive: Solvent based rubberized adhesive for use with Flex TPO membranes.
	3. Flex TPO Cut-Edge Sealant: Solvent based liquid, required to protect field cut edges of Flex TPO membranes. Applied directly from a squeeze bottle.
	4. Flex TPO Primer: Solvent based primer for preparing surfaces to receive butyl based adhesive tapes.
	5. Flex TPO Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes.
	6. Flex TPO Weathered Membrane Cleaner: Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding.
	7. Flex Polyurethane Sealant: Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings.
	8. Flex Thermoplastic Pourable Sealer: 100 percent solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Epoxy is part A. Polyamide is part B.
	9. Asphalt primer: ASTM D 41 Standard Asphalt Primer.
	10. Hot steep asphalt - All manufacturers. Type III and IV for very steep inclines.
	11. Flex Olybond Insulation Adhesive: Olybond 500 or Olybond 500 Spot Shot for adhering insulation or cover boards to approved substrates.
2. Fasteners:
	* + 1. Metal Decks: screw type fasteners treated for corrosion resistance with ultimate pull out value of minimum 275 lb in 22 (0.759 mm) gauge steel deck to be applied in conjunction with Factory Mutual approved pattern:
				1. Flex Screws, Corrosion Resistant # 10 Coating
				2. SFS Intec, Dekfast Fastening System, C-2 type, corrosion resistant only.
				3. OMG Inc., Fasteners, screws long and short, Endurion coated only.
			2. Plywood Decks: screw type fasteners applied in a Factory Mutual approved pattern and method.
				1. Flex Screws, Corrosion Resistant # 10 Coating
				2. SFS Intec Inc., Dekfast Fastening System, C-2 type, corrosion resistant only.
				3. OMG Inc. Fasteners, screws long and short, Endurion coated only.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + - 1. Solid Wood Decks: screw or nail type fasteners:
				1. Flex Screws, Corrosion Resistant # 10 Coating
				2. SFS Intec, Dekfast Fastening System, C-2 type, corrosion resistant only.
				3. OMG Inc., Fasteners, screws long and short, Endurion coated only.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + - 1. Masonry Decks: solid limestone concrete block minimum pullout resistance shall be 525 lb (236 kg), expanded slag block minimum pullout resistance shall be 1100 lb (495 kg), poured concrete, minimum pullout resistance shall be 1000 lb (450 kg):
				1. SFS Intec. Dekspike Concrete Roofing Anchor
				2. OMG Inc., Fluted Nail or Olympic CD-10

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + - 1. Through Lightweight Concrete or Gypsum Fill:
				1. On steel deck see 3A above.
				2. On foamboard: toggle bolts or,
				3. OMG, Inc. GypTec or Lite Deck Fastener.
				4. SFS Intec, Dek Lite Fastener.

C. Caulking: Silicon, polysulfide or polyurethane caulking, exterior grade for caulking, surface reglets and vent pipe details.

* + - 1. Mameco, Vulkem 116, Polyurethane.
			2. Sonneborn, NP1.
			3. BOSTIK, Chem Caulk
			4. For filling pitch pans: Flex Pourable Sealer or as approved by Flex Technical Services Department.
			5. Geocel 3300 Polyurethane

D. Flashing:

1. Reinforced Membrane: Same material, color and thickness as roof membrane for all curbs, walls and penetrations.

2. Non reinforced Membrane: Multi angled intersections, sealant pockets and other conditions that would be impractical for reinforced membrane application.

\*\* NOTE TO SPECIFIER \*\* Typically not required for mechanically attached applications. Delete if not required.

* + 1. Base Sheet:
			1. Base sheets or ply sheets installed over substrate or insulation system as an integrated component of Flex built up roofing system.
				1. Flex SBS 80 mil S/S Base Sheet.
				2. Premium Flex Ply Roofing Felt.
		2. Wood Nailers:
			1. Number 2 grade lumber minimum salt treated for rot and fire resistance.
				1. Wolmanized.
				2. Osmose treated.
				3. Pressure treated.

\*\* NOTE TO SPECIFIER \*\* Separation layers are for use over insulation and below membranes with mechanically fastened systems. Red rosin paper and sheet polyethylene are not approved. Delete if not required.

* + 1. Separation Layers:
			1. Flex Separator Sheet.
			2. Flex Green Guard 3/8 inch PB6W Fan Fold Roofing Recovery Board.
			3. Georgia Pacific Corporation: Dens Deck, Dens Deck Prime distributed by Flex Roofing System.
			4. USG Securock distributed by Flex Roofing System.
			5. Flex ½” HS Coverboard, High Strength Polyisocyanurate Foam with coated Glass Facers distributed by Flex Roofing System.
		2. Detailing Components:
			1. Flex Universal Inside/Outside Corners.
			2. Flex Molded Pipe Seals.
			3. Flex Molded Sealant Pocket.
			4. Flex Split Pipe Boots.
			5. Flex Square Tube Wraps.
			6. Flex TPO PS Coverstrip
			7. Flex TPO Coated Metal.
			8. Flex Retrofit Drains - Clamping Ring Model.
			9. Flex Walkway Pad: Traffic Pads: 34 inches (863 mm) wide by 50 feet (16 m) long thermoplastic material provided by the membrane manufacturer.
			10. Flex 2-3/8 inches (60 mm) XHD Barbed Plate.
			11. Flex 2-3/4 inches (70 mm) SXHD Barbed Plate.
			12. Flex Base Sheet Fastener.
			13. Flex Termination Bar.
			14. Flex Standard Screws.
			15. Flex HD Standard Screws.
			16. Flex XHD Standard Screws.
			17. Flex SXHD Standard Screws.

\*\* NOTE TO SPECIFIER \*\* Delete membrane materials not required.

1. EXECUTION
	1. EXAMINATION
		1. Verify that the surfaces and site conditions are ready to receive work.
		2. Verify that the deck is supported and secured.
		3. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
		4. Verify that the deck surfaces are dry and free of ice or snow.
		5. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.
	2. STONE BALLAST
		1. Stone ballast shall be smooth, water worn gravel with rounded edges and corners, relatively free of sand, loam, and other foreign substances, and contain less than 4 percent fines.

\*\* NOTE TO SPECIFIER \*\* Delete paver ballast if not required.

* 1. PAVER BALLAST
		1. Non-Interlocking Pavers: Commodity precast pavers engineered and fabricated for roof ballast application with drainage channel bottom and shiplap edges.
		2. Interlocking Pavers: Extruded polystyrene insulation panels with integral latex-modified mortar top face, 2 inches (51 mm) thick. Insulated pavers to be provided with tongue and groove interlocking edges, natural gray color.
	2. SUBSTRATE PREPARATION

\*\* NOTE TO SPECIFIER \*\* Delete roof deck type not required.

* + 1. Steel Deck:

\*\* NOTE TO SPECIFIER \*\* FM requirements may supercede those set forth in this section. Consult the current FM Guide for more information.

* + - 1. Metal decks shall be a minimum uncoated thickness of 22 gauge (0.8 mm) and shall have a G-90 galvanized finish on all panels.
			2. Decks shall comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.

\*\* NOTE TO SPECIFIER \*\* Delete if re-roofing not required.

* + - 1. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.
		1. Structural Concrete Deck:
			1. Minimum deck thickness for structural concrete is 4 inches (102 mm).

\*\* NOTE TO SPECIFIER \*\* Concrete decks that are poured over non-vented metal decks or pans that remain in place may trap moisture in the deck beneath the roof system and are not acceptable.

* + - 1. Only poured in place concrete decks that provide bottom side drying are acceptable.
			2. The roof deck shall be properly cured prior to application of the roofing system. Curing agents shall be checked for compatibility with roofing materials. Prior to the installation of the roof assemblies, evaluation of the surface moisture and deck's dryness by the use of ASTM D 4263 or hot bitumen test procedures shall be conducted.
			3. The deck shall be smooth, level and cannot be wet or frozen.
			4. Treat cracks greater than 1/8 inch (3 mm) in width in accordance with the deck manufacturer's recommendations.
			5. Sumps for the roof drains shall be provided in the casting of the deck.
			6. When insulation or roofing is to be adhered with hot asphalt, prime the deck with asphalt/concrete primer, ASTM D 41 at the rate of one gallon per 100 square feet (0.4 l/sm). Allow the primer to dry prior to the application of the roofing system.

\*\* NOTE TO SPECIFIER \*\* Delete if re-roofing not required.

* + - 1. With retrofit roof applications, it is required that the deck be inspected for defects. Defects are to be corrected per the deck manufacturer's recommendations prior to the roofing application.
		1. Lightweight Insulating Concrete Deck:

\*\* NOTE TO SPECIFIER \*\* Individual deck manufacturer's standards apply when their specifications exceed the minimum thickness, compressive strength, or density requirements.

* + - 1. Lightweight insulating concrete decks are required to have a minimum thickness of 2 inches (51 mm), a minimum compressive strength of 125 psi (0.86 MPa) and a minimum density of 22 pcf (352 kg/sm).
			2. The lightweight insulating deck/fill shall be installed by an applicator approved by the deck manufacturer.
			3. The roof system shall be installed immediately following deck curing to prevent damage from exposure to precipitation. The deck manufacturer determines the minimum curing time and maximum exposure limitations.
			4. LWIC shall not be poured during rainy periods. Deck areas that have frozen before they have cured shall be removed and replaced. Decks which receive precipitation prior to installation of the roof membrane shall be checked for moisture content and dryness.
			5. The moisture content of existing LWIC shall be under 20 percent when insulation is to be fastened directly to it. Where moisture content exceeds 20 percent, a layer of approved Venting Base Sheet shall be installed prior to the insulation.
			6. Lightweight insulating concrete decks are acceptable only on slopes up to 1 inch per foot (83 mm/m).

3.5 INSTALLATION

A. Install roof system in accordance with manufacturer's instructions.

B. Wood Nailers:

1. Locate and install along gravel stops and drip edges and other areas as required by membrane manufacturer.

2. Anchor nailer to structural deck with manufacturer’s approved fasteners, spaced appropriately for the specified installation; minimum withdrawal resistance 100 pounds (45 kg) per fastener.

C.\*\* NOTE TO SPECIFIER \*\* Typically not required for insulating concrete and recover decks. Delete if not required.

* + 1. Insulation:
			1. Insulation shall be loose laid.
			2. Insulation board size as recommended by manufacturer for ballasted application.

\*\* NOTE TO SPECIFIER \*\* Fully adhered fleece backed membrane on steel decks, Cementitious wood fiber, wood decks. Delete next three provisions if not required.

* + - 1. Do not install wet, damaged or warped insulation boards.

\*\* NOTE TO SPECIFIER \*\* Mechanically attached reinforced membrane. Delete next three provisions if not required.

* + - 1. Install insulation boards with staggered board joints in both directions.
			2. Insulation boards to be installed so that no gaps larger than 1/4 inch (6 mm) are found at the end joints and that the adjoining top surfaces are flat and smooth. All gaps in excess of 1/4 inch (6 mm) shall be filled with like insulation material.
			3. If more than one layer of insulation board is to be installed the joints of the subsequent layers must be staggered. Stagger the joints in the additional layers a minimum of 6 inches (152 mm) from the underlying insulation boards to eliminate vertical gaps.
			4. Do not install any more insulation than will be completely waterproofed each day.
			5. Provide separation layer as required by manufacturer.

D. \*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Recover Board:
			1. Recover boards shall be loose laid on top of the insulation.
			2. Recover boards to be installed so that no gaps larger than 1/4 inch (6 mm) are found at the end joints and that the adjoining top surfaces are flat and smooth.
			3. Stagger the joints in the recover board a minimum of 6 inches (152 mm) from the underlying insulation boards to eliminate vertical gaps.
			4. Do not install any more recover board than will be completely waterproofed each day.

E. Membrane Installation: \*\* NOTE TO SPECIFIER \*\* Adhered fleece backed application only. Delete if not required.

F. Membrane Application - Ballast Applied:

1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be mechanically fastened immediately after it is rolled out, followed by welding to adjacent sheets.

2. Overlap roof membrane a minimum of 3” (15 cm) for side laps and 3” (15 cm) for end laps.

* + - 1. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
			2. All exposed sheet corners shall be rounded a minimum of 1".
			3. Use full width rolls in the field of roof and perimeter of the roof.
			4. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
			5. Weld width shall be a minimum of 1-1/2” in width for automatic machine welding. Weld width shall be a minimum 2” in width for hand welding.
			6. All cut edges of reinforced membrane must be sealed with Flex TPO Cut Edge Sealant.
			7. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than ten (10) degrees (2” in 12”). Roofing membrane shall be secured to the structural deck with appropriate Flex screws and plates spaced every 12” o.c. The screws and plates must be installed no less than ½” from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3” and secured with screws and termination bar. Fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1-1/2” to 2” of the plane of the roof membrane, with a minimum of 1” of membrane extending above the termination bar.
			8. Supplemental membrane attachment to the structural deck is required at all penetrations. Roofing membrane shall be secured to the deck with appropriate Flex screws and membrane plates.
			9. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
			10. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

G. Flashing:

1. All penetrations must be at least 24 inches (610 mm) from curbs, walls, and edges to provide adequate space for proper flashing.

2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.

3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.

4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2 inch (51 mm) wide (hand welder) weld is required.

5. All cut edges of reinforced membrane must be sealed with Flex TPO Cut Edge Sealant.

6. Consult the Flex Application and Specifications Manual or Flex Technical Services for more information on specific construction details, or those not addressed in this section.

H. Self-Adhered Membrane Flashings:

1. Install self-adhering membrane flashings according to all applicable Flex construction details.

2. Apply flashing membrane only when outside temperature is above 40 degrees F. Recommended minimum application temperature is 50 degrees F to allow for improved adhesive performance.

3. The membrane flashing shall be carefully positioned prior to removal of release film to avoid wrinkles and buckles.

4. Adhere flashing membrane to the walls by removing the release film. Broom or roll all walls. All seams shall be rolled-in with a silicone roller.

3.6\*\* NOTE TO SPECIFIER \*\* Insulation bitumen. Delete if not required.

* 1. FLASHINGS

A. All penetrations shall be at least 2 feet (610 mm) from the curbs, walls, and edges to provide adequate space for proper flashing.

B. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.

* + 1. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
		2. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2” wide hand weld or minimum 1 - 1/2" automatic machine weld is required.
		3. Non-coated metal edge details shall be installed in accordance with current Flex construction details and requirements.
		4. Twenty (20) year Flex Roof Systems require the use of coated metal edges where applicable. Bonding adhesive and/or cover tape is not acceptable.
		5. All cut edges of reinforced membrane shall be sealed with Flex TPO Cut Edge Sealant.
		6. Coated Metal Flashings:
			1. Coated metal flashings shall be formed in accordance with current Flex construction details and SMACNA guidelines.
			2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a 1/4 inch (6 mm) gap to allow for expansion and contraction. Hot-air weld a 6 inch (152 mm) wide reinforced membrane flashing strip to both sides of the joint, with approximately 1 inch (25 mm) on either side of the joint left un-welded to allow for expansion and contraction. 2 inch (51 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
			3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a 6" wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
			4. Provide a 1/2 inch (12 mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
			5. Provide a 1/2 inch (12 mm) hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
			6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Roof Edges:
			1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
			2. Flash roof edges with metal flanges nailed 4 inches (102 mm) O.C. to pressure-treated wood nailers. Where required, hot-air weld roof membrane to coated metal flanges.
			3. When the fascia width exceeds 4 inches (102 mm), coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12 inches (305 mm) O.C.
			4. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8" on center prior to installing a snap-on fascia.
			5. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Parapet and Building Walls:
			1. Flash walls with Flex TPO membrane adhered to the substrate with bonding adhesive, loose applied (Less than 18 inches (457 mm) in height) or with coated metal flashing nailed 4 inches (102 mm) on center to pressure-treated wood nailers.
			2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 8 inches (203 mm) on center; termination bars that are counter flashed shall be fastened 12 inches (305 mm) on center.
			3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
				1. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inch (305 mm) maximum
				2. Fully / Self Adhered Systems: 12 inches (305 mm) on center
				3. Ballast Applied Systems: 8 inches (203 mm) on center
			4. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
			5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with approved caulking.
			6. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Curbs and Ducts:
			1. Flash curbs and ducts with Flex TPO membrane adhered to the curb substrate with bonding adhesive, loose applied (Less than 18 inches (457 mm) in height) or with coated metal flashing nailed 4 inches (102 mm) on center to pressure-treated wood nailers.
			2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every 8 inches (2.3 mm) o.c.; termination bars that are counter flashed shall be fastened 12 inches (305 mm) on center.
			3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
				1. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inches (305 mm) maximum
				2. Fully / Self Adhered Systems: 12 inches (305 mm) on center
				3. Ballast Applied Systems: 8 inches (203 mm) on center
			4. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
			5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with Flex caulking.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Roof Drains:
			1. Roof drains shall be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
			2. Roof drains shall be provided with a minimum 36 inches (914 mm) by 36 inches (914 mm) sump. Slope of tapered insulation within the sump shall not exceed 4 inches (102 mm) in 12 inches (305 mm).
			3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a 1/2 inch (13 mm) of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
			4. For cast iron and aluminum drains, the roofing membrane shall be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one 10.5 ounce (315 g) cartridge per drain.
			5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of 12 inches (305 mm) larger than the sump area shall be installed. The roof membrane shall be mechanically attached 12 inches (305 mm) on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.
			6. Tighten the drain compression ring in place.
		2. Expansion Joints:
			1. The membrane shall be mechanically fastened (or fully adhered based on system) along edge of expansion joint opening with appropriate Flex fasteners and plates within ¼” to ½” of the membrane edge 12” O.C

3.9\*\* NOTE TO SPECIFIER \*\* SEPARATION MAT. Delete if not required.

* 1. SEPARATION MAT
		1. Apply a 3 oz poly separation slip-sheet above the roofing membrane under all ballasted installations where existing stone ballast is reused or where the underside of the paver is smooth and regular, and has integral drainage channels.
		2. Apply a 6 oz poly cushioning slip-sheet above the roofing membrane under all paver applications where pavers are used as walkways, work surfaces, or as heavyweight perimeter ballast.
		3. Loose-lay separation mat over the membrane so that wrinkles and buckles are not formed. Overlap separation mat a minimum of 6 inches (153 mm) for side and end laps, and immediately install ballast or pavers over the loose laid separation mat.

3.10\*\* NOTE TO SPECIFIER \*\* INTERLOCKING PAVERS. Delete if not required.

* 1. INTERLOCKING PAVERS
		1. Install interlocking concrete pavers in accordance with requirements determined by the most current revision of ASCE 7, and the paver manufacturer's recommendations for stagger and interlock.
		2. Utilize perimeter securement of interlocking pavers and/or paver clips in accordance with the paver manufacturer's requirements.

3.11\*\* NOTE TO SPECIFIER \*\* NON-INTERLOCKING PAVERS. Delete if not required.

* 1. NON-INTERLOCKING PAVERS
		1. Install non-interlocking concrete pavers in accordance with requirements determined by the most current revision of ASCE 7 and the paver manufacturer's requirements.
		2. Utilize perimeter securement of non-interlocking pavers in accordance with the paver manufacturer's requirements.

3.12\*\* NOTE TO SPECIFIER \*\* STONE BALLAST. Delete if not required.

* 1. STONE BALLAST
		1. Install stone ballast in accordance with requirements determined by the most current revision of ANSI RP-4.
			1. Minimum ballast application rate for #4 nominal 1-1/2 inches (38 mm) ballast is 10 lb. per sf (50 kg/sm).
			2. Minimum ballast application rate for #2 nominal 2-1/2 inches (63 mm) ballast is 13 lb. per sf (65 kg/sm).

3.13\*\* NOTE TO SPECIFIER \*\* TRAFFIC PROTECTION. Delete if not required.

* 1. TRAFFIC PROTECTION
		1. Install walkway pads/rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.
		2. Walkway pads shall be spaced 2 inches (51 mm) apart to allow for drainage between the pads.
		3. Fully adhere walkway pads/rolls to the roof membrane with solvent-based bonding adhesive, applied at the rate of 1 gal per 100 sf (0.42 l/sm) to both the walkway and roof membrane surfaces. Press walkway in position once adhesive is tacky to the touch.
		4. Alternatively, walkway pads/rolls may be hot-air-welded to the roof membrane surface continuously around the perimeter of the pad/roll.

3.14 ROOF PROTECTION

A. Protect all partially and fully completed roofing work from other trades until completion.

B Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.

D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.15 CLEAN-UP

A. All work areas are to be kept clean, clear and free of debris at all times.

B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.

C. All tools and unused materials shall be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.

D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.

* + 1. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
		2. Clean and restore all damaged surfaces to their original condition.

3.16 MAINTENANCE

A. Inspections to the roof shall be performed bi-annually by a Flex Approved contractor.

END OF SECTION