 Specifications

SECTION 07 54 23

TPO THERMOPLASTIC SINGLE-PLY ROOFING

SELF ADHERED (SA) MEMBRANE ADHERED OVER STEEL DECK

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 R1306).
		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 manufacturer’s 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.
		3. LEED submittal: Coordinate with Section 01115 - Green Building Requirements, for LEED certification submittal forms and certification templates.
	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
			1. Installer shall be classified as an Approved Contractor as defined and certified by Flex Membrane.
		3. Source Limitations: Components listed shall be provided by a single manufacturer or approved by the primary roofing manufacturer.
		4. 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.
		5. 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.
	2. 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.
			5. Factory Mutual 1-135.
			6. Factory Mutual 1-150.
			7. Factory Mutual 1-180.
	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)

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

* + 1. Substitutions: Not permitted.
		2. 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 Self Adhered TPO Plus Roofing System

* + - 1. Color: White
			2. Color: Gray
			3. Color: Tan
			4. Roof System: Provide and install an Adhered, Thermoplastic, CRRC approved roofing membrane to a structural metal deck.
	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. Self Adhered TPO Membrane:

SA TPO Plus 45 Mil Reinforced

SA TPO Plus 60 Mil Reinforced

SA TPO Plus 80 Mil Reinforced

* 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 Insulation Adhesive: two part urethane foam adhesive for adhering insulation or cover boards to approved substrates.

a. Olybond 500, Olybond 500 Spot Shot or Olybond 500 Canister Spatter

b. Millennium PG-1 or One Step.

c. ICP CR-20 or Board Max

1. 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” HD 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. 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.

3.3 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 set in a flood coat of hot steep asphalt applied at an approximate rate of 25 lb per 100 square feet (1.2 kg/sm). If applying insulation with cold adhesives follow the adhesive manufacture’s installation instructions.
			2. Insulation board size as recommended by manufacturer for adhered 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. Subsequent layers of insulation shall be adhered with hot steep asphalt or cold adhesives. If applying cold adhesives follow the adhesive manufacture’s installation instructions.
			2. 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 one direction.
			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 set in a flood coat of Hot Steep Asphalt applied at an approximate rate of 25 lb per 100 sf (1.2 kg/sm) over the insulation board. If applying recover boards with cold adhesives follow the adhesive manufactures installation instructions.
			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. \*\* NOTE TO SPECIFIER \*\* Adhered fleece backed application only. Delete if not required.

* + 1. Base Sheet:

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

* + - 1. Fully mop substrate with a coating of hot steep asphalt applied to the substrate within 25 degrees F

(15 degrees C) of the bitumen's EVT. Imbed the base sheet or ply sheet into the hot steep asphalt. If applying base sheet with a cold adhesive follow the adhesive manufacturer's installation instructions.

* + - 1. Do not install any more base sheet or ply sheet than will be completely waterproofed each day

F.\*\* NOTE TO SPECIFIER \*\* Fully Adhered application. Delete if not required.

* + 1. Membrane Installation (Heat Weld Membrane Attachment):
			1. Unroll panel at the starting point of the roof. Remove the 3 inch (76 mm) selvedge edge that does not contain adhesive on the underside, and position the sheet so the factory edge is along the upslope side of the roll.
			2. Position membrane over the approved substrate without stretching.
			3. Fold the membrane longitudinally and peel approximately one-half of the release liner from the adhesive film back of the membrane and lay to the side of the panel (do not cut release liner).
			4. Roll the membrane with the exposed adhesive onto the approved substrate in line with the original layout position. Maintain a rounded radius at the fold to avoid creating wrinkles.
			5. Roll membrane back to the point that the release liner becomes accessible and peel the remaining release liner from the adhesive film on the rest of the roll.
			6. Using either a water-filled lawn roller to apply pressure or a stiff bristle push broom, roll/broom in the installed section of the membrane to promote maximum adhesion to the substrate. This installed area will be the anchor point and alignment guide for the installation of the remainder of the roll. Rolling or brooming in the width direction of the panel will aid in avoiding the creation of wrinkles in the sheet.
			7. 6 inch minimum (152 mm) end lap joints must be overlaid with Flex TPO Cover Tape or Flex Flashing Strips. The cover tape or strip-in flashing must cover the entire lap joint and extend 3 inch (76 mm) onto the adjacent sheets at both ends of the lap joints. When using flashing strips, the entire strip must be hot-air welded to the membrane.
			8. For the 2nd and subsequent panels, unroll the membrane and allow to relax as long as necessary depending on ambient conditions. Position the top membrane to overlap the bottom membrane 3" while ensuring the lap is installed shingle-fashion to prevent backwater laps.
			9. Using a clean rag saturated with Flex TPO Cleaner, thoroughly clean an area on both sheets at least 3 inch (76 mm) wide if seam area has become contaminated with dirt, debris, etc. Change rags frequently to avoid depositing previously removed materials and allow to dry.
			10. Using an approved automatic heat welding machine or hand held heat gun and silicone roller, continuously weld a minimum 1-1/2 inch (38 mm) wide seam. Flex recommends that only Robotic Automatic Walker Welders be used to weld all field seams.
			11. All welded seams must be manually checked for voids or seam deficiencies by probing the entire seam area with a blunted cotter key extractor after the seam has cooled. In addition, there must be destructive seam cuts taken daily at the job start and every time there is an interruption in the welding process (i.e., Power failure, welder shut down, change in job site conditions and after lunch). All deficiencies must be repaired.
			12. Once the seam is hot air welded so that the sheet is stabilized, fold half the membrane panel back onto the original membrane panel and remove the exposed half of the release liner from the membrane.
			13. After removing this half of the release liner from the membrane, start in the middle of the membrane panel and roll the membrane onto the roof substrate being careful to maintain a rounded roll in the membrane being applied and progressing from the center of the panel to the panel ends -do not try to push the entire panel onto the substrate at once or you may cause wrinkles in the roofing membrane.
			14. Using either a water-filled lawn roller or a stiff bristle push broom to apply pressure, roll/broom the membrane surface in order to achieve maximum adhesion to the roof substrate. The roller/brooming motion should be across the short dimension of the membrane panel in order to avoid creating wrinkles in the membrane panel.
			15. Roll back the remaining half of the Flex membrane and completely remove the remainder of the release liner before allowing the rest of the panel to be carefully rolled onto the substrate. Roll or broom this half of the membrane panel to promote maximum adhesion to the substrate before proceeding with subsequent panels.
			16. Apply adjoining sheets in same manner, lapping panel edges 3" minimum.
			17. Any wrinkles that impede the flow of water drainage must be cut out, laid flat and repaired using standard Flex repair procedures.

\*\* NOTE TO SPECIFIER \*\* OPTION 1 ~ GENERAL - ARCHITECT. Delete if not required.

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.

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

* 1. BITUMEN HANDLING
		1. Do not mix different types of asphalt.
		2. Do not heat the asphalt to or above its flash point or hold the asphalt at temperatures above the finished blowing temperature for more than 4 hours.
		3. Do not keep heated tankers above 325 degrees F (163 degrees C) overnight.

3.5\*\* NOTE TO SPECIFIER \*\* Permate vapor retarder Delete if not required.

* 1. VAPOR RETARDER
		1. General:
			1. Air/vapor barrier sheet shall typically be installed when required by design professional to address internal air pressure or humidity conditions.
			2. Insulation must be installed over the air/vapor barrier sheet and mechanically attached to the deck.
		2. Application:
			1. Install air/vapor barrier sheet loose-applied to the deck or fire board so that wrinkles and buckles are not formed.
			2. Overlap air/vapor barrier sheets a minimum of 6" for side and end laps. Tape laps together with duct tape or double sided tape.
			3. Seal perimeter and penetration areas with foam sealant.

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

3.6 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.

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* + 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
			2. When expansion joint is on curbs, the reinforced flashing must be bonded to curb face with Flex Bonding Adhesive and membrane on top of curb face must be nailed 12” O.C. with deformed shank roofing nail with 3/8” wide head.
			3. The expansion joint cover bellows shall be at least 1.5 times the expansion joint opening.
			4. Alternately, expansion joints may be field fabricated.

3.7 QUALITY CONTROL TESTING AND INSPECTION

* + 1. Seam Inspection:
			1. All seams are to be completed by the hot air welding method each day as the installation progresses.
			2. The roofing contractor is to designate a responsible person experienced in hot air welding techniques to inspect the completed installation each day as the installation progresses. The inspection is to include hand probing of all welded seams.
			3. Any defects found during these inspections should be immediately corrected.
		2. Manufacturer's Field Services:
			1. Provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of system installation in accordance with manufacturer's instructions.
			2. Site Visits: Final inspection and acceptance of the installation by the manufacturer’s technical representative is required before a warranty can be issued.

C. Electronic Leak Detection (ELD) in accordance to ASTM D7877 and ASTM D8231:

1. ELD testing of conventional roofing requires a conductive medium to enable testing. The conductive

 medium must be installed directly below the membrane. Placement below the coverboard is not acceptable.

3.8 TRAFFIC PROTECTION

A. 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.

B. Walkway pads shall be spaced 2 inches (51 mm) apart to allow for drainage between the pads.

C. 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.

D. Alternatively, walkway pads/rolls may be hot-air-welded to the roof membrane surface continuously around the perimeter of the pad/roll.

3.9 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.

4.0 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.

E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.

F. Clean and restore all damaged surfaces to their original condition.

4.1 MAINTENANCE

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

END OF SECTION