

System Specifications

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FULLY ADHERED TPO FLEECE BACK RECOVER OVER AGED SMOOTH BUR / MODIFIED BITUMEN OR GRANULATED CAP SHEET / MODIFIED BITUMEN

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Revision Date: April 2020

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PART 1 - GENERAL

1.01 Description

A. Scope:

1. Furnish and install a Mule-Hide Fully Adhered Mule-Hide TPO-c ("TPO") Fleece Back Roofing Membrane with flashings and accessories necessary to comprise a roofing system. The Mule-Hide TPO products and accessories shall be installed in strict compliance with current specifications and drawings as published by Mule-Hide Products Co., Inc. ("Mule-Hide").
2. The Mule-Hide Fully Adhered TPO (Thermoplastic Polyolefin) Fleece Back Membrane Recover Roof System utilizes a 45-mil (.045 inch), 60-mil (.060 inch) or 80-mil (.080 inch) thick reinforced membrane laminated to a 0.055" thick non-woven polyester fleece backing for a total sheet thickness of either 100 mils, 115 mils or 125 mils. The TPO Fleece Back membrane is fully adhered to the existing roof membrane (existing TPO Roof membrane) or other approved roof membrane with the Helix® Max Low-Rise Adhesive. DIRECT APPLICATION TO GRAVEL SURFACE BUR IS **NOT** ACCEPTABLE.
3. With the TPO Fleece Back membranes, adjoining sheets are overlapped a minimum of 3 inches and welded with a robotic welder with a minimum 1.5" wide hot air weld. End laps are butted together and stripped in with standard reinforced TPO membrane. Note: All membrane thicknesses listed in this specification are nominal thicknesses.

B. Related Work:

The work includes, but is not necessarily limited to the installation of:

1. Vapor Retarder (where specified)
2. Wood Blocking (nailers)
3. Insulation
4. Slip Sheet (where required)
5. Fasteners
6. Roof Membrane
7. Roof Membrane Flashings
8. Metal Flashings
9. Adhesives
10. Sealants
11. Walkways

Note: Mule-Hide recommends adherence to industry standards (SMACNA) for the installation of any metalwork.

C. General Design Considerations

1. It is the responsibility of the specifier to review local, state and regional codes to determine their impact on the specified Mule-Hide Roofing System.
2. It is the responsibility of the building owner or his/her designated representative to verify structural load limitation. In addition, a core cut may be taken to verify weight of existing components when the

roofing system is to be specified on an existing facility.

3. On new construction projects, especially in cold climate regions, moisture generated due to the construction process could adversely impact various components within the roofing assembly if not addressed. Refer to SPRI Advisory Bulletin included in the Design Reference DR-03-11 "Construction Generated Moisture".
4. Drainage must be evaluated by the specifier in accordance with all applicable codes. Slopes may be provided by tapering the structure or through the use of tapered insulation; a sufficient number of roof drains should also be specified and properly located to allow for positive drainage. Significant ponding that could remain after 48 hours should be eliminated with the addition of auxiliary drains in low areas where ponding is anticipated.
5. Mule-Hide specifically disclaims responsibility for the design and selection of an adequate drainage system and drain accessories. Selection must be made by the building owner or the owner's design professional.
6. Small incidental areas of ponded water will not impact the performance of this roofing system; however, in accordance with industry standards, the roofing assembly should be designed to prevent ponding of water on the roof for prolonged periods (longer than 48 hours). Good roofing practice dictates proper drainage to prevent possible excessive live load and, in the event of a roof leak, to minimize potential interior damage to the roofing assembly and to the interior of the building.
7. The removal of existing wet insulation and membrane must be specified. The specifier shall select an appropriate and compatible material as filler for voids created by removal of old insulation or membrane.
8. Regardless of the type of membrane or assembly selected, any loose flashings at the perimeter, roof drains and roof penetrations must be removed.

1.02 Quality Assurance

- A. When a project requires a Standard or Premium System Warranty (NDL), the Mule-Hide Roofing System must be installed in compliance with Mule-Hide published Specifications and Details by an independent Mule-Hide Warranty Eligible Contractor.
- B. There shall be no deviations from this specification or the Mule-Hide Products Co., Inc. ("Mule-Hide") standard details without prior written approval from Mule-Hide's Technical Department.
- C. Upon completion of the installation according to the terms and conditions stated in this specification and in accordance to the information given in the Warranty Application and Pre-Job Survey Form and any additional approvals which might have been given by Mule-Hide, an authorized representative of Mule-Hide shall perform an on-site inspection of the roof (commercial projects only) to verify that all installation and material requirements have been met.

Note: Inspections are only conducted on projects where a "System Warranty" is requested. Inspections are not conducted on projects not requiring a Mule-Hide Warranty or when only a "Roofing Membrane Limited Warranty" is requested. The sole purpose of an inspection by a Mule-Hide Representative is not to be a final inspection for the benefit of the Building owner/owner's representative. It is for the benefit of Mule-Hide to determine if a System Warranty may be offered for the project.

- D. Mule-Hide reserves the right to reject any roof system and refuse to issue any warranty on roofs which do not comply with Mule-Hide's specifications or current policies.
- E. Existing code ratings (UL and FM) will remain the same as the existing roofing system.

1.03 Submittals

- A. Prior to the time of bidding, the roofing contractor shall submit to the owner or owner's representative the following items:
 1. Copies of Mule-Hide specifications and published Product Data Sheets.

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2. Samples of each material to be used in the roof system.
3. Specimen copy of Mule-Hide Products Co., Inc. warranty
4. Dimensioned shop drawings to include an outline of the roof and appropriate details for flashings and terminations.
5. Certification from insulation, roofing and accessory components manufacturers that all materials supplied comply with identified ASTM and industry standards.
6. Verification that system specifications meet all identified code and insurance requirements including but not limited to the following if required:
 - a. Factory Mutual Research Laboratories
Norwood, MA
 - b. Underwriters Laboratories
Northbrook, IL

Note: It is the building owner/owner's representative's responsibility to determine what submittals are required for the project.

- B. Submit to Mule-Hide, prior to the job start, a Heat-Weld System Warranty Application to be reviewed by the Mule-Hide Technical Department to determine the acceptability of the project based on the information provided.
 1. The Heat-Weld System Warranty Application ("Warranty Application") must be completely filled out and should be accompanied with a copy of the written roof specification provided by the building owner/designer (if available). Also included should be any requests for deviations to Mule-Hide's standard published specification and details.
 2. A roof drawing shall be submitted with the Warranty Application indicating all dimensions and locations of all penetrations.

1.04 Product Delivery, Storage and Handling

- A. All products delivered to the job site shall be in their original unopened containers or wrappings and clearly labeled with the manufacturer's name, product identification and date of manufacture.
- B. Protect all materials from damage during transit, storage and delivery to the job site. Place all materials on pallets and protect from moisture.
- C. Store all materials in a dry, clean area protected from the elements. All rolls of membrane shall be stored flat on pallets. All fleece back membranes should be stored in its original plastic wrap and be covered to protect from moisture. Any moisture absorbed by the fleece-backing must be removed by using a wet-vac system, and allowed to dry prior to membrane installation.
- D. All adhesive and caulking shall be stored at temperatures between 60°F and 80°F. Materials exposed to lower temperatures affect the workability and performance of the product. Products shall be restored to the above temperature prior to use.
- E. All flammable materials shall be stored in a cool, dry area away from open flames and sparks. Follow precautions outlined on containers or supplied by the material manufacturer/supplier.
- F. All materials determined as being damaged (confirmed by Mule-Hide) due to improper storage on the job site are to be replaced with new materials.

1.05 Job Conditions

- A. This specification shall not be considered applicable without the appropriate additional specifications approved by Mule-Hide if it should be determined that any of the following conditions exist:

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1. The installation of any Mule-Hide Roof System is in a coastal area or high wind zone.
 2. If the Mule-Hide Roof System should exceed the structural load conditions as determined by an architect or engineer.
 3. When chemical or hazardous materials are discharged onto the Mule-Hide Roof System.
- B. Mule-Hide TPO roofing materials may be installed in temperatures below 40°F but only after consultation with the Mule-Hide Technical Department as special precautions or procedures may be necessary. The performance of the materials, installation costs and production rates may be affected.
- C. The General Contractor or the building owner shall be responsible for providing adequate surfaces and structures to receive the insulation, Mule-Hide Roof System and related sheet metal necessary for the successful completion of the project. It is the responsibility of the building owner or his designated representative to verify all structural load limitations including but not limited to the verification of the weight of the existing roof system.
- D. Only as much new roofing as can be made watertight each day shall be installed each day. This includes all flashing work.
- E. All substrates to receive new membrane or flashing shall be thoroughly dry. Should surface moisture occur, the contractor shall provide adequate equipment to dry the substrate prior to application of new materials. Chemical compatibility will depend on type of membrane used. Mule-Hide should be contacted for verification of compatibility with specific products, chemicals or waste products that may come in contact with the new roof membrane.
- F. Prior to and during application, all dirt, debris and dust shall be removed from surfaces to be roofed for both new and reroofing substrates.
- G. On all projects where the Fully Adhered TPO Fleece Back Recover Roof System is specified, it is the responsibility of the independent roofing contractor to have the owner or owner's representative verify the condition of the deck or substrate and to confirm the roof deck can withstand the additional load.
- H. Precautions shall be taken to prevent wind blow-off or wind damage during the course of the roofing application. This may necessitate additional securement of temporary construction, materials and equipment.
- I. The contractor shall verify and ensure that all roof drain lines are unblocked before starting work. Any blockages found shall be reported to the owner's representative and Mule-Hide's Technical Department in writing.
- J. Temporary waterstops shall be installed at the end of each day's work. Temporary waterstops shall be removed at the start of the next day's work and disposed of properly. Waterstops shall be compatible with all materials.
- K. Possible staining/discoloration of the white membrane may result when installing this system directly over existing smooth surfaced BUR or modified bitumen, especially along the selvage edge where fleece backing is not present. If aesthetics are critical, an approved insulation should be specified beneath the membrane.
- L. Do not install the Mule-Hide TPO Fleece Back Roof Membrane in direct contact with any product containing coal tar pitch, creosote or penta-based materials. Consult the Mule-Hide Technical Department for special installation requirements.
- M. Do not allow contaminants such as petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the Mule-Hide TPO Roof Membrane. Contact the Mule-Hide Technical Department for recommendations if such conditions exist.
- N. The contractor shall follow and comply with all safety regulations as recommended by OSHA.

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- O. All work shall be scheduled and executed without exposing interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- P. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surfaces and equipment movement. Contractor shall provide all necessary protection and barriers to segregate the work areas and prevent damage to adjacent areas. If excessive traffic over newly installed membrane is necessary, contractor shall provide plywood or polyester felt protection to prevent damage. All damaged materials shall be replaced with new materials.
- Q. On Recover (retrofit) projects, wet insulation and membrane must be removed and replaced with appropriate and compatible material similar to the existing roof system. All existing roofing materials to be removed for construction shall be immediately removed from the construction site to a dumping area authorized to receive such debris. Any hazardous materials such as asbestos or materials containing asbestos fibers shall be removed and disposed of in accordance with applicable City, State and Federal requirements. If the existing roofing system contains Phenolic Foam insulation, the insulation must be removed. Follow the Mule-Hide specifications for full roof replacement. A project containing Phenolic Foam does not qualify for a recover installation. Contact Mule-Hide Technical Department for recommendations.
- R. Any unusual or concealed condition discovered during the course of the work is to be reported to the owner and Mule-Hide immediately in writing. Work is to be halted until the owner has responded with a solution to the problems.
- S. On structural concrete decks, when a vapor retarder is not used, gaps in the deck along the perimeter and around penetrations must be sealed. If tilt-up panels are present, vertical joints between panels must be sealed as well. Sealing these areas will help prevent infiltration of hot humid air and possible moisture contamination resulting from condensation. This is specifically important when adhesive is used to attach the roof insulation.
- T. All local building codes, energy codes and requirements should be followed where applicable. Building codes are above and beyond the intended purpose of this specification. It is the roofing contractor's sole responsibility to determine and ensure that the roofing system selected complies with all local codes and requirements.
- U. Both interior and exterior building areas affected by construction shall be cleaned up and any damaged areas shall be repaired to the owner's satisfaction.
- V. Certain project conditions may require modifications to this specification. Contact the Mule-Hide Technical Department if any of the following conditions exist:
 - 1. Roof heights greater than 100 feet.
 - 2. Geographical location in a 100 mph or greater wind zone, per the ANSI 100 year mean recurrence interval wind isotach.
 - 3. Location with a D exposure as determined in ANSI A58.1.
- W. When using heat-welding equipment, always review the equipment manufacturer's instructions, precautions and warnings.
- X. Consideration should be given in the project design to problems that can precipitate from the smooth surface characteristic of the Mule-Hide TPO Fleece Back membranes.
- Y. While there are no maximum slope restrictions for the application of this roofing system, fire classification requirements may restrict the slope to which it may be applied.
- Z. Drainage
 - 1. Drainage must be evaluated by the building owner's designer/specifier in accordance with all applicable codes (local, state or national). Drainage may be provided by sloping the deck or installing

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tapered insulation in conjunction with the installation of a sufficient number of roof drains/ scuppers or an external drainage system (gutters and downspouts). Significant ponding that could remain beyond 48 hours should be eliminated.

2. Mule-Hide specifically disclaims responsibility for the design or the selection of an adequate drainage system and drain accessories. The selection of an adequate drainage must be made by the building owner or his design professional.
3. In accordance with industry standards, the roof assembly should be designed to eliminate ponding of water on the roof for prolonged periods (NRCA recommends no ponding longer than 48 hours). Proper drainage will help prevent possible excessive live loads and in the event of a roof leak, will help to minimize potential damage to the roofing assembly and interior of the building.
4. The installation of tapered edge strips, crickets or saddles may assist in directing the flow of water to help eliminate ponding conditions.

1.06 Warranties

All Mule-Hide warranties are available for commercial projects, term limits range from 10 to 30-years, and subject to enhancements as required such as membrane thicknesses. A Roofing Membrane Limited Warranty for a maximum of 20 years is available for residential projects

A. Mule-Hide's Roofing Membrane Limited Warranty For Commercial Projects

The Roofing Membrane Limited Warranty ("Warranty") covers only the Mule-Hide EPDM membrane (or portion thereof) determined by Mule-Hide to be defective and resulting in roof leaks. This Warranty does not cover workmanship or other components not supplied by Mule-Hide. Mule-Hide does not perform inspections of the installation before issuing the Roofing Membrane Limited Warranty. A Mule-Hide Warranty Application and the appropriate fee must be submitted to Mule-Hide to obtain this warranty. Proof of purchase may be required.

B. Mule-Hide's Standard System Warranty

The Standard warranty is an NDL ("No Dollar Limit"), labor and material warranty that covers only the Mule-Hide labeled membrane and accessories that comprise the Mule-Hide Roof System, other components supplied or approved in writing by Mule-Hide and exclusively installed by an independent Mule-Hide Warranty Eligible Contractor. Applicator must submit a Warranty Application and the appropriate fee to Mule-Hide. Standard warranties require inspections by a Mule-Hide representative.

C. Mule-Hide Premium System Warranty

The Premium warranty is an NDL ("No Dollar Limit"), labor and material warranty that covers only the Mule-Hide labeled membrane, insulation and accessories or components supplied or approved in writing by Mule-Hide and exclusively installed by an independent Mule-Hide Warranty Eligible Contractor. Applicator must submit a Warranty Application and the appropriate fee to Mule-Hide. Premium warranties require inspections by a Mule-Hide representative.

Warranty Table I

Fleece Back Adhered Systems Warranty Options								
Warranty Term	Minimum Membrane Thickness	Warranty Wind Speed				Hail Coverage*		
		55 mph	72 or 80 mph	90 or 100 mph	110 or 120 mph	1" Dia. Hail	2" Dia. Hail	3" Dia. Hail
10, or 15 year	Fleece Back TPO 100-mil	√	N/A	N/A	N/A	N/A	N/A	N/A

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20 year	Fleece Back TPO 115-mil	√	N/A	N/A	N/A	N/A	N/A	N/A
25-Year	Fleece Back TPO 135-mil	√	N/A	N/A	N/A	N/A	N/A	N/A
30 year	Fleece Back TPO 135-mil	√	N/A	N/A	N/A	N/A	N/A	N/A

*See Technical Data Bulletin for specific requirements for coverages

- C. Mule-Hide is under no obligation to issue warranties on projects completed prior to submittal to the Mule-Hide Technical Department of a properly completed Warranty Application.
- D. Metal flashing products supplied by Mule-Hide (Mule-Hide Metal Accessories) and installed by a Mule-Hide Warranty Eligible Contractor will be covered under the NDL System Warranty. The finish on the Mule-Hide labeled metal components are covered for a maximum warranty period for up to 25 years independent of the terms of the issued warranty (see Mule-Hide 25-yr Limited Metal Warranty for specific warranty coverage).
- E. NDL System Warranties are not available for residential projects.
- F. TPO tie-ins are not covered by Mule-Hide warranties.
- G. Contact Mule-Hide Technical Department for other extended warranties that may be available.
- H. Terms and Conditions of Warranties
 - 1. Mule-Hide's obligations under the Roofing Membrane Limited Warranty and the NDL System Warranty are limited to the specific terms and conditions of the respective Warranties. Sample copies of the Mule-Hide Warranties are available from the Mule-Hide Technical Department upon request.
 - 2. Mule-Hide does not warrant products incorporated or utilized in the installation that were not furnished or approved by Mule-Hide.

PART 2 - PRODUCTS

2.01 General

- A. The components of the Fully Adhered Mule-Hide TPO Fleece Back Membrane Recover Roof System are to be products manufactured or supplied by Mule-Hide Products Co., Inc.
- B. Components other than those supplied or manufactured by Mule-Hide may be submitted for review and acceptance by Mule-Hide's Technical Department. Mule-Hide's acceptance of any other product is based solely on chemical compatibility and published performance data provided by the component manufacturer. Other components may be considered on a job-by-job basis and must be approved in writing by Mule-Hide's Technical Department. Mule-Hide offers no warranty or guarantee for the performance or suitability of any component not supplied or manufactured by Mule-Hide.

2.02 Roofing Membrane

The Mule-Hide Reinforced TPO-c Fleece Back Membrane is available in 100 mils (FB-45), 115 mils (FB-60) and 135 mils (FB-80). The Mule-Hide TPO-c membrane is a polyester scrim reinforced thermoplastic polyolefin roofing membrane that meets and exceeds the requirements of ASTM D6878 Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing, and has been laminated to a 0.055" non-woven polyester fleece backing. Refer to the Product Data Sheets for physical properties and additional information.

The Mule-Hide Reinforced TPO-c Membrane is available in 45 mils (.045 inch), 60 mils (.060 inch), or 80 mils (.080 inch) thick and is used for flashings in a TPO Fleece Back Membrane Recover Roof System. The thickness of the TPO-c flashing membrane shall match the TPO thickness of the Fleece Back membrane. The Mule-Hide TPO-c membrane is a polyester scrim reinforced thermoplastic polyolefin roofing membrane that meets and exceeds the requirements of ASTM D6878 Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing. Refer to the Product Data Sheets for physical properties and additional information.

2.03 Accessory Materials

The following Mule-Hide materials must be used to install Mule-Hide Roof Systems. Mule-Hide will not warrant any application where another manufacturer's product is substituted for a Mule-Hide product. **All products listed below are physically and chemically compatible with each other.**

- A. Helix[®] Max Low-Rise Adhesive, Helix[®] Max Low-Rise Adhesive 5-Gallon Jug, Helix[®] Max Low-Rise Adhesive Dual Tank, and Helix[®] Max Low-Rise Adhesive Dual Cartridge (Helix Max Low-Rise Adhesive) are a two-component, low-rise, construction grade, polyurethane foam adhesive designed to adhere approved roof insulations, thermal barriers, cover boards and fleece backed single-ply membranes to acceptable substrates. This VOC, CFC, HCFC and solvent free adhesive is quickly and easily applied.
 - 1. Depending on the packaging and delivery option selected, these products can be installed in continuous beads, full spray, or splatter applications. Not all products have the same options so review of the Product Data Sheets is required to ensure proper use.
- B. Helix[®] Low-Rise Adhesive is a two-component, low-rise, construction grade, polyurethane foam adhesive designed to adhere approved roof insulations, thermal barriers, or cover boards to acceptable substrates, and is available in multiple packaging options; 15 and 50 gallon drums, Dual Tanks, and Dual Cartridges.
- C. Mule-Hide TPO Bonding Adhesive – A solvent-based rubberized adhesive used for bonding Mule-Hide TPO-c Membrane to various vertical substrates. Mule-Hide TPO Bonding Adhesive is a two-surface contact adhesive that is applied to both the underside of the membrane and substrate surface. This product may be used with TPO field membrane and flashing membrane. Adhesive is compatible with polyisocyanurate, wood fiberboard, fiberglass-faced gypsum panels, concrete, masonry, metal and wood surfaces. This adhesive is to be used for flashings only and not to adhere the Fleece Back or Fleece Back Plus Membrane.
- D. Mule-Hide Low-VOC Bonding Adhesive – A high strength solvent-based contact adhesive that allows bonding of TPO membrane to various porous and non-porous substrates. It is specially formulated using a blend of VOC exempt and non-exempt solvents to be meet the < 250 g/l VOC content requirements of the OTC Model Rule for Single Ply Roofing Adhesives. This adhesive is to be used for flashings only and not to adhere the Fleece Back or Fleece Back Plus Membrane.
- E. Mule-Hide Low-VOC Bonding Adhesive 1168 – A high strength solvent-based contact adhesive that allows bonding of TPO membrane to various porous and non-porous substrates. It is specially formulated using a blend of VOC exempt and non-exempt solvents to be meet the < 250 g/l VOC content requirements of the OTC Model Rule for Single Ply Roofing Adhesives. **This product COMPLIES with the following California counties' VOC regulations:** Alameda, Contra Costa, El Dorado, Los Angeles, Marin, Napa, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, and Tehama. This adhesive is to be used for flashings only and not to adhere the Fleece Back or Fleece Back Plus Membrane.
- F. Aqua Base 120 Bonding Adhesive – A water-based adhesive used to bond Mule-Hide TPO Fleece Back Membrane to various substrates and insulation boards. Aqua Base 120 is applied as a two-sided contact adhesive when used with standard (non-fleece back) TPO membranes, or as a single-side, wet lay-in adhesive when used with Mule-Hide Fleece Back TPO Membrane. Aqua Base 120 is to be used for adhering Fleece Back membrane only and not approved for use to adhere Fleece Back Plus membrane.
- G. AeroWeb Low-VOC Aerosol Contact Adhesive/Primer – A low VOC contact adhesive used to adhere membranes to various substrates, and prime surfaces prior to the application of F5 Air & Vapor Barrier. It features a quick dry time and ease of application from the self-contained pressurized cylinder.
- H. Mule-Hide TPO Primer – A high-solids-content, clear (translucent color), polymer-based splice primer used to prepare TPO membrane for improved adhesion to pressure-sensitive TPO accessories such as: RUSS Strips, TPO Pressure Sensitive Cover Strips, Uncured Flashing Tapes and Cured Cover Tapes. Mule-Hide TPO Primer is required to prepare TPO membrane surfaces prior to the application of any pressure sensitive Mule-Hide accessories.

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- I. Mule-Hide Low VOC Primer – A solvent-based product designed to prepare TPO membrane for improved adhesion to pressure-sensitive TPO accessories such as: RUSS Strips, TPO Pressure Sensitive Cover Strips, Uncured Flashing Tapes and Cured Cover Tapes. This Low-VOC product is ideal for use in states where VOC content is a concern.
- J. Mule-Hide TPO Flashing – A non-reinforced, .060-inch thick material primarily used to seal details where field fabrication is necessary, such as drain details, pipe flashings, pitch pocket flashings, seaming joints of the Mule-Hide TPO Coated Metal, and any place where reinforced membrane is not practical.
- K. Mule-Hide TPO Universal Corners – .060 inch thick pre-molded, non-reinforced TPO material. They are uniform in shape and size and provide water tightness at corners formed by TPO Coated Metal and flashing membrane. They provide a neat, finished look to building corners, curbs and parapet flashings with no cutting or stretching required. Universal Corners are available in white only.
- L. Mule-Hide TPO Outside Corners – Are pre-molded and are used for flashing outside corners on a variety of details. Installation is fast and easy with no cutting or stretching required. TPO Outside Corners are available in white, gray, and tan.
- M. Mule-Hide TPO Inside Corners – Are pre-molded and are used for flashing inside corners on a variety of details. Installation is fast and easy with no cutting or stretching required. TPO Inside Corners are available in white, gray, and tan.
- N. Mule-Hide Weathered Membrane Cleaner – Used to clean aged TPO-c membrane prior to the welding process. This cleaner helps to loosen and remove dirt and other contaminants from the surface of the TPO-c membranes and leaves a suitable surface for welding or the subsequent application of TPO Primer.
- O. Mule-Hide TPO Pipe Seal – An injection molded, pre-formed flashing for pipes made of Mule-Hide non-reinforced TPO material. They are designed to add ease to the installation process while offering increased watertight security and improved aesthetics. TPO Pipe Seals are designed as an economical flashing for single pipe penetrations on Mule-Hide TPO-c Membrane roof systems. The TPO Pipe Seals can be used wherever the TPO Pipe Seals may be slipped over the top of the pipe.
- P. Mule-Hide TPO T-Joint Cover – 60-mil non-reinforced flashing cut into a 4.5" diameter circle used to seal step-offs at splice intersections. Installation is mandatory on all 60-mil and 80-mil TPO systems and on all jobs warranted longer than 15 years.
- Q. Mule-Hide TPO Coated Metal – 24-gauge, galvanized steel to which is laminated 35 mils (.035" thick) of Mule-Hide non-reinforced TPO Membrane used for flashing and edge metal.
- R. Mule-Hide All-Purpose Bar ("A-P Bar") – An extruded aluminum bar, 50 mils (.050") thick, used to terminate adhered, reinforced membrane vertical flashings in certain constructions. Mule-Hide A-P Bar may also be used to anchor the field sheet at the base of vertical angle changes.
- S. Membrane Fasteners and Plates – Mule-Hide offers a variety of membrane fasteners and plates to meet specific job conditions and substrates.
- T. Mule-Hide Thermoplastic Pourable Sealer – A one-component thermoplastic sealant for use in pitch pockets.
- U. Mule-Hide TPO .045 Reinforced 6" X 100' – Used for stripping-in TPO Coated Metal and as cover strips over TPO Coated Metal joints.
- V. Mule-Hide TPO Cut Edge Sealant – A solvent-based, liquid sealant used to seal the cut edge of the Mule-Hide TPO Membrane.
- W. Mule-Hide TPO Walkway Rolls – A 1/8-inch thick embossed TPO membrane available in rolls (34" x 50')

having a herringbone traction surface. Walkway Rolls are trimmed in safety yellow along the length of the sheet to better define the walkway area. Walkway Rolls are welded directly to the TPO roofing membrane. The yellow edges are smooth without safety lugs to allow for easier welding. Walkway Rolls are available in white and gray colors.

- X. Mule-Hide Insulation – Mule-Hide Poly ISO 1 and Poly ISO 2 polyisocyanurate insulation (flat or tapered) is a closed-cell polyisocyanurate foam core laminated to heavy, black (non-asphaltic) glass fiber reinforced felt facers.
- Y. Mule-Hide HP Protective Mat – A nominal 6.0-ounce per square yard (140 grams per square meter) UV resistant polypropylene needle punched fabric. It can be used above the membrane as a slipsheet for protection from damage by materials placed on top of the membrane.
- Z. F5 Air & Vapor Barrier – A 40-mil thick composite consisting of 35-mil self-adhering rubberized asphalt membrane laminated to a 5-mil UV resistant poly film with an anti-skid surface which is fully compatible with Helix Max Low-Rise Adhesive. A white poly film is available for summer time exposure and a black poly film is available for winter time exposure. F5 Air & Vapor Retarder can also function as a temporary roof for up to 120 days. Available in rolls 39" wide by 75' long (244 square feet).
- AA. 115 CLEANER – A ready-to-use, environmentally friendly cleaner that is excellent at removing dirt, oil, and grease from a variety of surfaces. 115 CLEANER is used as a general purpose cleaner prior to the application of the Helix Max Low-Rise Adhesive. Power washing with 115 CLEANER effectively removes existing oil, dirt, or grease that would adversely affect the bond between the existing aged (5 years or more) TPO single ply roofing membrane.

2.04 Related Materials By Others

A. Wood Nailers

1. Nailers shall be #2 or better lumber. Creosote and asphaltic preservatives are not acceptable. Pressure treated lumber is not required on new construction unless specified by the architect.
2. Wood nailers shall conform to Factory Mutual's Loss Prevention Data Sheet 1-49.
3. Wood nailers shall be installed as specified on the project drawings and shall be of a height sufficient to match the thickness of the insulation being used.

B. Insulation/Coverboard

This specification has been written for the purpose of installing a new TPO Fleece Back Membrane directly over an existing aged smooth surfaced BUR / Modified Bitumen or granular surfaced BUR / Modified Bitumen membrane roofing system. If the building owner is requesting insulation or a coverboard installed prior to the installation of the new membrane, the Mule-Hide TPO Fleece Back Specification must be followed.

C. UL and FM Approved Assemblies

Contact Mule-Hide Technical Department for projects that require compliance with UL or FM requirements.

D. Sheet Metal

1. Metal flashing products supplied by Mule-Hide (Mule-Hide Metal Accessories) and installed by a Mule-Hide Warranty Eligible Contractor will be covered under an NDL System Warranty.
2. TPO Coated Metal and non-coated metal components such as gravel stops, drip aprons, counterflashings, copings, etc., should be fabricated and installed in accordance ES-1 recommendations and requirements.

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3. Sheet metal components supplied by others are not covered by the Mule-Hide warranties. Contact Mule-Hide's Technical Department for specific requirements.

E. Asphalt

Do not use asphalt to adhere Mule-Hide TPO Fleece Back membrane to an existing smooth surfaced BUR / Modified Bitumen or granular surfaced BUR / Modified Bitumen roofing system. If asphalt used as an adhesive for fleece back membrane, refer to Mule-Hide's TPO Fleece Back Plus fully adhered roofing system specification.

2.05 Precautions

- A. Consult Safety Data Sheets and container labels for specific safety instructions prior to use.
- B. Avoid breathing vapors of solvents, cleaners, primers, sealants and adhesives. Use with adequate ventilation. Avoid prolonged contact of solvents, sealants, cleaners, primers and adhesives with skin. Solvent resistant rubber gloves should always be worn during use.
- C. Do not use Mule-Hide TPO roofing products near fire or flame. Do not use open flames for drying of surfaces, sealants or adhesives. **Do not smoke near flammable products.**
- D. Do not use oil-based paint on Mule-Hide TPO Coated Metal or membrane. Contact Mule-Hide's Technical Department for recommendations.
- E. Do not allow muriatic acid (masonry cleaner) to come in direct contact with the Mule-Hide TPO Membrane or accessory products.
- F. Do not allow Mule-Hide TPO membranes or accessories to come into direct contact with steam or vents that produce temperatures in excess of 160°F.
- G. Do not apply Helix Max Low-Rise Adhesive when surface and/or ambient temperatures are below 25°F.
- H. Sprayed polyurethane foam application shall not proceed during periods of inclement weather. Follow Mule-Hide requirements for application temperatures and humidity levels.
- I. Wind barriers shall be used if conditions could affect the quality of the sprayed polyurethane adhesive and to prevent possible over spray.
- J. Cover Tapes may lose tack when exposed to temperatures below 40°F. for extended periods of time. A heat gun may be used to warm the product. Only apply heat to the membrane side. Be careful not to overheat. Hot boxes are the preferred method to warm tapes.
- K. In colder temperatures when the ambient temperature is near the dew point, condensation may form on the tape primer and adhesive as the solvents flash off. If condensation occurs, discontinue the application and allow the surface to dry. **Do not attempt to dry the surface with heat guns or torches.** When weather permits apply a new coat of product.

PART 3 - EXECUTION

3.01 General

- A. When installing a Fully Adhered Mule-Hide TPO Fleece Back Membrane Recover Roof System in cooler weather, it is recommended that liquids such as adhesives, solvents, sealants, etc. be stored at warmer temperatures (60°F or more but not exceeding 80°F) until just prior to use in order to facilitate the installation.
- B. When using Aqua Base 120 to adhere wall flashings, the TPO membrane must be installed in

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temperatures of 40°F and rising for 48 consecutive hours to prevent the Aqua Base 120 from freezing until fully cured.

- C. Application of the Helix Max Low-Rise Adhesive shall not proceed during periods of inclement weather. Follow Mule-Hide requirements for application temperatures and humidity levels.
- D. Do not apply Helix Max Low-Rise Adhesive when surface and/or ambient temperatures are below 25°F.

3.02 Substrate Conditions

The following general conditions apply to the substrate/existing roof system that will receive a Fully Adhered Mule-Hide TPO Fleece Back Membrane Recover Roof System.

- A. The Mule-Hide TPO Fleece Back Membrane Recover Roof System is approved over existing aged smooth surfaced BUR / Modified Bitumen roofing systems. For direct application to smooth BUR, the asphalt must be Type III or IV and aged at least 5 years. Any previously unexposed, or shiny, asphalt must be primed with AeroWeb prior to application of Helix Max Low-Rise Adhesive.
- B. The roof deck must be structurally sound to provide proper securement for mechanical fasteners. Areas showing a loss of integrity due to corrosion, rotting, warping, concrete spalling, etc., must be repaired or replaced prior to installing the roofing system.
- C. It is the responsibility of the roofing contractor to perform test cuts at each roof area prior to installation of the new roof system. The condition of the substrate must be suitable to receive a Fully Adhered Mule-Hide TPO Fleece Back Recover Roof System. Wet insulation must be removed and replaced with similar materials. See Single-Ply Roofing Institute's guidelines for determining wet insulation.
- D. Contact the material manufacturer when the substrate is exposed to excessively high humidity and/or a corrosive environment. Special fasteners (e.g. stainless steel) or details may be required.
- D. The existing roof system must be in sound, dry and clean condition.
- E. It is acceptable to install a Fully Adhered Mule-Hide TPO Fleece Back Membrane Recover Roof System over an existing aged smooth surfaced BUR / Modified Bitumen roofing that has been installed over the following deck substrates provided the decks are in a suitable condition. It shall be the responsibility of the roofing contractor to confirm that the existing roof system has been properly installed and is in sound condition.
 - 1. Structural Metal Deck shall be a minimum 22-gauge thick and shall conform to recommendations outlined in Factory Mutual's Loss Prevention Data Sheet 1-28 (requires insulation). Contact Mule-Hide's Technical Department for attachment requirements for decks less than 22-gauge in thickness. Additional mechanical attachment may be required.
 - 2. Structural concrete and pre-cast, pre-stressed concrete (2,500 psi minimum). It is the contractor's responsibility to confirm that there is no moisture trapped between the concrete deck and the existing roof membrane.
 - 3. Lightweight Insulating Concrete Fill - the existing TPO roof system must be properly attached through the insulating concrete into the metal or concrete deck.
 - 4. Wood Plank (1" minimum) shall conform to Factory Mutual's requirements for Class 1 impregnated decks (insulation is required). FM approved wood decks are a minimum, nominal 2-inch thick, tongue and groove planks.
 - 5. Plywood (15/32" minimum) shall be exterior grade (minimum CDX grade).
 - 6. OSB Decks must be a minimum of 7/16" thick.

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7. Cementitious Wood Fiber Decks
8. Gypsum Concrete Deck

Substrate Compatibility					
Insulation/Underlayments		Roof Decks		Existing Roofing Materials	
Poly ISO 1 & 2	Yes	Concrete	Yes	Smooth BUR	Yes ⁵
StructoDek [®] High Density	Yes	Cellular Lt.Wt. Concrete	Yes ¹²	Gravel BUR	Yes ⁶
Expanded Polystyrene (EPS)	Yes ¹	NVS Lt.Wt. Concrete	Yes ¹²	Mineral Cap Sheet	Yes
Extruded Polystyrene (XPS)	Yes ²	Gypsum	Yes	Granular Modified-Bitumen	Yes
New Sprayed Foam	No ⁹	Cementitious Wood Fiber	Yes	Smooth Modified-Bitumen	Yes
Scarified SPF	No ⁹	Plywood/OSB	Yes	Coal Tar Pitch	Yes ⁷
DensDeck [®]	Yes	Painted Steel	Yes	Aluminum-Coated BUR	No ⁸
Securock [®]	Yes	Galvanized Steel	Yes ³	Acrylic-Coated SPF	No ⁹
Oriented Strand Board	Yes	Acoustical Steel	Yes ⁴	Silicone-Coated SPF	No ⁹
Poly ISO 1HD	Yes	Wood Plank	Yes	Aged EPDM, Hypalon, TPO	Yes ¹⁰
				Unoxidized (Shiny) Asphalt	Yes ¹¹

1. Fleece Back membrane maybe installed directly over minimum 1.5-lb.-density EPS; however, to obtain UL & FM codes, an overlayment of StructoDek[®] High Density, DensDeck, Securock or Poly ISO insulation is required.
2. For insulation attachment only.
3. For new galvanized steel decks, power-washing is necessary to remove finishing oil residue if present.
4. For acoustical steel decks, fill the flutes with fiberglass or other suitable fill insulation and tack in place with strips of duct tape 3' OC, or other adhesive, prior to spraying the deck with Helix Max Adhesive.
5. Existing Smooth BUR must be Type III or IV asphalt if the Fleece Back membrane is to be installed directly without insulation.
6. A minimum of an approved cover board or insulation is required over properly prepared gravel BUR. **Fleece Back membrane cannot be installed directly over a gravel/slag surface.**
7. An insulation providing the necessary R-value must be specified to prevent the coal tar pitch from softening. **Fleece Back membrane cannot be installed directly to coal tar pitch.**
8. Aluminum coatings must be removed by power-washing or by physical abrasion prior to the application of Helix Max Adhesive. Adhesion tests are required to confirm sufficient preparation of the substrate.
9. SPF roofing assemblies may be considered on a job by job basis. Contact Mule Hide Technical Department prior to bidding.
10. Contact Mule-Hide for specific requirements on recover applications over aged EPDM, Hypalon, or TPO membrane.
11. Requires AeroWeb for all applications.
12. Cellular or air-entrained lightweight substrates are acceptable. Lightweight concrete containing expanded aggregate such as perlite or vermiculite is not acceptable. New lightweight concrete must be confirmed by the contractor to be thoroughly dry. Existing substrates will require adhesion tests.

- F. Mule-Hide recommends that all roof surfaces have a positive slope to provide adequate drainage. There should not be any ponding water 48 hours after a rainfall.

3.03 Preparation of Existing Substrate

A. General

1. To prevent delays or interruptions, coordinate work with other trades or suppliers to ensure that components to be incorporated into the Fully Adhered Mule-Hide TPO Fleece Back Membrane Recover Roof System are available as the work progresses. Examine substrates to which the roofing materials are to be applied to ensure that their condition is satisfactory for the Mule-Hide TPO Fleece Back Membrane Recover Roof System application.
2. Specifier or roofing contractor shall determine the condition of the existing roof deck and roofing system. Areas with deteriorated decking or wet insulation or other failed materials shall have those affected materials removed and replaced. Make sure all decking is securely fastened. The roofing contractor has the final responsibility to ensure an acceptable deck and existing roof system is provided to receive the new roof system.

3. All roof surfaces shall be free of ponded water, ice, or snow. Significant ponding that remains after a period of 48 hours should be eliminated by either installing tapered insulation to create positive drainage of the roof surface or by installing new drains in the low areas where the ponding remains. Positive drainage shall also eliminate the possibility of excessive live loads caused by ponding water that could cause structural damage or failure.
4. The existing roof membrane must be examined to ensure there is no crushed or damaged insulation.
5. The existing roof membrane must be power washed using the Mule-Hide 115 CLEANER. Spray the surface with the 115 CLEANER and let stand for 10 minutes. Areas with heavy dirt accumulation may require surface scrubbing with a stiff bristled broom. Thoroughly wash the roof surface clean by power washing. Loose granules must be removed by sweeping, vacuuming, or blowing.
6. Once the membrane has dried, cut and remove all existing flashing materials.
7. To ensure adequate adhesion not previously exposed, shiny, asphalt, the surface must be primed with AeroWeb.
8. Always ensure the existing roof membrane is adequately attached to not jeopardize the wind uplift performance of the newly installed roof membrane.
9. A field review of the project may be required by a Mule-Hide representative to determine any additional enhancements needed to meet the requested warranty requirements.

3.04 Membrane Installation

General – Once the existing membrane is cleaned, prepped and ready for the membrane installation, unroll the Mule-Hide TPO Membrane and position without stretching. Allow the membrane to relax at least 15 minutes when the temperature is above 60°F, or 30 minutes when the temperature is below 60°F, prior to installation. Inspect and remove any damaged membrane.

- A. All membrane overlaps shall be installed to facilitate the flow of water. Seams shall be shingled or run parallel to the flow of water. Backwater seams are not permitted.
- B. Long seams in the new Mule-Hide TPO Fleece Back Recover Roofing System should be run parallel with the seams in the existing modified bitumen or granular surfaced BUR roofing system whenever possible.
- C. Mule-Hide TPO Fleece Back membranes have a 3" fleece-free selvage edge along one edge of the membrane. Lap sheets a minimum of 3 inches of fleece-free seam to provide space for a continuous, minimum 1-1/2" weld. Membrane overlaps shall be shingled with the flow of water or parallel to the flow of water. All welded field seams shall be a minimum of 1-1/2 inches wide. End laps shall be butted and stripped in with TPO-c reinforced membrane, see Detail MHT-FA-104E.
- D. The roofing contractor shall check all welded seams for continuity and integrity using a cotter pin puller or other suitable blunt object. The contractor shall make sample test seams each day prior to welding field seams. The contractor shall, using scrap material, run at least two test seams, each a minimum of 2' long. Each test seam shall be used to determine adequate seam strength and to ensure the equipment has warmed up, is operating properly and proper settings have been determined. This should be done each time the equipment is turned on after a cool down period.
- E. Perimeter - When installing the Mule-Hide Fully Adhered TPO Fleece Back roofing membrane system, it is not necessary to install Half Sheets parallel with the perimeter. Full size sheets should be used everywhere practical to minimize the number of field seams. In place of Half Sheets, more ribbons of adhesive are installed in the perimeter. Weld all laps (seams and end laps) continuously with a minimum weld width of 1-1/2 inches. All field welds shall be completed with an automatic welder. Perimeter areas shall be determined by one of the following methods:

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1. Mule-Hide Technical Bulletin TPO-FA01-2006, Standard Fastening Patterns and Guidelines. Mule-Hide defines the minimum perimeter area as 8' in from the roof edge along all exterior roof edges.
 2. For Factory Mutual insured buildings, contact Mule-Hide Technical Department for perimeter requirements.
- F. Contact the Mule-Hide Technical Department for bead spacing of the adhesive in the field, perimeter and corner areas.

3.05 Field Sheet Attachment

A. General

Position membrane over substrate with 3" selvage edge overlap at lap seams, and positioned so that laps will shed water. Allow the membrane to relax at least 15 minutes prior to installing when temperatures are 60° F and above or 30 minutes when temperatures are below 60° F. Run TPO sheets parallel to seams in existing modified bitumen and granular surfaced BUR roofing systems. **CAUTION:** Keep the protective packaging of the Mule-Hide Heat-Weld Membrane intact until ready to use.

B. Membrane Attachment using Helix Max Low-Rise Adhesive

Slide-in Method:

1. Unroll Fleece Back sheet and position. Fold the sheet back in half lengthwise (end-to-end).
2. Spray apply, splatter apply, or bead apply Helix Max Adhesive to the substrate.
 - a. For fully adhered application, spray adhesive to obtain full coverage (approx. 1/8" to 1/4" thick after foaming). Ensure end laps are protected from adhesive.
 - b. For bead applications, apply at 4", 6", or 12" on center with a **min. 1/2" wide wet bead**. Ensure end laps are protected from adhesive.
3. Once "string time" occurs, gradually roll Fleece Back membrane into Helix Max Adhesive, checking for "string/body" every few feet. If membrane reaches adhesive that has NOT developed "string/body" stop rolling Fleece Back membrane into adhesive until string develops. As sheet is being installed, immediately start rolling the membrane width-wise with a 150-lb. segmented weighted roller. Repeat process until Fleece Back sheet is fully installed.

Roll-in (Mod Bit) Method:

1. Unroll the Fleece Back sheet and position in place. Starting at one end of the membrane, using the roll core, carefully roll the membrane back up half way making sure you do not reposition the membrane. Leaving half the membrane laid out will help prevent this.
2. Spray apply, splatter apply, or bead apply Helix Max Adhesive to the substrate.
 - a. For fully adhered application, spray adhesive to obtain full coverage (approx. 1/8" to 1/4" thick after foaming). Ensure end laps are protected from adhesive.
 - b. For bead applications, apply at 4", 6", or 12" on center with a **min. 1/2" wide wet bead**. Ensure end laps are protected from adhesive.
3. Once "string time" occurs, gradually roll Fleece Back membrane into Helix Max Adhesive, checking for "string/body" every few feet. If membrane reaches adhesive that has NOT developed "string/body" stop rolling Fleece Back membrane into adhesive until string develops. As sheet is being installed, immediately start rolling the membrane width-wise with a 150-lb. segmented weighted roller. Repeat process until Fleece Back sheet is fully installed.

3.06 Welding of Laps

A. General

1. The Mule-Hide TPO Roofing membrane is to be hot air welded only. Seaming "membrane to

membrane" and "flashing/detail membrane to membrane" shall only be done by hot air welding.

2. All surfaces to be welded shall be clean and dry.
3. Side laps have a selvage edge that allows them to be heat welded together. End laps must be butted together and covered with a minimum 6" wide strip of reinforced membrane that is heat welded along all edges, refer to Mule-Hide Detail # MHT-UN-104E. Apply cut edge sealant to all cut edges of reinforced membrane.

B. Hot Air Welding

1. Machines for hot air welding are available from several different sources. Each manufacturer's instructions for use shall be followed, as well as all local codes regarding electric grounding, supply and other related functions. Since most automatic welding machines require 218 to 230 volts, the use of a portable generator on the roof is recommended for greater flexibility. **Mule-Hide requires the use of automatic welding machines for all field sheet seaming. Hand welding is only acceptable for flashings and those seams where the automatic welder cannot be used.**
2. Hand-held welding equipment is also available to weld membrane. After the preheated nozzle tip is applied in the overlap area and the material starts to soften, immediately follow with a silicone hand roller to press the heated membrane surfaces together with slow, even movements. Keep the roller within 1 inch of the nozzle tip. Angle the hot air tool so that the flowing air faces the roller. Seam strength may be tested when cool. For best results, testing seams 8 hours after hot air welding is recommended.
3. If the seams of the new Mule-Hide TPO Fleece Back Recover roofing system run perpendicular to the seams of the existing modified bitumen or granular surfaced BUR roofing system, special attention should be given where the automatic welder passes over the seams in the existing roofing system.

C. "T" Joint Covers

1. **For 45-mil membrane and maximum warranty length of 15-years.** Pay special attention to the "T" lap seams formed where three layers of membrane overlap at a seam. To ensure proper seaming of the "T" joints, the top layer of the Heat-Weld Membrane is creased a minimum of one inch into the lower layer of membrane by using a heat gun with a narrow or pencil tip nozzle and a rubber hand roller. By inserting a heat gun nozzle between the layers of the membrane, the membrane will soften and begin to flow allowing it to crease and seal completely after applying pressure with a hand roller to ensure adequate bonding of the softened material. After heat-sealing the "T" joint, Edge Sealant must be applied on all cut edges of reinforced membrane. See Detail MHT-UN-105A.
2. **For membrane thickness greater than 45-mil or warranty length greater than 15-years.** Separate "T" joint patches are required over all "T" joints. See Detail MHT-UN-105B

D. Seam Patches at Roof/Wall Transitions

1. Mule-Hide requires the installation of Non-Reinforced TPO Flashing Membrane patches over any seam that transitions from the horizontal to the vertical. These patches are to be constructed with Non-Reinforced TPO Flashing Membrane only and hot air welded. Refer to Mule-Hide Detail MHT-UN-105C

E. Daily Welding Equipment Setup

1. The roofing contractor shall make sample test seams each day prior to welding field seams. The contractor shall, using scrap material, run at least two test seams, each a minimum of 2 feet long. Each test seam shall be used to determine adequate seam strength and to ensure the equipment has warmed up, is operating properly and proper settings have been determined. This should be done each time the equipment is turned on after a cool down period.

F. Quality Control of Seams

1. After seaming, the seams are checked for integrity with a probe. Any openings or "fishmouths" are to be repaired with a hand-held hot air tool fitted with a narrow nozzle tip and with a roller. Each day the contractor shall attempt to pull apart several sections of welded seams to test the quality of the welds. Should the welds be deficient, a more thorough examination of the work performed must be carried out and necessary repairs made.

3.07 Additional Membrane Securement (Base Attachment)

- A. Additional securement of the TPO membrane by mechanical attachment must be provided at the perimeter of each roof level, base of walls, curbs, skylights, expansion joints, tie-ins, interior walls, bottom of valleys and any angle changes that exceed inclines of 2:12 (2" rise in 12") and various penetrations as shown in the Mule-Hide Standard Details. All securement must be either horizontally to the roof deck or vertically to the base of the various penetrations as shown in the Mule-Hide Standard Details.
- B. The mechanical attachment of the membrane may be achieved by the following method:
 1. 2.4" Seam Plate and appropriate fasteners spaced a maximum of 12" OC
 - a. The 2.4" Seam Plate and appropriate fasteners (Mule-Hide HD or EHD fasteners) are placed with the edge of the Seam Plate approximately 1/2" away from the angle change. Seam Plates may be placed horizontally at the base of all angle changes greater than inclines of 2:12 (2" rise in 12"). Refer to the Mule-Hide TPO Standard Details for proper placement.
 - b. Option 1: Fasten directly through the new TPO Fleece Back Membrane and the existing roof system into the deck.
 - c. Option 2: Fasten the existing roof membrane prior to installing the new TPO Fleece Back Membrane.
 2. TPO PS RUSS attachment strip is not approved for use in a TPO Fleece Back Recover Roof System.
 3. Drip Apron and Gravel Stop
 - a. For drip aprons and gravel stops, the metal flange shall extend a minimum of 3 inches onto the wood nailer. The wood nailer must be wider than the metal flange. Approved screw fasteners shall be installed a maximum of 6 inches on center and 1-1/2" to 3/4" from the inside edge of the metal flange. Ring shank nails spaced a maximum of 4" on center may also be used.
 - b. Drip aprons and gravel stops not made out of TPO Coated Metal shall be primed with Mule-Hide's TPO Primer or Low VOC Primer and stripped with Mule-Hide's TPO Cover Strip. Cleaning the metal with a solvent such as toluene or xylene to remove oil film may be required prior to installing and priming with the TPO Primer. Refer to Mule-Hide detail # MHT-UN-106B.

3.08 Flashing Installation

A. TPO Membrane Flashings

1. **All vertical flashings in a Fully Adhered TPO Fleece Back Roofing System must be standard TPO-c Membrane** following Mule-Hide's standard details. The TPO membrane used for flashing must match the thickness of the TPO Fleece Back Membrane. Adhere the membrane to the vertical with the appropriate bonding adhesive.
2. All membrane flashings are to be installed concurrently with the roof membrane as the project progresses. Temporary flashings are not allowed without prior written approval from the Mule-Hide Technical Service Department. Should any water penetrate the new roofing because of incomplete flashings, the affected areas shall be removed and replaced at the contractor's expense

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- All surfaces to be fully adhered should be compatible, dry and smooth with no excessive surface roughness.
- On recover projects, tear off all existing base flashings, cant strips and projection flashings down to the substrate (level with the existing membrane).

B. Adhesive options for wall flashings (Standard TPO only)

Adhesive*	Single Sided (Wet Lay)	Double Sided (Contact)
TPO Bonding Adhesive	No	Yes
Low-VOC Bonding Adhesive	No	Yes
Low-VOC 1168 Bonding Adhesive	No	Yes
Aqua Base 120	No	Yes
AeroWeb Low-VOC Aerosol Contact Adhesive	No	Yes
*Refer to Product Data Sheets for specific installation instructions related to each adhesive option.		

C. TPO Bonding Adhesive, Low VOC Bonding Adhesive, and Low VOC Bonding Adhesive 1168 (solvent base) – Standard TPO membrane flashings

- Mix adhesive scraping the sides and bottom of the can (minimum 5 minutes is required) until adhesive is uniform in color. Consult product data sheet for adhesive instructions.
 - Low VOC Bonding Adhesive and Low VOC Bonding Adhesive 1168 require mechanical stirring (electric drill), both initially and periodically during application.
 - Porous surfaces and substrates may require the application of a prime coat and second coat of Low VOC Bonding Adhesive and Low VOC Bonding Adhesive 1168 to accomplish proper adhesion.
- Using a plastic core, medium nap roller, apply a smooth even coat of TPO Bonding Adhesive to back side of membrane and substrate (no globs or puddles). A nine inch roller will easily fit into a 5-gallon adhesive container. **Do not apply adhesive in area of seam laps.**
- Coverage rate to be approximately:

120 square feet per gallon for one surface (membrane or substrate only) or
60 square feet per gallon per finished surface (membrane and substrate)
- Allow adhesive to dry to a 'tacky' state. Test adhesive by placing a knuckle into it and turning your wrist a one-quarter turn. Adhesive is ready to mate when it is tacky but does not string when knuckle is lifted.
- Care must be taken to ensure proper drying. Avoid thin layers of adhesive which can result in over drying and improper adhesion.
- Roll coated membrane onto substrate being careful to not wrinkle the sheet or trap air bubbles. Once membrane is mated to the substrate, carefully roll the membrane with a 2-inch wide rubber hand roller to promote maximum positive contact between the membrane and the substrate.
- TPO Membrane Flashings shall extend a minimum of 6 inches onto the field sheet and be adhered securely. There shall be a minimum of 2 inches between the front of the fastener plates and the edge of the sheet to allow for heat welding. All side laps are to overlap a minimum of 2 inches.
- Areas of the flashings and membrane to be welded are not to have TPO Bonding Adhesive applied to them.**

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9. Extended drying times can be expected during cool, overcast, humid, shaded, or late day applications. The adhesive must be dry (but still tacky) before mating surfaces to avoid permanent blisters due to trapped solvents.
10. All flashings shall be extended a minimum of 8 inches above roof membrane level and be terminated unless previously accepted by the owner or his representative and the Mule-Hide Technical Department. All flashings shall be hot air welded at their connections with the roofing membrane. Apply Cut Edge Sealant at all welded edges of cut membrane flashings. Refer to Mule-Hide TPO Standard Details for more information.

NOTE: After flashing is adhered in place, promote full contact adhesion by going back over entire area with a 2-inch rubber hand roller.

D. Aqua Base 120 (Water Base Bonding Adhesive) – Standard TPO membrane flashings

1. Mix adhesive scraping the sides and bottom of the can (minimum 5 minutes is required) until adhesive is uniform in color. Consult product data sheet for adhesive instructions.
2. Using a 9" wide, 1/4" or 3/8" nap roller, apply a smooth even coat of Aqua Base 120 adhesive to back side of membrane and substrate (no globs or puddles). A nine inch roller will easily fit into a 5-gallon adhesive container. **Do not apply adhesive in area of seam laps.**
3. Coverage rate to be approximately:

120 square feet per gallon for one surface (membrane or substrate only) or
60 square feet per gallon per finished surface (membrane and substrate)
4. Allow adhesive to dry until it turns translucent and does not transfer to a dry finger or pull away from the substrate. AQUA BASE 120 adhesive will take a longer time to dry. Adhesive must remain tacky.
5. Mate surfaces together avoiding wrinkles. Immediately roll the bonded area of the sheet with a 2-inch wide rubber hand roller to promote maximum positive contact between the membrane and the substrate. Overlap all adjacent flashing sheets a minimum of 2 inches.
6. **Do not apply adhesive in area to be heat-welded.**
7. Extended drying times can be expected during cool, overcast, humid, shaded, or late day applications. The adhesive must be dry (but still tacky) before mating surfaces to avoid permanent blisters due to trapped moisture.
8. Overlap all adjacent flashing sheets a minimum of 2 inches. TPO Membrane Flashings shall extend a minimum of 6 inches onto the field sheet and be adhered securely. There shall be a minimum of 2 inches between the front of the fastener plates and the edge of the sheet to allow for heat welding. All side laps are to overlap a minimum of 2 inches.
9. All flashings shall be extended a minimum of 8 inches above roof membrane level unless previously accepted by the owner or his representative and the Mule-Hide Technical Department. All flashings shall be hot air welded at their connections with the roofing membrane. All welds must be a minimum of 2" wide. Apply Cut Edge Sealant at all welded edges of cut membrane flashings. Refer to Mule-Hide TPO Standard Details for more information.

NOTE: After flashing is adhered in place, promote full contact adhesion by going back over entire area with a 2-inch rubber hand roller.

10. All flashings shall be hot air welded at their connections with the roofing membrane. All hand welds shall be a minimum of 1-1/2" wide.
11. All flashings shall be properly terminated according to Mule-Hide's published Standard Details.

NOTE: When using Mule-Hide All-Purpose Bar under Counterflashing to terminate TPO Membrane wall flashing or when coping is used, TPO Bonding Adhesive, Low VOC Bonding Adhesive, Low VOC Bonding Adhesive 1168, or WBBA 2000 Bonding Adhesive may be eliminated when flashing height is 118" or less, depending on the type of termination. Refer to Mule-Hide's published Standard TPO Details for additional information.

3.09 Drains, Expansion Joints, Pitch Pans

A. Roof Drains

1. All existing roofing materials and metal flashings shall be removed.
2. Do not run field seams through drains or sumps. If sheet layout causes a seam to fall in line with a drain, a target patch (minimum 36" x 36") shall be required.
3. Prepare the surface around each drain to prevent any distortion, tenting, or bridging of the membrane. A smooth transition shall be provided from the roof surface to the surface of the drain bowl/clamping ring.
4. Mule-Hide recommends the installation of a target patch of standard TPO membrane at the drain.
5. If TPO Fleece Back membrane is extended into roof drain, fleece backing must be removed from portion of membrane that extends into the roof drain. See approved detail drawings.
6. Mule-Hide requires the application of one full tube of Water Cut-Off Mastic per drain applied to the drain bowl, under the membrane, where the clamping ring will be seated. This will provide a continuous seal between the membrane and the drain bowl. The membrane terminating into the drain must have the fleece backing removed where contact is made with the Water Cut-Off mastic. This is accomplished by heating the fleece and scraping it off the back of the membrane. Removal of the fleece allows the Water Cut-Off to bond directly to the membrane creating a complete seal.

B. Expansion Joints

1. Refer to Mule-Hide's published Standard TPO Details for application methods for flashing expansion joints.

C. Pitch Pans

1. Install and flash pitch pans as indicated in Mule-Hide's published Standard TPO Details. All pitch pans shall be filled with Thermoplastic One-Part Pourable Sealer.

3.10 Walkway Installation

Walkways should be provided in areas where routine rooftop maintenance occurs and in areas where regular rooftop traffic is expected.

A. TPO Walkway Roll Installation

1. Install TPO Walkway Rolls over clean, dry surfaces.
2. Layout areas where TPO Walkway Rolls are to be installed with most of the material being oriented so that it is placed between field seams with each adjacent and abutting section gapped a minimum of 6". Do not install walkway pads over seams or flashings.
3. Heat weld the perimeter of the properly positioned TPO Walkway Roll. Check seams for any voids or inconsistencies that might prevent watertightness.

B. Precast Pavers

1. Install precast paver systems acceptable to Mule-Hide over one layer of 6 oz. HP Protection Mat. Contact Mule-Hide for other acceptable slipsheets.

3.11 Temporary Tie-ins

- A. Install temporary cutoffs around incomplete edges of roofing assembly at the end of each day's work and when work must be postponed due to inclement weather. Temporary tie-ins shall be positioned so any sealed membrane edge will not buck or pond water. Ensure drainage is not restricted.
- B. Remove all gravel, dirt, debris or other contaminants from the tie-in area and make sure all surfaces are clean and dry.
- C. All loose membrane edges should be sealed downslope with products compatible with the existing substrate and membrane type being installed. Provide continuous pressure along the sealed edge to prevent water migration under the finished roof sections.
- D. When work resumes, remove the temporary seals completely including contaminated membrane, sealants, insulation fillers, etc. from the work area and properly dispose.

Note: Mule-Hide does not warrant or guarantee the water tightness of any nightly tie-in. Temporary night seals and their performance are the sole responsibility of the roofing contractor.

END OF SECTION

This specification represents the applicable information available at the time of its publication. Mule-Hide reserves the right to change this information at any time. Contact Mule-Hide or check the Mule-Hide website (www.mulehide.com) for the latest updates regarding changes or modifications to this specification.