Product Data Sheet

TPO-c FLEECE BACK PLUS MEMBRANE

PRODUCT DESCRIPTION

Revision Date: May 2022

Mule-Hide's TPO-c Fleece Back Plus FBP-045, FBP-060 and FBP-80 Membranes are polyester reinforced, 45-mil, 60-mil, or 80-mil thick, polyolefin based thermoplastic, heat-weldable membranes with a special 10 oz / yd^2, stain resistant, polyester fleece backing designed for attachment with hot asphalt. All Mule-Hide TPO membranes include MHP Weathering Package, an industry leading, state of the art weather package that enables Mule-Hide TPO membranes to withstand the extreme weatherability testing which simulates exposure to severe climates.

BASIC USES

The TPO-c Fleece Back Plus membrane is used in fully adhered roofing systems in new construction, reroofing and recover (retrofit) applications, where the roof membrane is adhered with hot asphalt. The system must be installed over an acceptable roof insulation or other suitable substrate. See the Mule-Hide TPO Fleece Back PLUS Specifications Manual for complete specifications and details.

SPECIFICATIONS

Colors: White top/White bottom

Material: 45-mil (FBP-45), 60-mil (FBP-60) and 80-mil (FBP-80) (nominal) thick polyester reinforced thermoplastic
FBP-045 = 120 mils total thickness, FBP-60 = 135 mils total thickness, FMP-80 = 155 mils total thickness

Physical Properties*	Test Method	Specification (min.)	Mule-Hide TPO
Tolerance on Nominal Thickness, %	ASTM D751	± -10	± -10
Thickness over fleece FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	ASTM D4637	 0.030 inch (.762 mm) 0.045 inch (1.14 mm) 0.080 inch (2.03 mm)	 0.045 inch (1.14 mm) 0.060 inch (1.52 mm) 0.080 inch (2.03 mm)
Weight FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	 --- --- ---	 --- --- ---	 0.31 lbm/ft^2 0.40 lbm/ft^2 0.50 lbm/ft^2
Breaking Strength FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	ASTM D-751 (Grab Method)	90 lb (0.4 kN)	 300 lb (1.3 kN) 400 lb (1.8 kN) 425 lb (1.9 kN)
Elongation at break of internal fabric	ASTM D-751	---	25%
Tearing Strength, B Tongue Tear	ASTM D-751	10 lb (45 kN)	55 lb (245 kN)
Brittleness point	ASTM D-2137	-40 Fº (-40 Cº) max.	-50 Fº (-46 Cº)
Linear Dimensional Change	ASTM D-1204	+/- 1.0% max	-0.2% typical
Ozone resistance, 100 pphm, 168 hours	ASTM D-1149	No cracks	No cracks
Resistance to water absorption After 7 days immersion 158ºF (70ºC) Change in mass, %	ASTM D-471 (fleece removed, edges sealed)	+ 4.0%	+2.0%
Resistance to microbial surface growth, rating (1 is very poor, 10 is no growth)	ASTM D-3274	---	9-10 typical
Field seam strength, seam tested in peel FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	ASTM D-1876	 25 lbf/in (4.4 kN/m) 25 lbf/in (4.4 kN/m) 40 lbf/in (7.0 kN/m)	 40 lbf/in (7.4 kN/m) 60 lbf/in (10.5 kN/m) 70 lbf/in (12.3 kN/m)
Water vapor permeance, Proc B	ASTM E-96	---	0.10 perms max 0.05 perms typical
Puncture resistance FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	FTM 101C Method 2031 (lbf) ASTM D5635 (Joules)	 350 lbf (--- Joules) 400 lbf (--- Joules) 425 lbf (--- Joules)	 525 lbf (17.5 Joules) 575 lb (22.5 Joules) 600 lb (30.0 Joules)
Resistance to Outdoor (UV) Weathering Xenon-Arc, 0.70 W/m^2 irradiance exposure FBP-45 (120 mils total) FBP-60 (135 mils total) FBP-80 (155 mils total)	ASTM G155 0.70 W/m^2 80ºC B.P.T.	No cracks No loss of breaking or tearing strength	No cracks No loss of breaking or tearing strength 17,640 kg/m^2 20,160 kg/m^2 27,720 kg/m^2
Properties after heat aging Breaking Strength - % retained Elongation Reinforced - % retained Tearing Strength - % retained Weight Change -%	ASTM D573 670 hrs @ 240 ºF	 --- --- --- ---	 90% min 90% min 60% min ± 1.0 min

*Typical properties and characteristics are based on samples tested and are not guaranteed for all samples of this product. This data and information is intended as a guide and does not reflect the specification range for any particular property of this product.

BENEFITS & SUPPLEMENTAL STATEMENTS

- Wide window of weldability
- Thick 10 oz / yd^2 stain resistance fleece specifically designed for use with hot asphalt
- 75% fewer seams than modified - bitumen systems
- Outstanding puncture resistance which is enhanced further by the fleece backing
- Chlorine-free with no halogenated flame retardants
- UL 2218 Class 4 hail rating available on select systems
- Excellent low temperature impact resistance
- Excellent chemical resistance to acids, bases, restaurant oils and greases
- Plasticizer-free. Does not contain liquid or polymeric plasticizer
- Exceptional resistance to solar UV, ozone and oxidation
- Hot melt extrusion processed for complete scrim encapsulation
- Warp knitted fabric (not woven) for smooth surface and greater thickness-over-scrim
- Low vapor permeance and water absorption
- Polyester reinforcing fabric and fleece backing which are resistant to degradation by bacteria, mildew and fungi
- Polyester fleece backing for fully adhered systems provided exceptional wind uplift resistance

CODE APPROVALS/COMPLIANCE

A variety of Factory Mutual Ratings and Underwriters Laboratories Classifications are available. Contact Mule-Hide Technical Services Department for additional information.

INSTALLATION INSTRUCTIONS

1) A proper substrate shall be provided to receive the Mule-Hide TPO-c Fleece Back Plus Membrane Roofing System.
2) The Mule-Hide TPO-c Fleece Back Plus membrane shall be fully adhered to the properly installed and prepared substrate using the techniques stated in Mule-Hide's specifications
3) The membrane side laps shall be overlapped before being hot air welded. All seams are to be hot air welded and probed.
4) The membrane is required to be mechanically attached only at the base of all vertical surfaces, roof edges, and angle changes.
5) The field of the roof is fully adhered to the substrate with hot asphalt applied at EVT.
6) All details will be done in accordance with Mule-Hide details use standard TPO-c membrane.
7) On projects where a Mule-Hide Standard or Premium Warranty is requested, an authorized Mule-Hide representative shall inspect all completed work. This is only a brief summary and not the complete specification. The Mule-Hide TPO-c Fleece Back Plus Specifications, Details, Technical Bulletins, associated documents should be thoroughly reviewed prior to starting any project.

PRECAUTIONS

- Surfaces may be slippery when wet, or due to frost and ice build-up. Exercise caution to prevent falls.
- Mule-Hide TPO membranes are highly reflective to sunlight. Workers should dress appropriately, wear sunscreen, and wear sunglasses that filter out UV light.
- Exercise care when working near roof edge. Roof edges may not be visible when surrounding area is covered with snow.
- TPO Fleece Back Plus membranes must be tarped and elevated to keep dry prior to application. If fleece gets wet, use a wet vac system to help remove moisture from the fleece. DO NOT INSTALL MEMBRANE IF FLEECE IS WET
- TPO Fleece Back Plus membrane exposed to the weather must be prepared with Weathered Membrane Cleaner prior to hot-air welding.
- Maximum sustained temperature not to exceed 160ºF (71ºC) for TPO membrane.
- Use proper stacking procedures to ensure sufficient stability. Avoid creasing the membrane.
- Once installed, membrane must be sealed daily to prevent wicking of moisture into fleece.

PROTECTION & SAFETY

Mule-Hide maintains Safety Data Sheets on all of its non-exempt products. Safety Data Sheets contain health and safety information for your development of appropriate product handling procedures to protect your employees and customers. Mule-Hide's Safety Data Sheets should be read and understood by all of your supervisory personnel and employees before using Mule-Hide products in your facilities.

EXTREME TESTING FOR SEVERE CLIMATES

ASTM Standard D6878 is the material specification for Thermoplastic Polyolefin-Based Sheet Roofing. It covers material property requirements for TPO roof sheeting and includes initial and aged properties after heat and xenon-arc exposure. As stated in the standard, "the tests and property limits used to characterize the sheet are values intended to ensure minimum quality for the intended purpose." Mule-Hide's goal is to provide TPO that delivers maximum performance for the intended purpose of roofing membranes. Maximum performance requires the membrane to far exceed the requirements of ASTM Standard D6878.

HEAT AGING		
Test Method	**ASTM Requirement**	**Typical Results**
ASTM Test - 240º F (116º C), No Visible Cracks	670hrs or 4 weeks	5,376hrs or 32 Weeks
* comparable to 1,024 weeks (20-years) at 185°F for 6hrs/day		
Heat Aging accelerates the oxidation rate that roughly doubles for each 10º C (18º F) increase in roof membrane temperature. Oxidation (reaction with oxygen) is one of the primary chemical degradation mechanisms of roofing materials.		

Environmental Cycling subjects the membrane to repeated cycles of heat aging, hot-water immersion or acid fog followed by xenon-arc exposure. The acid fog accelerates acid etching that may occur from acid rain if the roof membrane is not resistant to acidic conditions.

Environmental Cycling
10 days heat aging at 240°F (116°C) followed by 5 days water immersion at 158°F (70°C) or with another specimen set
5 eight hour cycles in Kesternich sulfur dioxide chamber (sulfurous acid fog) followed by 5040 kJ/m^2 (2000hrs at 0.70 W/m^2 irradiance) xenon-arc exposure

SUPPLEMENTAL APPROVALS, STATEMENTS AND CHARACTERISTICS

1) TPO-c meets and exceeds the requirements of **ASTM D6878** Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
2) Radiative Properties for Cool Roof Rating Council (CRRC) and LEED.
3) Mule-Hide TPO-c membranes conform to requirements of the U.S.E.P.A. Toxic Leachate Test (40 CFR part 136) performed by an independent analytical laboratory.
4) TPO-c was tested for dynamic puncture resistance per ASTM D5635-04 using the most recently modified impact head. 45-mil was watertight after an impact energy of 12.5 J (9.2 ft-lbf) and 60-mil was watertight after an impact energy of 22.5 J (16.6 ft-lbf)
5) NSF-P151 Certification for rainwater catchment systems components. (Plant 91/White Only)

RADIATIVE PROPERTIES for CRRC and LEED		
DESCRIPTION	**TEST METHOD**	**WHITE TPO-c**
CRRC initial solar reflectance	ASTM C1549	0.79
CRRC solar reflectance after 3 years	ASTM C1549 (uncleaned)	0.70
CRRC initial thermal emittance	ASTM C1371	0.90
CRRC thermal emittance after 3 years	ASTM C1371 (uncleaned)	0.86
LEED thermal emittance	ASTM E408	0.90
Solar Reflectance Index (SRI)	ASTM E1980	99
CRRC Product ID Number		0670-0009

Solar Reflectance Index (SRI) is calculated per ASTM E 1980. The SRI is a measure of the roof's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. Materials with the highest SRI values are the coolest choices for roofing. Due to the way SRI is defined, particularly hot materials can even take slightly negative values, and particularly cool materials can even exceed 100.

SUPPLEMENTAL APPROVALS, STATEMENTS AND CHARACTERISTICS (continued)

LEED® Information	
Pre-consumer Recycled Content	10%
Post-consumer Recycled Content	0%
Manufacturing Location	Senatobia, MS or Tooele, UT
Solar Reflectance Index (SRI)	111 (white)

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ADDITIONAL INFORMATION

The information given on this PDS is subject to change without notice. Always check the Mule-Hide website at www.mulehide.com for the latest information, changes and updates or contact Mule-Hide Products Company at 800-786-1492.

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