



# TPO-c FLEECE BACK FR MEMBRANE

## PRODUCT DESCRIPTION

Revision Date: Sept 2021

Mule-Hide's TPO-c Fleece Back FR membranes are manufactured using a hot-melt extrusion process for complete scrim encapsulation. Once the TPO is reinforced and enhanced with 10-ounce fire-resistant fleece, the total sheet thickness is 115-mils, creating a durable sheet that is quick to install and is ideal for re-roofing or new construction projects.

TPO-c Fleece Back FR membranes are intended for use in mechanically fastened roofing systems for direct to combustible deck applications that require a UL Class A fire rating. TPO-c Fleece Back FR is chlorine- and plasticizer-free and provides excellent resistance to chemicals, acids, bases, restaurant oils, and greases.

Mule-Hide's TPO-c Fleece Back FR membranes are a highly reflective white color and are available in 10' x 50' and 10' x 100' sizes. Mule-Hide's white TPO membranes are ENERGY STAR®-qualified, California Title 24 compliant, and can contribute toward LEED® credits.



## FEATURES and BENEFITS

- UL Class A approved for direct application to combustible deck
- System installation not restricted by ambient temperature limits
- 67% fewer seams than modified bitumen
- Wide window of weldability
- Fleece reinforcement adds toughness, durability, and enhanced puncture resistance
- Greater puncture resistance than modified bitumen
- Chlorine-free, does not contain halogenated flame retardants
- Plasticizer-free, does not contain liquid or polymeric plasticizers
- Excellent resistance to impacts, low temperatures, acids, bases, and restaurant exhaust emissions
- Exceptional resistance to heat, solar UV, ozone, and oxidation
- Enhanced with the MHP Weathering Package weathering package
- VOC- and odor-free
- Excellent resistance to hail and punctures

## INSTALLATION INSTRUCTIONS (Mechanically Attached Only)

TPO-c Fleece Back FR membranes are mechanically fastened to the combustible deck with Mule-Hide HDP (#14) or EHD (#15) Fasteners and 2.4" Seam Plates positioned along the centerline of the 10'-wide sheets as follows:

Adjoining sheets of TPO-c Fleece Back FR are overlapped approximately 5½" along the length of the membrane (at the selvage edge) where fastening plates will be located. At end laps (along the width of the sheet), membranes shall be butted together which will be overlaid with minimum 6"-wide Mule-Hide TPO 45-mil reinforced flashing strips hot-air welded on all edges.

Note: To qualify for Mule-Hide's 2" hail coverage warranty, adjoin the two TPO-c Fleece Back FR sheets by overlapping approximately 8"– 9" to ensure the fastening plates are covered by the FR fleece. The fleece portion of the membrane must extend a minimum of ¾" past the edge of the plate.

## PERIMETER ATTACHMENT

The membrane shall be secured around the building perimeter using additional rows of Mule-Hide HDP (#14) or EHD (#15) Fasteners and 2.4" Seam Plates positioned along the centerline of the 10'-wide sheets.

TPO Cover Strip - a minimum 6"-wide Mule-Hide TPO 45-mil reinforced flashing strip (hot-air welded) shall be used to overlay the fasteners and plates.

# TPO-c Fleece Back FR Membrane

## PRECAUTIONS

- Sunglasses that filter out ultraviolet light are strongly recommended, as white surfaces are highly reflective. Roofing technicians should dress appropriately and wear sunscreen.
- Surfaces may become slippery due to frost and ice buildup. Exercise caution during cold conditions to prevent falls.
- Care must be exercised when working close to a roof edge when the surrounding area is snow-covered, as the roof edge may not be clearly visible.
- Use proper stacking procedures to ensure sufficient stability of the rolls.
- Exercise caution when walking on wet membrane. Membranes may be slippery when wet.
- Store membrane in the original undisturbed plastic wrap in a cool, shaded area and cover with light-colored, breathable, waterproof tarpaulins. Membrane that has been exposed to the weather must be prepared with Weathered Membrane Cleaner prior to hot-air welding.
- Take care not to stand or place heavy objects on the edge of folded-over membrane, as this could cause a hard crease in the membrane.
- Maximum sustained temperature not to exceed 160°F (71°C) for TPO membrane.
- TPO-c Fleece Back FR membrane rolls must be tarped and elevated to keep dry prior to installation. If the fleece gets wet, use a wet-vac system to help remove moisture from the fleece. **DO NOT INSTALL MEMBRANE IF FLEECE IS WET.**

## 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 scope of 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 produce TPO that delivers maximum performance for the intended purpose of roofing membranes. Maximum performance requires the membrane to far exceed the requirements of ASTM D6878.

**Heat Aging** accelerates the oxidation rate that roughly doubles for each 18°F (10°C) increase in roof membrane temperature. Oxidation (reaction with oxygen) is one of the primary chemical degradation mechanisms of roofing materials.

HEAT AGING		
Test Method	ASTM Requirement	Mule-Hide Requirement
ASTM Test - 240°	32 Weeks*	>128 weeks
Test specimen is 2" by 6" piece of 45-mil membrane unbacked, placed in circulating hot-air oven Criterion-no visible cracks after bending aged test sample around 3" diameter mandrel.		

**Xenon-arc** exposes the membrane samples to the combined effect of UV, visible and infrared radiation as well as ozone, heat and water spray to greatly accelerate the effects of outdoor weathering. The radiation dose is measured in kilojoules per square meter (kJ/m<sup>2</sup>) at 340 nm machine UV wavelength. The irradiance power of the xenon-arc lamp is measured in watts per square meter (W/m<sup>2</sup>).

XENON-ARC TESTING		
ASTM Test	ASTM D6878 Requirement	Typical Results 60-mil
kJ/ m <sup>2</sup> at 340 nm	10,080	>50,000
Test sample is 2.75" by 5.5" piece of membrane, unbacked, weathering side facing arc lamp. Criterion-no visible cracks viewed under 7x magnification while wrapped around 3" diameter mandrel.		

**Q-Trac** testing combines accelerated weathering with real-world conditions using an array of ten mirrors to reflect and concentrate full spectrum sunlight onto membrane test specimens. The Q-Trac device automatically tracks the sun’s path from morning to night. Also, it adjusts to compensate for seasonal changes in the sun’s altitude. Eight years in Q-Trac testing is equal to 40 years of real-world exposure. Mule-Hide requires its TPO membranes to pass the equivalent of 40 year exposure in the Q-Trac.

# TPO-c Fleece Back FR Membrane

Q-Trac Testing		
Test Method	ASTM Requirement	Mule-Hide Requirement
ASTM Test N/A	N/A	Equivalent of 40 years exposure
<b>Environmental Cycling</b> subjects the membrane to repeated cycles of heat aging, hot-water immersion and xenon-arc exposure.		
Test specimen is 2.75" by 5.5" piece of membrane with edges sealed.		
<ul style="list-style-type: none"> <li>- 10 days heat aging at 240° F (116° C) followed by</li> <li>- 5 days water immersion at 158° F (70° C) followed by</li> <li>- 5,040 kJ/m<sup>2</sup> (2000 hours at 0.70 W/m<sup>2</sup> irradiance) xenon-arc exposure</li> </ul>		
Criterion – after 3 completed cycles, test specimens shall remain flexible and not have any cracking under 10x magnifications while wrapped around a 3" diameter mandrel.		

## SUPPLEMENTAL APPROVALS, STATEMENTS AND CHARACTERISTICS

- TPO-c Fleece Back FR meets or exceeds the requirements of ASTM D6878 Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.
- Radiative Properties for ENERGY STAR, Cool Roof Rating Council (CRRC) and LEED.
- TPO-c Fleece Back FR membrane conform to requirements of the US E.P.A. Toxic Leachate Test (40 CFR part 136) performed by an independent analytical laboratory.
- TPO-c Fleece Back FR membrane 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 22.5 J (16.6 ft-lbf). 80-mil EXTRA was water tight after an impact energy of 30.0 J (22.1 ft-lbf).
- NSF-P151 Certification for rainwater catchment system components - Plant 91/White Only

LEED Information	
Pre-consumer Recycled Content	10%
Post-consumer Recycled Content	0%
Manufacturing Location	Tooele, UT
Solar Reflectance Index (SRI)	99 (white)

Radiative Properties for ENERGY STAR <sup>®*</sup> , Cool Roof Rating Council (CRRC) and LEED		
DESCRIPTION	TEST METHOD	WHITE TPO-c
ENERGY STAR <sup>®</sup> initial solar reflectance	Solar Spectrum Reflectometer	0.79
ENERGY STAR <sup>®</sup> initial solar reflectance after 3 years (uncleaned)		0.70
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	C1371	0.90
CRRC SRI (Solar Reflectance Index)	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.

\*ENERGY STAR recommends that using the Roof Savings Calculator ([rsn.ornl.gov](http://rsn.ornl.gov)), which factors in both heating and cooling costs, to determine whether a cool roof will be an energy efficient choice for your geographical climate and building type.

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## SPECIFICATIONS

Physical Properties	Test Method	Specification (min.)	Mule-Hide TPO
Tolerance on Nominal Thickness, %	ASTM D751	± -10	± -10
Thickness over fleece FB-60 (115 mils total, 2.92 mm)	ASTM D4637	---	0.060 inch (1.52 mm)
Weight - FB-60 (115 mils, 2.92 mm)	---	---	0.33 lbm/ft <sup>2</sup>
Breaking Strength – Min lbf (N) 115-mil	ASTM D-751 B Tongue Tear	55 lb (245 kN)	100 lb (445 kN)
Puncture resistance FB-60 (115 mils total)	FTM 101C Method 2031 (lbf) ASTM D5635 (Joules)	300 lbf (--- Joules)	350 lb (17.5 Joules)
Brittleness point	ASTM D-2137	-40 F° (-40 C°) max.	-50 F° (-46 C°)
Linear Dimensional Change	ASTM D-1204	+/- 1.0% max	-0.2% typical
Field seam strength, seam tested in peel FB-60 (115 mils total)	ASTM D-1876	25 lbf/in (4.4 kN/m)	60 lbf/in (10.5 kN/m)
Water vapor permeance,	ASTM E-96 Proc B	---	0.10 perms max 0.05 perms typical
Resistance to microbial surface growth, rating (1 is very poor, 10 is no growth)	ASTM D-3274	---	9-10 typical
Properties after heat aging Breaking Strength - % retained Elongation Reinforced - % retained Tearing Strength - % retained Weight Change - %	ASTM D573 670 hrs @ 240 °F	--- --- --- ---	90% min 90% min 60% min ± 1.0% max
Ozone resistance, 100 pphm, 168 hours	ASTM D-1149	PASS	PASS
Resistance to water absorption After 7 days immersion 158°F (70°C) Change in mass, % (one side)	ASTM D-471	± 3.0%	+0.9%
Resistance to Outdoor (Ultraviolet) Weathering, Xenon-Arc, total radiant exposure at 0.70 W/m <sup>2</sup> irradiance, 80°C black panel temperature.  FB-60 (115 mils total)	ASTM G155	No cracks No loss of breaking or tearing strength	No cracks No loss of breaking or tearing strength  20,160 kg/m <sup>2</sup>
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.			

## 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.

## ADDITIONAL INFORMATION

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

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