TPO-C Membrane (Standard, FR & Clean Film)

Polyester Reinforced, Heat-Weldable Membrane

PRODUCT DATA SHEET

DESCRIPTION

MuleHide TPO-C Membrane is a polyester reinforced, .045 or .060 thick, polyolefin-based, thermoplastic, heat-weldable membrane. High breaking strength, tearing strength, and puncture resistance is achieved by encapsulating a strong polyester fabric between the top and bottom plies. MuleHide TPO-C FR membrane is formulated with additional flame retardant (compared to Standard) for higher slope fire code approvals. The TPO-C membrane is also available in a 0.80" thickness (see Product Data Sheet for TPO-C EXTRA). The membrane is environmentally friendly and safe to install.

BASIC USES

The TPO-C membrane is used in mechanically attached, induction welded, and fully adhered roofing systems in new construction, reroofing and recover (retrofit) applications. It may also be used as flexible membrane flashings for walls, curbs, etc., when installing TPO-C membrane roofing systems. The system must be installed over acceptable roof insulation or other suitable substrates. See the MuleHide TPO Specifications Manual for complete specifications and details. MuleHide's 16' wide sheet is only available for fully adhered and induction welded roofs. The maximum sheet width that may be used for mechanically attached roof systems is 12' wide TPO membranes.

OPTIONAL CLEAN FILM

The TPO-C membrane is available with an optional CLEAN Film (Standard colors only), a temporary protective film factory-applied to the top surface of the membrane. By protecting the membrane surface from scuffs and dirt accumulation during installation, this protective film can save labor and time by helping to eliminate the need for roof cleaning upon project completion. CLEAN Film can be left in place for up to 90 days. Durable and easy to remove, CLEAN Film helps to improve the aesthetics and long-term reflectivity and is ideal for use on re-roofing, re-cover and new construction projects. CLEAN Film is available on TPO-C 60-mil membranes supplied in 6' x100' and 10' x 100' rolls.

BENEFITS AND SUPPLEMENTAL STATEMENTS

- Wide window of weldability
- Outstanding puncture resistance
- 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
- Low water vapor permeance and water absorption
- Hot melt extrusion processed for complete scrim encapsulation
- Non-woven reinforcement fabric for smooth surface and greater thickness-over-scrim
- Polyester reinforcing fabric which is resistant to degradation by bacteria, mildew and fungi
- TPO-C is 100% recyclable
- Meets and exceeds requirements of ASTM D6878 Standard Specification for Thermal Plastic Polyolefin Based Sheet Roofing
- CLEAN Film guards the TPO membrane surface from scuffs and dirt accumulation during installation, helping to improve the roof systems appearance and maintain long-term reflectivity.
- CLEAN Film can be left in place for up to 90 days due to its excellent heat and UV resistance.
- MuleHide's tan and white TPO membranes are CRRC listed and California Title 24 compliant and can contribute toward LEED® (Leadership in Energy and Environmental Design) credits.

SPECIFICATIONS

Standard colors: White, Gray and Tan

Colorway colors: Medium Bronze, Patina Green, Rock Brown, Slate Gray and Terra Cotta

Materials: .045" (standard colors only) and .060" (nominal) thick polyester reinforced thermoplastic

Sizes: Standard colors: 4', 6', 8', 10', 12' and 16' sheet widths by 100' length
Colorway colors: 5' and 10' sheet widths by 100' length

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INSTALLATION INSTRUCTIONS

1. Approved insulation shall be attached to the roof deck with an approved insulation adhesive or approved fasteners and plates. Install insulation with its largest dimension perpendicular to the direction of the membrane seams where possible.
2. Mechanically Attached Roofing System
   a. Perimeter sheets to be installed in an approved pattern along all exterior roof edges.
   b. Mechanical fasteners and plates are installed in the seams of both the perimeter sheets and field sheets and into the roof deck. Use approved fasteners and maintain proper penetration for specific roof decks.
   c. 12' wide sheet is the maximum sheet width for mechanically attached systems.
3. Fully Adhered Roofing System
   a. Perimeter sheets are not required.
   b. The membrane is required to be mechanically attached at the base of all vertical surfaces, roof edges, and angle changes.
   c. The field of the roof is fully adhered to the substrate with a MuleHide approved adhesive.
4. Induction-Welded Roofing System
   a. Membrane is attached over a suitable substrate utilizing an induction welding tool being placed over the membrane where a fastened TPO induction welding plate is located to weld the two components together.
5. Remove CLEAN Film from areas that are to be heat-welded together. In areas not requiring heat-welding, CLEAN Film can be left in place for up to 90 days. Upon completion of the TPO roofing system, remove the CLEAN film and discard.
6. All seams are hot-air welded and checked by probing.
7. All details will be done in accordance with MuleHide details.
8. On projects where a MuleHide System Warranty is requested, an authorized MuleHide representative shall inspect all completed work. This is only a brief summary and not the complete specification. MuleHide's specifications, details,technical bulletins, and associated documents should be thoroughly reviewed prior to starting any project. Contact the MuleHide Technical Department for additional information.

PRECAUTIONS

- Maximum sustained temperature not to exceed 160ºF (71ºC) for TPO membrane.
- Use proper stacking procedures to ensure roll stability. Avoid creasing the membrane.
- Surfaces may be slippery when wet, or due to frost and ice build-up. Exercise caution to prevent falls.
- MuleHide 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 as edges may not be visible when surrounding area is covered with snow.
- Store MuleHide membrane in original wrappings in a cool, shaded area. Cover with light-colored, breathable, waterproof tarpaulins. MuleHide membrane that has been exposed to the weather must be prepared with Weathered Membrane Cleaner prior to hot-air welding.
- Use proper stacking procedures to ensure sufficient stability of the rolls.
- 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.
- Do not use razor blades or other sharp tools to cut the CLEAN Film while it is still adhered to the TPO membrane as damage to the underlying membrane may occur. Pull the protective film away from the membrane prior to cutting.
- Remove CLEAN Film by pulling towards the center of the roof. Do not remove the film by pulling towards the roof edge.
- A static electricity charge may develop when removing the CLEAN Film from the surface of the membrane sheet. To avoid the possibility of ignition, lids must be closed on any flammable products and fire extinguishers should be readily available.
- Color membranes will ‘fade’ over time mainly due to the ultraviolet portion of sunlight. Since most roof surfaces are exposed to variable sunlight, some areas will be more susceptible to color changes caused by UV fading. Warranties for color membranes do not cover fading of colors.

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.” MuleHide’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.

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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**	**Typical Results**
ASTM Test - 240°F (116°C) No visible cracks	32 Weeks**	>128 Weeks
**Heat exposure comparable to 3,120 weeks (80 years) at 185°F for 8 hours per day.		
Test specimen is 2" by 6" piece of 45-mil membrane un-backed, placed in circulating hot-air oven. Criterion-no visible cracks after bending aged test sample around 3" diameter mandrel.		
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.		

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. MuleHide requires its TPO membranes to pass the equivalent of 40 years exposure in the Q-Trac.

Q-TRAC TESTING		
Test Method	**ASTM Requirement**	**MH Requirement**
ASTM Test N/A	NA	Equivalent of 40 years exposure
Environmental Cycling 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. - 10 days heat aging at 240°F (116°C) followed by - 5 days water immersion at 158°F (70°C) followed by - 5,040 kJ/m² (2000 hours at 0.70 W/m² irradiance) xenon-arc exposure		
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

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. CRRC Product ID: TPO-C White 0670-0009.
4. MuleHide 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.
5. 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).
6. NSF-P151 Certification for rainwater catchment systems components (Tooele Plant/White Only).

RADIATIVE PROPERTIES FOR CRRC AND LEED				
CRRC Description	**Test Method**	**White**	**Gray**	**Tan**
Initial solar reflectance	ASTM C1549	0.79	0.46	0.71
Solar reflectance after 3 years	ASTM C1549 (uncleaned)	0.70	0.43	0.64
Initial thermal emittance	ASTM C1371	0.90	0.89	0.86
Thermal emittance after 3 years	ASTM C1371 (uncleaned)	0.86	0.88	0.87
Thermal emittance	ASTM E408	0.90	0.88	0.86
SRI (Solar Reflectance Index)	ASTM E1980	99	53	86
SRI (Solar Reflectance Index) after 3 years	ASTM E1980	85	48	77
Product ID Number		0670-0009	0670-0017	0670-0016

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.

RADIATIVE PROPERTIES (INITIAL) FOR COLORWAY COLORS			
Color	**Reflectance**	**Emittance**	**SRI**
Medium Bronze	0.28	0.86	29
Rock Brown	0.25	0.87	26
Slate Gray	0.38	0.87	42
Terra Cotta	0.25	0.86	25
Patina Green	0.25	0.88	25

LEED INFORMATION	
Pre-consumer Recycled Content	10%
Post-consumer Recycled Content	0%
Manufacturing Location	Senatobia, MS Tooele, UT Carlisle, PA
Solar Reflectance Index (SRI)	99 (white) 86 (tan)

PROTECTION & SAFETY

MuleHide 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. MuleHide's safety data sheets should be read and understood by all of your supervisory personnel and employees before using MuleHide products in your facilities.

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TYPICAL PHYSICAL PROPERTIES					
Physical Properties*	**Test Method**	**Requirement**	**45-mil**	**60-mil**	**80-mil**
Thickness tolerance on nominal, %	ASTM D751	±15, -10	±10	±10	±10
Thickness over scrim, in. (mm) (average of 3 areas)	ASTM D6878 (Optical Method)	0.015 min. (0.380)	0.018 typical (0.457)	0.024 typical (0.610)	0.034 typical (0.864)
Breaking strength, lbf (kN)	ASTM D751 (Grab Method)	220 (976 N) minimum	225 (1.0) min. 320 (1.4) typical	250 (1.1) min. 360 (1.6) typical	350 (1.6) min. 425 (1.9) typical
Elongation at break of fabric, %	ASTM D751 (Grab Method)	15 minimum	15 minimum 25 typical	15 minimum 25 typical	15 minimum 25 typical
Tear strength, lbf (N) 8 by 8 in. specimen	ASTM D751 (B Tongue Tear)	55 (245) minimum	55 (245) min. 130 (578) typical	55 (245) min. 130 (578) typical	55 (245) min. 130 (578) typical
Brittleness point, °F (°C)	ASTM D2137	-40 (-40) maximum	-40°F (-40°C) max -50°F (-46°C) typical	-40°F (-40°C) max -50°F (-46°C) typical	-40°F (-40°C) max -50°F (-46°C) typical
Linear dimensional change (shrinkage) % change	ASTM D1204 6 hrs at 158°F (70°C)	±1maximum	±1max -0.2 typical	±1max -0.2 typical	±1max -0.2 typical
Ozone resistance, 100 pphm, 168 hrs.	ASTM D1149	PASS	PASS	PASS	PASS
UV exposure (Xenon Arc), no cracks 7 x min. exposure 10,080 kJ/m^2 (4,000 hrs - 0.70W/m^2)	ASTM G155	PASS	PASS	PASS	PASS
Factory seam strength, lbf/in (kN/m)	ASTM D751	66 (290) min	66 (290) minimum	66 (290) minimum	66 (290) minimum
Field seam strength, lbf/in (kN/m) Seams tested in peel	ASTM D1876	No requirement	25 (4.4) min. 50 (8.8) typical	25 (4.4) min. 60 (10.5) typical	40 (7.0) min. 70 (12.3) typical
Water vapor permeance, Perms	ASTM E96 proc. B	No requirement	0.10 max. 0.05 typical	0.10 max. 0.05 typical	0.10 max. 0.05 typical
Water absorption resistance, mass % top surface only @ 158F, 166 hours	ASTM D471	No requirement	3.0 max. 0.90 typical	3.0 max. 0.90 typical	3.0 max. 0.90 typical
Puncture resistance, lbf (N)	FTM 101C (Method 2031)	No requirement	250 (1.1) min. 325 (1.4) typical	300 (1.3) min. 350 (1.6) typical	400 (1.8) min. 450 (2.0) typical
Properties after heat aging	ASTM D573, 32 weeks at 240°F or 8 weeks at 275°F No cracking when bent around 3" dia. Madrel Weight change, %	PASS No Cracking ±1.0 max	PASS No Cracking ±1.0 max	PASS No Cracking ±1.0 max	PASS No Cracking ±1.0 max
Typical weights lb/ft^2 (kg/m^2)	N/A	N/A	0.25	0.33	0.45

*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.

ADDITIONAL INFORMATION

On projects where a MuleHide Standard or Premium Warranty is requested, an authorized MuleHide representative shall inspect all completed work.

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

DISCLAIMER