

# FleeceBACK® TPO

## Membranes



### Overview

FleeceBACK TPO membranes are manufactured using a hot-melt extrusion process for complete scrim encapsulation. Once the TPO is reinforced and enhanced with fleece, the total sheet thicknesses available are 100-, 115-, and 135-mils, creating a very tough, durable and versatile sheet that is ideal for re-roofing or new construction projects. FleeceBACK TPO sheets are chlorine free and plasticizer free with excellent chemical resistance to acids, bases, restaurant oils, and greases.

All FleeceBACK TPO membranes utilize Octaguard XT™ weathering package technology to withstand extreme durability testing intended to simulate exposure to severe climates. FleeceBACK TPO's advanced polymerization technology combines the flexibility of ethylene-propylene (EP) rubber with the heat weldability of polypropylene.

FleeceBACK TPO membranes are intended to be used with adhered or mechanically fastened roofing systems. FleeceBACK TPO is ideally suited for roof garden and solar panel applications and projects demanding superior wind uplift resistance due to its added toughness and durability. FleeceBACK TPO is also a great solution for buildings requiring low noise and odors during roofing application.

### Features and Benefits

- » No VOCs, low odor, low noise, and speed of application minimizes occupied building disruptions
- » Superior wind uplift performance and ratings (up to an FM 1-990) due to a mechanical bond between fleece and adhesive
- » 75% fewer seams than Modified Bitumen

- » Wide window of weldability
- » Fleece reinforcement adds toughness, durability, and enhanced puncture resistance
  - 115-mil membrane delivers 33% greater puncture resistance and 33% greater breaking strength than 60-mil TPO
  - Greater puncture resistance than Modified Bitumen
- » Excellent hail damage resistance:
  - Passes FM's severe hail test
  - Passes UL-2218 Class 4 rating
  - Passes National Bureau of Standards – 23 Ice Ball test up to 3"-diameter hail with the membrane cooled to 32°F

- » Standard Colors:



White      Gray      Tan

- » Special Colors:



Slate Gray    Med Bronze    Terra Cotta    Patina Green    Rock Brown

\*Sure-Weld® HS Special Color TPO membranes are available in limited sizes. Refer to Carlisle's Sure-Weld HS TPO Special Color Program Sell Sheet for details.



### Sustainable Attributes

Carlisle SynTec Systems' focus has always been innovation - Innovation to solve problems, improve performance, reduce labor, and above all, improve sustainability. Carlisle is committed to driving sustainable and efficient processes in the design and manufacturing of our products.

- » Up to 10% pre-consumer recycled content
- » Free of Living Building Challenge red list chemicals
- » NSF P151 Certification for rainwater catchment\*
- » 3<sup>rd</sup>-party verified Environmental Product Declaration available

\*Plant 91/White only

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### Optional APEEL™ Protective Film

Shield Carlisle's FleeceBACK TPO membrane from dirt and scuffs during installation with APEEL Protective Film. Factory-applied and easy to remove, APEEL eliminates the need for rooftop cleaning upon project completion.



- » Ideal for re-roofing, re-cover, and new construction projects
- » Simple and easy to remove
- » Saves time and money when compared to pressure washing
- » Protecting from dirt maintains maximum membrane reflectivity and long-term performance

### Installation

Simply order membrane with APEEL, install, and remove the film to reveal a clean, new roof.

- » APEEL Protective Film should be removed from within areas that are to be heat-welded together. In areas that do not require heat-welding, the APEEL Protective Film can be left in place for up to 90 days without degrading due to its excellent heat- and UV-resistance .
- » When the installation of the entire roofing system is complete, remove and discard the APEEL Protective Film.

### Installation

#### Adhered Roofing System

Insulation is mechanically fastened or adhered. Spray-apply, splatter, or extrude Flexible FAST™ Adhesive to the substrate and allow foam to "string/body" approx 1–2 minutes prior to setting FleeceBACK TPO into the Flexible FAST Adhesive. Roll FleeceBACK TPO membrane with a 30"-wide, 150-pound weighted roller to ensure full embedment. Splices are hot-air welded. End laps are butted and sealed with reinforced membrane or a head sheet may be utilized.

*Review Carlisle specifications and details for complete installation information, including mechanically fastened options.*

### Precautions

- » Use proper stacking procedures to ensure sufficient stability.
- » Exercise caution when walking on wet membrane.
- » Sunglasses that filter out ultraviolet light are strongly recommended, as tan and white surfaces are highly reflective. Roofing technicians should dress appropriately and wear sunscreen.
- » White surfaces reflect heat and may become slippery due to frost and ice accumulation.
- » Care must be exercised when working close to a roof edge when the surrounding area is snow covered.
- » FleeceBACK TPO 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.**
- » FleeceBACK TPO membrane exposed to the weather must be prepared with Weathered Membrane Cleaner prior to hot-air welding.

### Supplemental Approvals, Statements and Characteristics:

1. FleeceBACK TPO meets or exceeds the requirements of ASTM D6878 Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.
2. Radiative Properties for Cool Roof Rating Council (CRR) and LEED.
3. FleeceBACK TPO membranes conform to requirements of the US E.P.A. Toxic Leachate Test (40 CFR part 136) performed by an independent analytical laboratory.
4. FleeceBACK TPO was tested for dynamic puncture resistance per ASTM D5635-04 using the most recently modified impact head. 100-mil was watertight after an impact energy of 20 joules, 115-mil was watertight after 25 joules, and 135-mil was watertight after 32.5 joules.

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## LEED® Information

Pre-consumer Recycled Content	10%
Post-consumer Recycled Content	0%
Manufacturing Location	Senatobia, MS; Tooele, UT
Solar Reflectance Index	White: 99    Gray: 52    Tan: 86

## Radiative Properties for Cool Roof Rating Council (CRRC) and LEED

Physical Property	Test Method	White	Tan	Gray
CRRC – Initial solar reflectance	ASTM C1549	0.79	0.71	0.46
CRRC – Solar reflectance after 3 years	ASTM C1549 (uncleaned)	0.70	0.64	0.43
CRRC – Initial thermal emittance	ASTM C1371	0.90	0.86	0.89
CRRC – Initial thermal emittance after 3 years	ASTM C1371 (uncleaned)	0.86	0.87	0.88
LEED – Thermal emittance	C1371	0.90	0.86	0.85
Solar Reflectance Index (SRI) – Initial	ASTM E1980	99	86	52
Solar Reflectance Index (SRI) – Aged 3 Years	ASTM E1980	85	77	49

## Carlisle Extreme Testing – Heat Aging

ASTM Test	ASTM Requirement	FleeceBACK TPO Requirement
240°F	32 weeks*	>128 weeks

\*Comparable to 3,120 weeks (6 years) at 185°F for 8 hrs/day.

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.

## Carlisle Extreme Testing – Environmental Cycling

–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/m<sup>2</sup> (2000 hrs. at 0.70 W/m<sup>2</sup> irradiance) xenon-arc exposure

Environmental Cycling subjects the membrane to repeated cycles of heat aging, hot-water immersion followed by xenon-arc exposure.

## Carlisle Testing – Q-Trac

ASTM TEST	ASTM D6878 Requirement	Sure-Weld Requirement
N/A	N/A	Equivalent of 40 years of exposure

## Radiative Properties (Initial) for Special Colors

	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

Solar Reflectance Index (SRI) is calculated per ASTM E1980. 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.

## 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.” Carlisle’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.

**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. Carlisle requires its Sure-Weld TPO membranes to pass the equivalent of 40 years of exposure in the Q-Trac.



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## Typical Properties and Characteristics

Physical Property	Test Method	SPEC. (Min.)	FleeceBACK TPO Typicals
Tolerance on Nominal Thickness, %	ASTM D751	±10	±10
Thickness over Fleece, min			
100-mil (2.54 mm)	—	—	.045 (1.14)
115-mil (2.92 mm)	—	—	.060 (1.52)
135-mil (3.43 mm)	—	—	.080 (2.03)
Weight, lbm/ft <sup>2</sup>			
100-mil	—	—	0.27
115-mil	—	—	0.33
135-mil	—	—	0.46
Breaking Strength, min, lbf (kN)	ASTM D751 Grab Method	220 (1)	
100-mil			375 (1.7)
115-mil			450 (2)
135-mil			500 (2.2)
Elongation at break of internal fabric, %	ASTM D751	15	25
Tearing Strength, min, lbf (N)	ASTM D751 B Tongue Tear	55 (245)	100 (445)
100- & 115-mil, 135-mil			
Puncture Resistance, Joules	ASTM D5635		
100-mil		—	20
115-mil		—	25
135-mil		—	32.5
Puncture Resistance, lbf	FTM 101C Method 2031		
100-mil		350	450
115-mil		400	525
135-mil		425	600
Brittleness point, max, °F (°C)	ASTM D2137	-40 (-40)	-50 (-46)
Linear Dimensional Change, %	ASTM D1204	± 1 max	-0.2 typical
Field Seam Strength, lbf/in. (kN/m) ASTM D1876 tested in peel	ASTM D1876		
100-mil		25 (4.4)	50 (8.8)
115-mil		25 (4.4)	60 (10.5)
135-mil		40 (7.0)	70 (12.3)
Water Vapor Permeance, Perms	ASTM E96 Proc B	—	0.10 max, 0.05 typical
Resistance to Microbial Surface Growth, Rating (1 is very poor, 10 is no growth)	ASTM D3274	—	9-10 typical
Properties after heat aging—ASTM D573, 670 hrs. at 240 °F	ASTM D573		
Breaking strength, % retained		—	90 min
Elongation reinf. % retained		—	90 min
Tearing Strength, % retained		—	60 min
Weight Change, %		—	± 1.0 max
Ozone Resistance 100 pphm, 168 hours	ASTM D1149	No cracks	No cracks
Resistance to Water Absorption	ASTM D471	± 3.0	0.90
After 7 days immersion @ 158°F (70°C) Change in mass, max, % (one side)			
Resistance to Outdoor (Ultraviolet) Weathering Xenon-Arc, total radiant exposure at 0.70 W/m <sup>2</sup> irradiance, 80°C black panel temp.	ASTM G155	No cracks; No loss of breaking or tearing strength	No cracks; No loss of breaking or tearing strength
100-mil			17,640 kJ/m <sup>2</sup>
115-mil			20,160 kJ/m <sup>2</sup>
135-mil			27,720 kJ/m <sup>2</sup>