CARLISLE SYNTEC SYSTEMS

Sure-Weld® TPO
Reinforced Membrane – Minimum Thickness



Productivity Boosting Features and Benefits:

Optional APEEL™ Protective Film



Carlisle's Sure-Weld TPO reinforced membrane is available with an optional APEEL Protective Film, saving time and labor by eliminating the need for roof cleaning upon project completion. Carlisle's innovative APEEL Protective Film can be left in place for up to 90 days without affecting the integrity of the film, guarding the TPO membrane's surface from scuffs and dirt accumulation during installation. Durable and easy to remove, APEEL Protective Film improves aesthetics and long-term reflectivity and is ideal for re-roofing, re-cover, and new construction projects.

Overview

Carlisle's Sure-Weld TPO reinforced membrane is a premium, heat-weldable, single-ply thermoplastic polyolefin (TPO) sheet designed for new roof construction and re-roofing applications. Sure-Weld High Slope (HS) membrane is formulated with additional flame retardant for higher-slope fire code approvals. Sure-Weld EXTRA is 80 mils thick for significantly higher strength and weatherability.

Sure-Weld TPO membranes use advanced polymerization technology that combines the flexibility of ethylene-propylene (EP) rubber with the heat weldability of polypropylene. All Sure-Weld TPO membranes include OctaGuard XT™, an industry-leading, state-of-the-art weathering package. OctaGuard XT technology enables Sure-Weld TPO to withstand the extreme weatherability testing that is intended to simulate exposure to severe climates.

Physical properties of the membrane are enhanced by a strong polyester fabric that is encapsulated between the TPO-based top and bottom plies. The combination of the fabric and TPO plies provides high breaking and tearing strength, as well as excellent puncture resistance. The relatively smooth surface of the membrane produces a total surface fusion weld that results in a consistent, watertight, monolithic roof assembly. The membrane is environmentally friendly and safe to install.

Carlisle's standard and HS TPO membranes are available in highly reflective white, tan, and gray, in both 45-mil and 60-mil thicknesses. 80-mil Sure-Weld EXTRA (including HS) is also offered in white, gray, and tan colors. Special color Sure-Weld HS TPO membranes are also available (see Carlisle's TPO Color Palette brochure). Carlisle's TPO is offered in 4-, and 6-ft perimeter sheets and 8-, 10-, and 12-ft Sure-Weld field sheets. Sure-Weld HS and special color TPO membranes are available in limited sizes.

Carlisle's tan and white TPO membranes are California Title 24 compliant and can contribute toward LEED® (Leadership in Energy and Environmental Design) credits.

OCTAGUARD XT WEATHERING PACKAGE

APEEL PROTECTIVE FILM

Features and Benefits

- Outstanding puncture resistance
- Excellent fire resistant assemblies
- Environmentally friendly and stable formulation
- Excellent resistance to impact and low temperatures
- Excellent chemical resistance to acids, bases and restaurant exhaust emissions
- UL 2218 Class 4 hail rating
- Exceptional resistance to heat, solar UV, ozone and oxidation
- Manufactured using a hot-melt extrusion process for complete scrim encapsulation
- 100% recyclable (see Carlisle's Recyclability Statement)
- Enhanced with the OctaGuard XT weathering package
- APEEL Protective Film application guards the TPO membrane's surface from scuffs and dirt accumulation during installation, improving the roof system's appearance and long-term performance
- APEEL Protective Film can be left in place for up to 90 days without degrading due to its excellent heat- and UV-resistance

Sure-Weld TPO
Reinforced Membrane – Minimum Thickness

Installation

1. Sure-Weld TPO roofing systems are quick to install, as minimal labor and few components are required. TPO systems are installed using an Automatic Heat Welder, making sheet welding fast, clean, consistent, and easy to learn, while reducing strain on the roofing technician.
2. 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. When the installation of the entire TPO roofing system is complete, remove and discard the APEEL Protective Film.
3. **The Carlisle Mechanically Fastened Roof System** installation starts by fastening the insulation with a minimum of 4 fasteners per 4' by 8' board. The membrane is mechanically fastened to the deck using HP-X™ Fasteners and Piranha Plates™ or HP-XTRA Fasteners and Piranha XTRA Plates. Adjoining sheets of membrane are overlapped over the fasteners and plates and joined together with a minimum 1½"-wide (4 cm) hot-air weld.

Typical Properties and Characteristics

Physical Property	ASTM D6878 Requirement	45-mil	60-mil	80-mil EXTRA
Tolerance on Nominal Thickness, % ASTM D751 test method	+15, -10	+10, -0	+10, -0	+10, -0
Thickness Over Scrim, in. (mm) ASTM D7635 optical method, average of 3 areas	0.015 min (0.380)	0.019 typical (0.483)	0.026 typical (0.660)	0.036 typical (0.914)
Breaking Strength, lbf (kN) ASTM D751 grab	220 (976 N) min	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 Break of Reinforcement, % ASTM D751 grab method	15 min	15 min 25 typical	15 min 25 typical	15 min 25 typical
Tearing Strength, lbf (N) ASTM D751 proc. B 8 in. x 8 in.	55 (245) min	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) max	-40 (-40) max -50 (-46) typical	-40 (-40) max -50 (-46) typical	-40 (-40) max -50 (-46) typical
Linear Dimensional Change, % ASTM D1204, 6 hours at 158°F	± 1 max	± 1 max -0.2 typical	± 1 max -0.2 typical	± 1 max -0.2 typical
Ozone Resistance, no cracks 7X ASTM D1149, 100 pphm, 168 hrs	PASS	PASS	PASS	PASS
Water Absorption Resistance, mass % ASTM D471 top surface only 166 hours at 158°F water	± 3.0 max	± 3.0 max 0.90 typical	± 3.0 max 0.90 typical	± 3.0 max 0.90 typical
Factory Seam Strength, lbf (N) ASTM D751 grab method	66 (290) min	66 (290) min	66 (290) min	66 (290) min
Field Seam Strength, lbf/in (kN/m) ASTM D1876 tested in peel	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
Puncture Resistance, lbf (kN) FTM 101C, method 2031 (see supplemental section)	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 @ 240°F or 8 weeks @ 275°F No cracking when bent around 3" diameter mandrel Weight Change, %	 PASS No cracking ± 1.5 max	 PASS No cracking 1.0 max	 PASS No cracking 1.0 max	 PASS No cracking 1.0 max
Typical Weights lb/ft² (kg/m²)		0.23 (1.1)	0.29 (1.4)	0.40 (2.0)
Air Permeance, ASTM E2178	No Requirement	PASS	PASS	PASS

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.

Sure-Weld TPO
Reinforced Membrane – Minimum Thickness

4. **The Carlisle Fully Adhered Roofing System** installation begins by fastening the insulation at the required density necessary to meet the appropriate warranty or wind load requirement. The substrate and membrane are then coated with an appropriate Sure-Weld TPO bonding adhesive and the membrane is rolled into place.

Review Carlisle specifications and details for complete installation information.

Precautions

- 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.
- 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.
- Do not use razor blades or other sharp tools to cut the APEEL Protective 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 APEEL Protective Film by pulling towards the center of the roof. Do not remove the film by pulling towards the roof edge.
- A static electric charge may develop when removing APEEL Protective Film from the surface of the membrane sheet. To avoid the possibility of ignition, lids must be closed on any flammable products and a fire extinguisher 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 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.

Carlisle Testing – Heat Aging

	ASTM Requirement	Sure-Weld Requirement
ASTM TEST 240°F	32 weeks**	>128 weeks

**Heat exposure comparable to 3,120 weeks (60 years) at 185°F for 8 hours/day.

- Test specimen is a 2" by 6" piece of 45-mil membrane unbacked, placed in circulating hot-air oven.
- Criterion – no visible cracks after bending aged test specimen 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. Carlisle requires its Sure-Weld TPO membranes to pass the equivalent of 40 years of exposure in the Q-Trac.

Carlisle Testing – Q-Trac

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

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

- ASTM requirement – none
- Carlisle EXTREME test*:
  - 10 days heat aging at 240°F (116°C) followed by

CARLISLE SYNTEC SYSTEMS

Sure-Weld TPO
Reinforced Membrane – Minimum Thickness

- 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

*Test specimen is 2.75" by 5.5" piece of membrane with edges sealed.

*Criterion – after 3 complete cycles, test specimens shall remain flexible and not have any cracking under 10x magnification while wrapped around a 3"-diameter mandrel.

Supplemental Approvals, Statements and Characteristics:

1. Sure-Weld 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 (CRRC) and LEED.
3. Sure-Weld 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. Sure-Weld TPO 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 watertight after an impact energy of 30.0 J (22.1 ft-lbf).
5. NSF-P151 Certification for rainwater catchment system components.
   - Plant 91/White Only

Green Building Information

Pre-Consumer Recycled Content	10 %
Post-Consumer Recycled Content	0%
Solar Reflectance Index (SRI)	See Radiative Properties Table
Global Warming Potential (GWP)	45 mils – 2.90E+00 60 mils – 3.77E+00 80 mils – 5.28E+00
Volatile Organic Compounds (VOC) Content	N/A
Manufacturing Location(s)	Senatobia, MS Tooele, UT Carlisle, PA
Corporate Sustainability Report (CSR) Availability	Yes
Environmental Product Declaration (EPD) Availability	

Radiative Properties for LEED

	Test Method	White TPO	Tan TPO	Gray TPO
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 – Thermal emittance after 3 years	ASTM C1371 (uncleaned)	0.86	0.87	0.88
LEED – Thermal emittance	PASS	0.90	0.86	0.85
SRI – Initial (Solar Reflectance Index)		99	86	53
SRI – 3 year aged (Solar Reflectance Index)		85	77	48

Radiative Properties (Initial) for Special Colors

	Reflectance	Emittance	SRI
Medium Bronze	0.12	0.89	8
Rock Brown	0.23	0.88	23
Slate Gray	0.20	0.89	18
Terra Cotta	0.25	0.88	24
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.

800-479-6832 | P.O. Box 7000 | Carlisle, PA 17013 | Fax: 717-245-7053 | www.carlislesyntec.com

08.25.25 © 2025 Carlisle.

U.S. Patent Numbers: 8,833,037 - 9,163,140 - 10,422,138 - 10,801,207
Carlisle, Sure-Weld, OctaGuard XT, APEEL, Piranha Plates and HP-X are trademarks of Carlisle.
LEED is a registered trademark of the U.S. Green Building Council.