

ICC-ES Evaluation Report

ESR-2831

Issued September 1, 2009

This report is subject to re-examination in one year.

www.icc-es.org | (800) 423-6587 | (562) 699-0543

A Subsidiary of the International Code Council®

DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07540—Thermoplastic Membrane Roofing

REPORT HOLDER:

FIRESTONE BUILDING PRODUCTS COMPANY, LLC
250 WEST 96th STREET
INDIANAPOLIS, INDIANA 46260
(800) 428-4442
www.firestonebpco.com

EVALUATION SUBJECT

FIRESTONE ULTRAPLY™ TPO AND TPO XR SINGLE-
PLY ROOFING MEMBRANES

1.0 EVALUATION SCOPE

Compliance with the following code:

2006 *International Building Code*® (IBC)

Properties evaluated:

- Roof covering classification
- Weather resistance
- Wind resistance
- Impact resistance

2.0 USES

Firestone UltraPly TPO (thermoplastic polyolefin) and TPO XR single-ply roofing membranes are used as roof coverings in adhered and mechanically fastened membrane roofing systems.

3.0 DESCRIPTION

3.1 General:

The UltraPly TPO and TPO XR Membrane Roofing Systems described in this report consist of single-ply roofing membranes, insulation where used, barrier board or slip sheet where used, flashing, mechanical fasteners and adhesives that are installed on a combustible or noncombustible deck.

3.2 Membranes:

3.2.1 UltraPly TPO: The UltraPly TPO is a flexible thermoplastic polyolefin roofing membrane that is produced with a polyester weft inserted reinforcement. The membrane is available in white (tan or gray on special orders) and in 45-mil (1.1 mm), 60-mil (1.5 mm) and 80-mil (2 mm) thicknesses.

3.2.2 UltraPly TPO XR: The UltraPly TPO XR is a flexible thermoplastic polyolefin roofing membrane that is produced with a polyester weft inserted reinforcement and an 8-ounce, polyester backing. The membrane is available in white and in 45-mil (1.1 mm) and 60-mil (1.5 mm) thicknesses.

3.3 Insulation:

Foam plastic insulation, where used, must have a flame-spread index of not more than 75 when tested in accordance with ASTM E 84 at the maximum thickness intended for use. Polyisocyanurate and polystyrene rigid-cellular foam plastic thermal insulation specified in Tables 1 through 4 must comply, respectively, with ASTM C 1289 or ASTM C 578. See Tables 1 through 4 for insulations used with specific roof covering systems.

3.4 Barrier or Cover Board:

Barrier or cover board, where used, may be either minimum 1/4-inch-thick (6.4 mm) G-P Gypsum Corporation "DensDeck," minimum 1/2-inch-thick (12.7 mm) gypsum board or 1/2-inch-thick Firestone ISOGARD HD.

3.5 Slip Sheet:

Slip sheet, where used, may be any of the following:

- a. One or two layers of Atlas Roofing FR10 or FR50.
- b. One or two layers of Elk VersaShield FB-2S.
- c. Three layers of Elk VersaShield FB-1S.

3.6 Fasteners:

Fasteners and stress plates used to attach barrier or cover board layer materials, insulation boards and the roof covering membrane must be corrosion-resistant. Fasteners may be any of the Firestone insulation and membrane fasteners and plates summarized in this section (Section 3.6) or shown in Tables 3 and 4.

3.6.1 Firestone All-Purpose Fastener: An epoxy-coated steel screw used in combination with the Firestone Insulation Fastening Plate to attach roofing insulation and base sheets to steel and wood substrates. Fastener length must be sufficient to penetrate through the steel deck a minimum of 3/4 inch (19 mm), and into the wood deck a minimum of 1 inch (25.4 mm).

3.6.2 Firestone Heavy-Duty Fastener: An epoxy-coated steel screw used in combination with the Firestone Insulation Fastening Plate to attach roofing insulation and base sheets to steel, wood and concrete decks. Fastener length must be sufficient to penetrate through the steel deck a minimum of 3/4 inch (19 mm), and into the wood or concrete deck a minimum of 1 inch (25.4 mm).

3.6.3 Firestone Concrete Drive Fastener: A nonthreaded hammer-in fastener, epoxy-coated, used with Firestone Insulation Plates to attach roofing insulation, base sheets and other accessories to structural concrete substrates. Fastener length must be sufficient to penetrate into the concrete deck a minimum of 1¹/₄ inches (32 mm).

3.6.4 Firestone HD HailGard Fastener: An epoxy-coated steel screw used in roofing applications where HailGard insulation or an OSB or plywood overlay is used and fastened into steel, concrete or wood deck. Fastener length must be sufficient to penetrate through the steel deck a minimum of 3/4 inch (19 mm), and into the wood or concrete deck a minimum of 1 inch (25.4 mm).

3.6.5 Firestone Insulation Fastening Plate: A 3-inch-diameter (76 mm) galvalume plate used in combination with Firestone fasteners to secure insulation and base sheets to the roof deck.

3.6.6 Firestone Hex Insulation Plate: A 3¹/₄-inch-by-2⁷/₈-inch (83 mm by 73 mm) hexagonal galvalume plate used in combination with Firestone HD or All-Purpose fasteners to secure insulation to the roof deck.

3.6.7 Firestone UltraPly TPO Barbed Seam Plate: A nominally 2³/₈-inch-diameter (60 mm) galvalume plate, with six pointed barbs projecting downward, that is used in combination with Firestone fasteners to secure UltraPly TPO membranes to the roof deck.

3.6.8 Firestone HD Seam Plate: A 2³/₈-inch-diameter (60 mm) galvalume plate used in combination with Firestone HD or All-Purpose fasteners to secure UltraPly TPO membranes to the roof deck.

3.6.9 Firestone HD Plus Seam Plate: A 2³/₄-inch-diameter (70 mm) galvalume plate used in combination with Firestone HD or All-Purpose fasteners to secure UltraPly TPO membranes to the roof deck.

3.7 Adhesives:

3.7.1 Firestone UltraPly Bonding Adhesive: A solvent-based contact adhesive designed for bonding Firestone UltraPly TPO membranes to approved insulations, wood, metal, masonry and other acceptable substrates. The adhesive is applied to both the substrate and the underside of the membrane with a coverage of approximately 45 to 60 square feet (4.18 to 5.58 m²) per gallon (3.78 L), total, for both the substrate and the membrane.

3.7.2 Firestone Water-Based Bonding Adhesive (S): A contact adhesive designed for bonding Firestone UltraPly TPO membranes to wood, metal, masonry and other acceptable substrates. The adhesive is applied to both the substrate and the underside of the membrane with a coverage of approximately 100 to 125 square feet (9.3 to 11.62 m²) per gallon (3.78 L), total, for both the substrate and the membrane.

3.7.3 Firestone XR Bonding Adhesive: A contact adhesive designed for bonding Firestone UltraPly TPO XR membranes to approved insulations, wood, metal, masonry and other acceptable substrates. The adhesive is applied to the substrate only, at a nominal rate of 70 to 90 square feet (6.51 to 8.37 m²) per gallon (3.78 L).

3.7.4 Firestone I.S.O. Twin-Pack Insulation Adhesive: A two-component, low-rise, polyurethane insulation adhesive designed for bonding Firestone-approved roof insulations to deck types as allowed by Firestone specifications.

3.8 Impact Resistance:

The Firestone UltraPly TPO and TPO XR Membrane Roofing Systems described in this report comply with requirements for impact resistance in accordance with FM 4470.

4.0 INSTALLATION

4.1 General:

Installation of the TPO and TPO XR roofing membranes described in this report must comply with the applicable code, the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions must be available on the jobsite at all times during installation.

The slope of the roof on which the single-ply membranes are installed must be a minimum of 1/4:12 (2 percent slope) and must not be more than the maximum slope indicated for the particular assembly as listed in Tables 1 and 2.

Penetrations and terminations of the roof covering must be flashed and made weathertight in accordance with the requirements of the membrane manufacturer and the applicable code.

4.2 Fire Classification:

4.2.1 New Construction: Roof covering systems described in Tables 1 and 2, when installed in accordance with this report, are classified as Class A or B roof covering systems in accordance with ASTM E 108 or UL 790.

4.2.2 Reroofing: The existing deck must be inspected to verify that the structure to be reroofed is structurally sound and adequate to support and secure the roofing membrane.

Class A, B, or C roof covering systems may be installed over existing classified roof covering systems under the following conditions without additional roof classification tests, provided the resulting classification is the lower of the new and existing roofing classification:

- New uninsulated systems installed only over existing uninsulated assemblies
- New insulated systems installed over existing uninsulated systems only

4.3 Wind Uplift Resistance:

4.3.1 New Construction: The allowable wind uplift pressures for the Firestone membrane roof covering systems described in the report are noted in Tables 3 and 4. Metal edge securement for all roofing systems must be designed and tested in accordance with ANSI/SPRI ES-1, complying with IBC Section 1504.5.

4.3.2 Reroofing: Roof covering systems employing mechanical fasteners must be qualified, to the satisfaction of the code official, as to the adequacy of fasteners penetrating through existing roof coverings into structural substrates. Since the composition and/or condition of any particular underlying existing roofing material may vary widely, reroofing with adhered systems is outside the scope of this report.

5.0 CONDITIONS OF USE

The single-ply roofing membranes described in this report comply with, or are suitable alternatives to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation of the roofing systems must comply with the IBC, the manufacturer's published installation instructions and this report. The instructions within this report govern if there are any conflicts between the manufacturer's published installation instructions and this report.
- 5.2 The roof covering systems must be installed only by applicators approved by Firestone Building Products Company, LLC.
- 5.3 Foam plastic insulation must be separated from the interior of the building by an approved thermal barrier in accordance with IBC Section 2603.4.1.5.
- 5.4 Foam plastic insulation, where used, must bear the label of an approved agency indicating that the foam plastic has a flame-spread index of not more than 75 when tested at the maximum thickness intended for use in accordance with ASTM E 84, subject to the approval of the code official.
- 5.5 Above-deck thermal insulation board must comply with the applicable standards listed in Table 1508.2 of the IBC.
- 5.6 Design wind uplift pressure on any roof area, including edge and corner zones, must not exceed the allowable wind pressure for the system installed in that particular area. Refer to the allowable wind uplift pressure for roof coverings as listed in Tables 3 and 4.
- 5.7 The allowable wind uplift pressures listed in Tables 3 and 4 are for the roof covering only. The deck and framing to which the roof covering is attached must be designed for the applicable components and cladding wind loads in accordance with the IBC.
- 5.8 Calculations demonstrating that the required wind resistance is less than the allowable wind resistance must be submitted to the code official.
- 5.9 The membranes are manufactured in Tusculumbia, Alabama, under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Membrane Roof-covering Systems (AC75), dated April 2007.

7.0 IDENTIFICATION

The Firestone Roof Covering System components (membrane, fasteners and adhesives) described in this report are identified with a label indicating the report holder's name (Firestone Building Products Company, LLC), the product type, the name of the inspection agency (Underwriters Laboratories Inc.) and the evaluation report number (ESR-2831).

TABLE 1—FIRE CLASSIFICATION ASSEMBLIES—ADHERED ROOFING SYSTEMS

SYSTEM NO.	ROOF CLASS	DECK ²	MAX. ROOF SLOPE	INSULATION ¹	BARRIER OR COVER BD./ BASE/PLY SHEET	MEMBRANE
1	A	Noncombustible	1/4:12	UL-classified polyisocyanurate, any thickness (Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	1/2-inch thick "ISOGARD HD"	UltraPly TPO
2	A	Noncombustible	1/4:12	(Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	---	UltraPly TPO
3	A	Combustible	2 1/2:12	1 1/2-inch-thick Firestone "ISO 95 + GL"	1 1/2-inch thick "DensDeck"	UltraPly TPO
4	A	Combustible	1/4:12	(Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Min. 1-inch thick "ISOGARD HD"	UltraPly TPO
5	A	Combustible	1:12	(Optional) UL-classified foam plastic insulation, any thickness	Min. 1/4-inch thick "DensDeck", "DensDeck Prime" or "DensDeck DuraGuard"	UltraPly TPO XR
6	B	Combustible	1/4:12	(Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	1/2-inch thick "ISOGARD HD"	UltraPly TPO
7	B	Noncombustible	1:12	UL-classified foam plastic insulation, any thickness	Min. 7/16-inch thick APA-rated OSB	UltraPly TPO XR
8	B	Noncombustible	1:12	4-inch-thick Firestone "ISO 95 + GL"	Two plies, Type G2 "MB Base Sheet"	UltraPly TPO XR
9	B	Noncombustible	1:12	4-inch-thick Firestone "ISO 95 + GL"	Two plies, Type G2 "MB Base Sheet", 1 ply "APP 70", 1 ply "APP 180FR"	UltraPly TPO XR
10	Existing Class A, B or C system to retain existing classification.	Combustible	1/2:12	Existing Class A, B or C uninsulated BUR system (mineral surfaced cap sheet)	---	UltraPly TPO XR

¹All foam plastic insulation must be limited to the maximum thickness in accordance with Section 5.4 of this report or the maximum thickness in accordance with this table, whichever is less.

²Wood deck must be minimum 1 5/32-inch-thick (11.9 mm) plywood. Steel deck must be minimum No. 22 gage galvanized steel [0.030 inch (0.76 mm)]. Concrete must have a minimum compressive strength (f_c) of 2500 psi.

TABLE 2—FIRE CLASSIFICATION ASSEMBLIES—MECHANICALLY FASTENED ROOFING SYSTEMS

SYSTEM NO.	ROOF CLASS	DECK ²	MAX. ROOF SLOPE	SLIP SHEET	INSULATION ¹	BARRIER OR COVER BD./ BASE/PLY SHEET	MEMBRANE
1	A	Combustible	3 ¹ / ₂ :12	---	2-inch-thick Firestone "ISO 95 + GL"	Min. 1/4-inch thick "DensDeck",	UltraPly TPO
2	A	Combustible	3 ³ / ₄ :12	---	2-inch-thick Firestone "ISO 95 + GL"	---	UltraPly TPO
3	A	Combustible	1 ¹ / ₂ :12	---	(Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	1/2-inch thick "ISOGARD HD"	UltraPly TPO
4	A	Noncombustible	3 ³ / ₄ :12	---	(Optional) UL-classified foam plastic insulation, any thickness.	1/2-inch thick "ISOGARD HD"	UltraPly TPO
5	A	Combustible	1 ¹ / ₂ :12	Two layers of "VersaShield Underlayment" or "VersaShield FB-2S"	---	---	UltraPly TPO
6	B	Combustible	1 ¹ / ₂ :12	---	(Optional) Min. 1-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	1/2-inch thick "ISOGARD HD"	UltraPly TPO
7	B	Combustible	1 ¹ / ₂ :12	One layer of "VersaShield Underlayment" or "VersaShield FB-2S"	---	---	UltraPly TPO
8	B	Noncombustible	1:12	---	4-inch-thick Firestone "ISO 95 + GL"	One ply of MB Base Sheet, 1 ply of Type G3	UltraPly TPO XR

¹All foam plastic insulation must be limited to the maximum thickness in accordance with Section 5.4 of this report or the maximum thickness in accordance with this table, whichever is less.

²Wood deck must be minimum 1³/₂-inch-thick (11.9 mm) plywood. Steel deck must be minimum No. 22 gage galvanized steel [0.030 inch (0.76 mm)]. Concrete must have a minimum compressive strength (*f*_c) of 2500 psi.

TABLE 3—WIND RESISTANCE—ADHERED ROOFING SYSTEMS

SYSTEM NO.	DECK ³	INSULATION		COVER BOARD		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
		TYPE ^{1,2}	ATTACHMENT ¹	TYPE ^{1,2}	ATTACHMENT ¹	TYPE	ATTACHMENT ¹	
W-1	Wood	(a) Min. 1.2-inch to max. 4-inch-thick Firestone "ISO 95 + GL" or (b) min. 2-inch to max. 4-inch-thick Firestone HailGard	(a) Loose-laid or (b) HD HailGard fastener @ 1.6 ft ² per fastener	7/16-inch-thick OSB (Omit for HailGard insulation)	HD HailGard fastener to deck @ 2.6 ft ² per fastener	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 120 ft ² per gallon	45
W-2	Wood	---	---	1-inch-thick "ISOGARD HD"	All-purpose Fastener & Insulation Fastening Plate @ 1 per 2 ft ²	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 60 ft ² per gallon	45
W-3	Wood	---	---	1-inch-thick "ISOGARD HD"	All-purpose Fastener & Insulation Fastening Plate @ 1 per 1.33 ft ²	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 60 ft ² per gallon	75
W-4	Wood	---	---	Min. 1/4-inch thick DensDeck	Heavy-duty Fastener & Insulation Fastening Plate @ 1 per 1.33 ft ²	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 60 ft ² per gallon	60
S-1	Steel	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	All-purpose Fastener & Insulation Fastening Plate @ 1.33 ft ² per fastener	---	---	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 120 ft ² per gallon	90
S-2	Steel	Min. 2-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	All-purpose Fastener & Insulation Fastening Plate @ 1.6 ft ² per fastener	---	---	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 120 ft ² per gallon	75
S-3	Steel	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	All-purpose Fastener & Insulation Fastening Plate @ 2 ft ² per fastener	Min. 1/4-inch thick DensDeck or DensDeck Prime	I.S.O. Twin Pack Insulation Adhesive 1/2- to 3/4-inch beads @ 12 inches o.c.	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane @ 120 ft ² per gallon	45

TABLE 3—WIND RESISTANCE—ADHERED ROOFING SYSTEMS (Continued)

SYSTEM NO.	DECK ³	VAPOR BARRIER	INSULATION		COVER BOARD		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
			TYPE ^{1,2}	ATTACHMENT ¹	TYPE ¹	ATTACHMENT ¹	TYPE	ATTACHMENT ¹	
C-1	Concrete	Firestone MB Base M secure to deck with I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	One or 2 layers of 1.5-inch-thick Firestone "ISO 95 + GL"	I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	Min. ¼-inch-thick DensDeck or DensDeck Prime	I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane at 120 ft ² per gallon	232
C-2	Concrete	Firestone SBS PolyTorch or Glass Torch Base, torch adhered.	One or 2 layers of 1.5-inch-thick Firestone "ISO 95 + GL"	I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	Min. ¼-inch-thick DensDeck or DensDeck Prime	I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane at 120 ft ² per gallon	232
C-3	Concrete	---	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	I.S.O. Twin Pack Insulation Adhesive ½ to ¾-inch ribbons at 12 inches o.c.	---	---	UltraPly TPO	UltraPly Bonding Adhesive to substrate and underside of membrane at 120 ft ² per gallon	165
C-4	Concrete	---	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Hot asphalt, full mopping	½-inch thick Fiber Top fiberglass insulation	Hot asphalt, full mopping	UltraPly TPO	UltraPly Bonding Adhesive to Fiber Top at 60 ft ² per gallon	135
C-5	Concrete	---	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Hot asphalt, full mopping	Min. ¼-inch-thick DensDeck	Hot asphalt, full mopping	UltraPly TPO	UltraPly Bonding Adhesive to DensDeck at 60 ft ² per gallon	195
C-6	Concrete	---	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Hot asphalt, full mopping	---	---	UltraPly TPO	UltraPly Bonding Adhesive to DensDeck at 60 ft ² per gallon	180

TABLE 3—WIND RESISTANCE—ADHERED ROOFING SYSTEMS (Continued)

SYSTEM NO.	DECK ³	INSULATION		COVER BOARD		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
		TYPE ^{1,2}	ATTACHMENT ¹	TYPE ¹	ATTACHMENT ¹	TYPE	ATTACHMENT ¹	
C-7	Concrete	---	---	Min. ½-inch fiberboard or min. ¼-inch-thick DensDeck	Concrete Drive or High Density Fasteners with Hex Plates at 2.7 ft ² (fiberboard) or 1.8 ft ² (DensDeck) per fastener	UltraPly TPO	UltraPly Bonding Adhesive or Water Based Bonding Adhesive to substrate and underside of membrane at 90 ft ² per gallon	38
C-8	Concrete	---	---	---	---	UltraPly TPO XR	Water Based Bonding Adhesive to substrate @ 100 ft ² per gallon.	382
C-9	Concrete	---	---	---	---	UltraPly TPO XR	Hot asphalt at 20 to 40 lbs per sq.	500
C-10	Concrete	---	---	---	---	UltraPly TPO XR	XR Bonding Adhesive at 70 to 90 ft ² per gal.	470
C-11	Concrete	---	---	---	---	UltraPly TPO XR	Water Based Bonding Adhesive at 100 to 125 ft ² per gal.	100
C-12	Concrete	Min. 1.4-inch to max. 4-inch-thick, any FM-approved polyisocyanurate insulation	Loose laid	Min. ½-inch thick FM-approved fiberboard insulation	Heavy Duty Fasteners with Hex Plates at 2.7 ft ² per fastener.	UltraPly TPO	UltraPly Bonding Adhesive or Water Based Bonding Adhesive to substrate and underside of membrane at 90 ft ² per gallon	38
SC-1	Steel or concrete	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	All-purpose Fasteners (steel), Heavy Duty or Concrete Drive Fasteners (concrete) with Hex Plates at 2.7 ft ² per fastener.	---	---	UltraPly TPO	UltraPly Bonding Adhesive or Water Based Bonding Adhesive to substrate and underside of membrane at 90 ft ² per gallon	38

TABLE 3—WIND RESISTANCE—ADHERED ROOFING SYSTEMS (Continued)

SYSTEM NO.	DECK ³	SUPPLEMENTAL LIGHTWEIGHT CONCRETE ATTACHMENT ¹	INSULATION		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
			TYPE	ATTACHMENT	TYPE	ATTACHMENT ¹	
LC-1	Cellular lightweight concrete, 200 psi, on structural concrete.	---	---	---	UltraPly TPO XR	XR Bonding Adhesive to substrate at 70-90 ft ² per gallon.	467
LC-2	Cellular lightweight concrete, 200 psi, on structural concrete.	---	---	---	UltraPly TPO XR	Water Based Bonding Adhesive to substrate at 100 ft ² per gallon.	347
LC-3	Cellular lightweight concrete, 300 psi, on steel deck.	High Density Fasteners with Insulation Fastening Plates at 2 ft ² per fastener	---	---	UltraPly TPO XR	XR Bonding Adhesive to substrate at 70-90 ft ² per gallon.	75
LC-4	Celcore lightweight concrete, 300 psi, on steel deck.	High Density Fasteners with Insulation Fastening Plates at 2 ft ² per fastener	---	---	UltraPly TPO XR	XR Bonding Adhesive to substrate at 70-90 ft ² per gallon.	90
LC-5	Celcore lightweight concrete, 300 psi, on steel deck.	---	---	---	UltraPly TPO XR	XR Bonding Adhesive to substrate at 70-90 ft ² per gallon.	45

For **SI**: 1 inch = 25.4 mm; 1 ft = 0.305 m; 1 psf = 47.88 Pa; 1 gal = 3.785 L.

¹Insulation, adhesive and fasteners must be FM-approved.

²All foam plastic insulation must be limited to the maximum thickness in accordance with Section 5.4 of this report or the maximum thickness in accordance with this table, whichever is less.

³Wood deck must be minimum ¹⁵/₃₂-inch-thick (11.9 mm) plywood. Steel deck must be minimum No. 22 gage galvanized steel [0.030 inch (0.76 mm)]. Concrete must have a minimum compressive strength (*f_c*) of 2500 psi, unless otherwise noted. See Section 5.8 of this report.

TABLE 4—WIND RESISTANCE—MECHANICALLY FASTENED ROOFING SYSTEMS

SYSTEM NO.	DECK ³	INSULATION		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
		TYPE ^{1,2}	ATTACHMENT ¹	TYPE	ATTACHMENT ¹	
SC-1	Steel or concrete	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Preliminarily attached	UltraPly TPO	Heavy-Duty Plus Fasteners with HD Plus Seam Plates (steel) or Concrete Drive Fasteners with HD Seam Plates (concrete), fastener rows at 142 inches o.c., 12 inches o.c. along side laps	30
SC-2	Steel or concrete	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Preliminarily attached	UltraPly TPO	Heavy-Duty Plus Fasteners with HD Plus Seam Plates (steel) or Concrete Drive Fasteners with HD Seam Plates (concrete), fastener rows at 142 inches o.c., 6 inches o.c. along side laps	60
SC-3	Steel or concrete	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Preliminarily attached	UltraPly TPO	Heavy-Duty Plus Fasteners with HD Plus Seam Plates (steel) or Concrete Drive Fasteners with HD Seam Plates (concrete), fastener rows at 114 inches o.c., 6 inches o.c. along side laps	68
SC-4	Steel or concrete	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL"	Loose laid	UltraPly TPO	Heavy-Duty Fasteners with HD Seam Plates, fastener rows at 142 inches o.c., 6 inches o.c. along side laps	52
SC-5	Steel or concrete	Min. 1.4-inch to max. 4-inch-thick Firestone "ISO 95 + GL", Atlas Roofing "ACFoam II", Johns Manville "ENRGY 3", Dow Chemical "HY-THERM AP", or RMax "Multi-Max FA-3"	Preliminarily attached	UltraPly TPO	Heavy-Duty Fasteners with UltraPly TPO Barbed Seam Plates, fastener rows at 6 ft o.c., 18 inches o.c. along side laps	30

TABLE 4—WIND RESISTANCE—MECHANICALLY FASTENED ROOFING SYSTEMS (Continued)

SYSTEM NO.	DECK ³	INSULATION		MEMBRANE		ALLOWABLE WIND UPLIFT PRESSURE (psf)
		TYPE ^{1,2}	ATTACHMENT ¹	TYPE	ATTACHMENT ¹	
SC-6	Steel or concrete	Min. 1.4-inch to max. 4-inch-thick Firestone "ISO 95 + GL", Atlas Roofing "ACFoam II", Johns Manville "ENERGY 3", Dow Chemical "HY-THERM AP", or RMax "Multi-Max FA-3"	Preliminarily attached	UltraPly TPO	Heavy-Duty Fasteners with UltraPly TPO Barbed Seam Plates, fastener rows at 9 ft-6 inches o.c., 6 inches o.c. along side laps	38
SC-7	Steel or concrete	Min. 1.4-inch to max. 4-inch-thick, any FM-approved foam plastic insulation	Preliminarily attached	UltraPly TPO	Heavy-Duty Plus Fasteners with HD Plus Seam Plates (steel only) or Heavy-duty Fasteners with HD Seam Plates, fastener rows at 7 ft-6 inches o.c., 12 inches o.c. along side laps	45
MS-1	Steel	Min. 1.4-inch to max. 4-inch-thick, any FM-approved foam plastic insulation	Preliminarily attached	UltraPly TPO	Heavy-Duty Plus Fasteners with HD Plus Seam Plates, fastener rows at 9 ft-6 inches o.c., 12 inches o.c. along side laps	45
MS-2	Steel	Min. 1.5-inch to max. 4-inch-thick Firestone "ISO 95 + GL", Atlas "ACFoam II", Johns Manville "ENERGY3", Dow Chemical "Hy-Therm AP" or Rmax "Multi-Max FA-3"	Preliminarily attached	UltraPly TPO	UltraPly QuickSeam R.M.A. Strips @ 10 ft o.c. with Coiled Metal Batten Strips and Heavy-duty Fasteners along strips @ 6 inches o.c.; UltraPly TPO Quick Prime to underside of membrane at strip locations	45

For SI: 1 inch = 25.4 mm; 1 ft = 0.305 m; 1 psf = 47.88 Pa.

¹Insulation and fasteners must be FM-approved.

²All foam plastic insulation must be limited to the maximum thickness in accordance with Section 5.4 of this report or the maximum thickness in accordance with this table, whichever is less.

³Wood deck must be minimum 1⁵/₃₂-inch-thick (11.9 mm) plywood. Steel deck must be minimum No. 22 gage galvanized steel [0.030 inch (0.76 mm)]. Concrete must have a minimum compressive strength (*f_c*) of 2500 psi, unless otherwise noted. See Section 5.8 of this report.