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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 54 00—Thermoplastic Membrane Roofing
Section: 07 54 19—Polyvinyl-Chloride Roofing

REPORT HOLDER:

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EVALUATION SUBJECT:

S327 AND G410 SINGLE-PLY ROOFING SYSTEMS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- Other Codes (see Section 8.0.)

Properties evaluated:

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

2.0 USES

The Sarnafil S327 and G410 Single-Ply Roofing Systems are used as classified roof covering assemblies.

3.0 DESCRIPTION

3.1 General:

The Sarnafil Single-Ply Roofing Systems consist of single-ply reinforced thermoplastic membranes constructed with reinforced poly (vinyl chloride) (PVC). The systems can be installed over various types of roof decking, including wood, steel and concrete surfaces. The systems are either adhered, mechanically fastened or a combination of mechanically fastened and adhered to resist wind uplift. Sarnafil membranes are manufactured in rolls 3.25, 5, 6.5 and 10 feet wide (914, 1520, 1980 and 3050 mm) with lengths from 65.6 to 100 feet (20 to 30.5 m). The membranes are typically manufactured with a white weathering surface and a grey underside. However, custom pigments are available upon request.

3.2 Materials:

3.2.1 Sarnafil S327 Single-Ply Membrane: The Sarnafil S327 membrane is a polyester reinforced PVC membrane available with or without a factory-applied felt backing. The Sarnafil S327 is manufactured in four thicknesses. See Table 4 for thicknesses and weights of the membranes with and without the felt backing. The membrane is reinforced with a polyester scrim with specifications as outlined in the manufacturer's quality manual. Sarnafil S327 is limited to installation over insulation with a maximum slope as indicated in Table 1 and is attached with mechanical fasteners described in Section 3.2.4.

3.2.2 Sarnafil G410 Single-Ply Membrane: The Sarnafil G410 membrane, typically used in adhered systems, is a glass fiber–reinforced PVC membrane available with or without factory-applied felt backing. The Sarnafil G410 is manufactured in four thicknesses. See Table 4 for thicknesses and weights of the membranes with and without the felt backing. The fiberglass reinforcement is arranged in a woven mat with specifications as outlined in the manufacturer's quality manual. Sarnafil G410 is limited to installation over insulation that is attached to roof decks with a maximum slope as indicated in Table 1, and is fully adhered to the substrate using proprietary adhesives as described in Section 3.2.

3.2.3 Insulation: Insulation, where used, must have a flame-spread index of not greater than 75 when tested, at the maximum thickness intended for use, by an approved testing laboratory in accordance with ASTM E 84. See Tables 1, 2 and 3 for insulations recognized for use with the respective roofing systems.

3.2.4 Mechanical Fasteners: Substrate, fastener and plate combinations must be as outlined in the manufacturer's published installation instructions and Table 2 of this report.

3.2.4.1 Sarnafastener #12: The Sarnafastener #12 is used with the Sarnaplate, described in Section 3.2.4.4, to attach insulation boards to steel or combustible roof decks. Sarnafastener #12 has a modified buttress thread, a shank diameter of 0.168 inch (4.3 mm) and a thread diameter of 0.214 inch (5.4 mm).

3.2.4.2 Sarnafastener XP: The Sarnafastener XP is used with the Sarnadisc, described in Section 3.2.4.5, to attach insulation, and with the Sarnadisc XPN, described in Section 3.2.4.6, or the Sarnarail Polymer Batten, described in Section 3.2.4.8, to attach the membrane (through the insulation) to combustible or noncombustible roof decks. The Sarnafastener XP has a shank diameter of 0.21 inch (5.3 mm) and thread diameter of 0.26 inch (6.6 mm).

3.2.4.3 Sarnafastener MAXLoad: The Sarnafastener MAXLoad is used to attach the Sarnafil membrane with the Sarnadisc MAXLoad, described in Section 3.2.4.7, or Sarnarail Polymer Batten, described in Section 3.2.4.8, to steel or combustible decks. The Sarnafastener MAXLoad has a shank diameter of 0.26 inch (6.6 mm) and a thread diameter of 0.33 inch (8.4 mm).

3.2.4.4 Sarnaplate: The Sarnaplate is a 3-by-3-inch (76 mm by 76 mm), No. 26 gage [0.018 to 0.021 inch (0.45 to 0.53 mm) base-metal thickness], AZ 55 Galvalume-coated plate complying with ASTM A 108 Grade 1018 steel with a minimum F_y = 55 ksi (379 kPa).

3.2.4.5 Sarnadisc: The Sarnadisc is a 3-inch-diameter (76 mm), No. 26 gage [0.018 to 0.021 inch (0.45 to 0.53 mm) base-metal thickness], AZ 55 Galvalume-coated plate complying with ASTM A 108 Grade 1018 steel with a minimum F_y = 55 ksi (379 kPa).

3.2.4.6 Sarnadisc XPN: The Sarnadisc XPN is a $1^1/_2$-by-$3^3/_4$-inch (38 by 95 mm), No. 18 gage [0.040 to 0.042 inch (1.00 to1.05 mm) base-metal thickness], AZ 55 Galvalume-coated plate complying with ASTM A 108 Grade 1018 steel with a minimum F_y = 55 ksi (379 kPa).

3.2.4.7 Sarnadisc MAXLoad: The Sarnadisc MAXLoad is a 3.5-inch-diameter (89 mm), No. 20 gage [0.031 to 0.041 inch (0.78 to 1.02 mm) base-metal thickness], AZ 55 Galvalume-coated plate complying with ASTM A 108 Grade 1018 steel with a minimum F_y = 55 ksi (379 kPa).

3.2.4.8 Sarnarail Polymer Batten: The Sarnarail Polymer Batten is a 1-inch-wide-by-250-foot-long-by-$^1/_{20}$-inch-thick (25 mm by 762 m by 1.27 mm) modified polymer batten. The batten, manufactured in coils, has holes spaced 6 inches (152 mm) on center and is used with either the Sarnafastener XP or the MAXLoad fasteners, described in Sections 3.2.4.2 or 3.2.4.3, respectively, for securing the roof membrane.

3.2.5 Adhesives:

3.2.5.1 Sarnacol 2170: Sarnacol 2170 is a solvent-based adhesive for bonding Sarnafil membranes to foam plastic substrates or DensDeck with application rates as specified in Table 3. Sarnacol 2170 is supplied in 5-gallon (22.7 L) steel containers. The shelf life is one year when the adhesive is stored in the original container at temperatures between 40°F and 80°F (4.4°C and 26.7°C).

3.2.5.2 Sarnacol 2121: Sarnacol 2121 is a water-based adhesive for bonding Sarnafil membranes to foam plastic substrates or DensDeck with application rates as specified in Table 3. Sarnacol 2170 is supplied in 5-gallon (22.7 L) steel containers. The shelf life is one year when the adhesive is stored in the original container at temperatures between 40°F and 80°F (4.4°C and 26.7°C).

3.2.6 Barrier Board: Barrier board, where used, must be a minimum of $^1/_4$-inch (6.4 mm) DensDeck® manufactured by Georgia-Pacific Corporation.

3.3 Impact Resistance:

The Sarnafil S327 and G410 Single-Ply Roofing Systems described in this report comply with the requirements for impact resistance in accordance with FM 4470.

4.0 INSTALLATION

4.1 General:

Installation of the Sarnafil S327 and G410 Single-Ply Roofing Systems must comply with the applicable code, this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation. The substrate must be smooth, dry, clean and free of sharp projections, loose fasteners, protrusions, depressions or contaminants that might interfere with the adhesion or attachment of the membrane. Any surface defects must be corrected prior to the membrane installation. All materials must be protected against contact with incompatible materials. The roof systems must not be installed on roofs having slopes less than $^1/_4$:12 (2 percent slope) or more than that specified for the particular assembly as listed in Table 1 for the corresponding assembly and roof classification.

4.2 Roof Covering Classification:

See Table 1 for a full description of components and the roof covering classification for each of the evaluated systems.

4.3 Wind Resistance:

See Tables 2 and 3 for a full description of components, fastener spacing, adhesive application and allowable design wind uplift pressures for each of the evaluated systems.

4.4 Flashing:

Flashing must be provided as required by Section 1503.2.1 of the IBC. Where flashing is of metal, the metal must be corrosion-resistant with a thickness of not less than No. 26 gage [base-metal thickness of 0.019 inch (0.48 mm)].

4.5 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. Prior to installation of new roof coverings, inspection by, and written approval from, the code official having jurisdiction are required. The roof covering systems described in this report, installed over an existing roof covering system, must be shown to satisfy classification requirements by testing of the composite system in accordance with ASTM E 108 or UL 790. As an alternative, Class A, B or C roof covering systems are permitted to 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 classification for the new and existing roofing:

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

5.0 CONDITIONS OF USE

The Sarnafil S327 and G410 Single-Ply Roofing Systems 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 must comply with this report, the manufacturer's published instructions and the applicable code. If there is a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 The Sarnafil S327 and G410 Single-Ply Roofing Systems must be installed by a Sarnafil, Inc., trained and approved contractor. Evidence of this approval must be made available to the code official upon request.

5.3 Design wind uplift pressures on any roof area, including edge and corner zones, must not exceed the allowable wind uplift pressure for the system installed in that particular area.

5.4 The foam plastic board, utilized in the systems described in this report, must bear the label of an approved agency indicating that the foam plastic has a flame-spread index of no greater than 75 at the maximum thickness intended for use in accordance with ASTM E 84.

5.5 Foam plastic must be separated from the interior of the building by an approved thermal barrier in accordance with Section 2603.4 of the IBC.

5.6 The allowable wind uplift pressures listed in Tables 2 and 3 are for the roof covering systems only. The deck and framing to which the system is attached must be designed for the applicable components and cladding wind loads in accordance with the code.

5.7 Wind uplift resistance of roof coverings placed over existing roof coverings is outside the scope of this report.

5.8 The Sarnafil S327 and G410 Single-Ply Roofing Systems are produced in Canton, Massachusetts, 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 Sarnafil S327 and G410 single-ply membranes and adhesives described in this report must be identified with the manufacturer's name (Sika Sarnafil, Inc.), the product type, the manufacturing date, the name of the inspection agency (Underwriters Laboratories Inc.) and the evaluation report number (ESR-1157).

8.0 OTHER CODES

8.1 Evaluation Scope:

In addition to the code referenced in Section 1.0, the products in this report were evaluated for compliance with the requirements of the following codes:

- BOCA® *National Building Code*/1999 (BNBC)
- 1999 *Standard Building Code*© (SBC)
- 1997 *Uniform Building Code*™ (UBC)

8.2 Uses:

See Section 2.0.

8.3 Description:

See Section 3.0.

8.4 Installation:

8.4.1 through 8.4.3: See Sections 4.1 through 4.3. See Section 4.0, except change the wording of Section 4.4 to read as follows:

Flashing: Flashing must be provided as required by Section 1508.1 of the BNBC, Section 1503.2 of the SBC and Section 1509 of the UBC. Where flashing is of metal, the metal must be corrosion-resistant with a thickness of not less than No. 26 gage [base-metal thickness of 0.019 inch (0.48 mm)].

8.5 Conditions of Use:

The Sarnafil S327 and G410 Single-Ply Roofing Systems described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 8.1 of this report, subject to the conditions listed in Section 5.0, except replace the wording in Section 5.5 with the following:

Foam plastic must be separated from the interior of the building by an approved thermal barrier in accordance with Section 2603.4 of the BNBC, Section 2603.5 of the SBC and Section 2602.4 of the UBC.

8.6 Evidence Submitted:

See Section 6.0.

8.7 Identification:

See Section 7.0.

TABLE 1—ROOF CLASSIFICATIONS OF SARNAFIL ROOFING SYSTEMS

SYSTEM NO.	RATING	SUBSTRATE[2]	MAXIMUM ROOF SLOPE	INSULATION, SLIP SHEET, BARRIER BOARD OR COVER BOARD[3]			MEMBRANE[3]	
				Insulation[4,5]	Barrier or Cover Board or Slip Sheet	Attachment	Type	Attachment[1]
1	A	Combustible	Unlimited	(Optional) one or more layers of polyisocyanurate or polystyrene or combination	$^1/_4$-inch DensDeck® roof board	Mechanically fastened	Sarnafil G410	Adhered with Sarnacol 2170 adhesive, 2 gal/sq
2	A	Combustible	Unlimited	(Optional) one or more layers of polyisocyanurate or polystyrene or combination	$^1/_4$-inch DensDeck® roof board	Mechanically fastened	Sarnafil S327, S327 Feltback	Mechanically attached
3	B	Combustible	Unlimited	(Optional) one or more layers of polyisocyanurate or polystyrene or combination	$^1/_4$-inch DensDeck® roof board	Mechanically fastened	Sarnafil G410 Feltback	Adhered with Sarnacol 2121 adhesive, 1.75 gal/sq
4	A	Noncombustible	2:12	RMax Multi-Max-3, and RMax Thermaroof Plus-3	Optional	Presecured	Sarnafil S327, S327 Feltback	Mechanically attached
5	A	Noncombustible	2:12	RMax Multi-Max-3, and RMax Thermaroof Plus-3	Optional	Mechanically attached	Sarnafil G410, G410 Feltback	Feltback adhered with Sarnacol 2170 adhesive, 1.5 to 2.5 gal/sq, or 2121 adhesive, 1.75 gal/sq

For **SI:** 1 inch = 25.4 mm; 1 gal/sq = 407 mL/m^2.

[1]The application rate is given in gallons per 100 square feet (gal/sq).
[2]Noncombustible includes concrete and minimum No. 22 gage steel. Combustible wood decks must be minimum $^{15}/_{32}$-inch-thick (11.9 mm) plywood.
[3]Insulation, barrier, coverboard, coversheet, membrane adhesive and membrane must be UL-classified for roofing system applications.
[4]All foam plastic insulation must be UL-classified foam plastic for roofing systems, and must be limited to the maximum thickness in accordance with Section 5.4.
[5]Polyisocyanurate foam plastic insulation board must comply with ASTM C 1289. Extruded polystyrene (XPS) and expanded polystyrene (EPS) foam plastic insulation boards must comply with ASTM C 578.

TABLE 2—SARNAFIL S327 MECHANICALLY ATTACHED ROOFING MEMBRANE ALLOWABLE WIND UPLIFT

SYSTEM NO.	SUBSTRATE	INSULATION[2, 3]		SARNAFIL PVC MEMBRANE					ALLOWABLE WIND UPLIFT CAPACITY (psf)
		Type	Attachment	Fasteners and Plates or Bars[1]	Lap Width (inches)	Weld Width (inches)	Typical Lap Spacing[4] (inches)	Fastener Spacing[1] (inches)	
1	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnadisc XPN	5.5	1.75	114.5	6	60
2	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnadisc XPN	5.5	1.75	114.5	12	38
3	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnarail Polymer Batten	5.5	1.25 outside and 0.75 inside	114.5	6	52
4	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener MAXLoad and Sarnarail Polymer Batten	5.5	1.25 outside and 0.75 inside	114.5	12	52
5	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener MAXLoad and Sarnarail Polymer Batten	5.5	1.25 outside and 0.75 inside	114.5	6	60
6	Steel, min. 22 gage	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener MAXLoad and Sarnadisc MAXLoad	7	1.5	113	12	45
7	Concrete (min. 2500 psi compressive strength), steel ($m^{in.}$22 gage) or min. $^3/_4$-inch-thick plywood	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnadisc XPN	5.25	1.5	73.5	12	45
8	Concrete (min. 2500 psi compressive strength), steel (min. 22 gage) or min. $^3/_4$-inch-thick plywood	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnadisc XPN	5.25	1.5	73.5	18	30
9	Concrete, steel (min. 22 gage)	One or more layers of polyisocyanurate, min. 1.3-inch-thick SarnaTherm insulation board	Presecured	Sarnafastener XP and Sarnadisc XPN	5.25	1.5	73.5	6	60

For **SI:** 1 inch = 25.4 mm; 1 lbf/in^2 = 6.89 kPa; 1 lbf/ft^2 = 47.9 Pa; 1 mph = 1.61 km/h.

[1]Fasteners must be of sufficient length to penetrate substrates a minimum of $^3/_4$ inch for steel and 1 inch for wood and concrete. Pilot holes for concrete substrates must be $^1/_2$ inch deeper than fastener embedment.

[2]All foam plastic insulation must be UL-classified foam plastic for roofing systems, and must be limited to a maximum thickness in accordance with Section 5.4.

[3]Polyisocyanurate foam plastic insulation board must comply with ASTM C 1289. Extruded polystyrene (XPS) and expanded polystyrene (EPS) foam plastic insulation boards must comply with ASTM C 578.

[4]The distance of the first row of fasteners from the roof edge must not exceed $^1/_2$ the typical lap spacing. System Nos. 1 through 9 comply with ANSI/SPRI ES-1, Test RE-1, using Sika Sarnafil's Standard Sarnaclad metal edge system.

TABLE 3—ATTACHMENT OF SARNAFIL G410 ADHERED PVC ROOFING MEMBRANES FOR WIND UPLIFT CAPACITY

SYSTEM NO.	SUBSTRATE	INSULATION[2,3]		COVERBOARD		SARNAFIL PVC MEMBRANE	ALLOWABLE WIND UPLIFT CAPACITY (PSF)
		Type	Attachment	Type	Attachment		
1	Steel, min. 22 gage	Min. 1.5-inch-thick polyisocyanurate Atlas ACFoam II	Loosely laid	$^{5}/_{8}$-inch DensDeck Prime	Sarnafasteners and Sarnaplates at 1 fastener per 2 sq. ft.	G410 membrane adhered to the cover board with Sarnacol 2170 adhesive applied to the membrane and board at 1.5 gal./100 sq. ft.	60
2	Steel, min. 22 gage	Min. 1.5-inch-thick polyisocyanurate Atlas ACFoam II	Loosely laid	$^{5}/_{8}$-inch DensDeck Prime	Sarnafasteners and Sarnaplates at 1 fastener per 1.8 sq. ft.	G410 Feltback membrane is adhered to the cover board with Sarnacol 2121 adhesive applied to the cover board at 2.25 gal/100 sq. ft.	52
3	Concrete[1]	Johns Manville E'NRGY-2 3, Rmax Multi-Max FA-3, Atlas ACFoam II, and Hunter Panels H-Shield	Adhered to primed concrete with hot asphalt applied at 25 lbs./100 sq. ft.	$^{1}/_{4}$-inch DensDeck	Adhered to primed concrete with hot asphalt applied at 25 lbs./100 sq. ft.	G410 membrane adhered to the cover board with Sarnacol 2170 adhesive applied to the membrane and board at 1.5 gal./100 sq. ft. G410 Feltback adhered to the cover board with Sarnacol 2170 applied to the cover board at 2 gal/100 sq. ft., or Sarnacol 2121 adhesive applied to the cover board at 1.5 gal/100 sq. ft.	232
4	Concrete[1]	Johns Manville E'NRGY 3, Rmax Multi-Max FA-3, Atlas ACFoam II, and Hunter Panels H-Shield	Adhered to primed concrete with hot asphalt applied at 25 lbs./100 sq. ft.	---	---	G410 membrane adhered to the insulation with Sarnacol 2170 adhesive applied to the membrane and insulation at 1.5 gal./100 sq. ft., or Sarnacol 2121 adhesive applied to the membrane and insulation at 1.75 gal/100 sq. ft.	202

For **SI:** 1 inch = 25.4 mm, 1 lbf/in^2 = 6.89 kPa, 1 lbf/ft2 = 47.9 Pa; 1 gal/sq = 407mL/m^2.

[1]Concrete must have a minimum compressive strength of 2500 psi.
[2]All foam plastic insulation must be UL-classified foam plastic for roofing systems, and must be limited to a maximum thickness in accordance with Section 5.4.
[3] Polyisocyanurate foam plastic insulation board must comply with ASTM C 1289. Extruded polystyrene (XPS) and expanded polystyrene (EPS) foam plastic insulation boards must comply with ASTM C 578.

TABLE 4—TYPICAL MEMBRANE THICKNESSES AND WEIGHTS

THICKNESS (mil)	ACTUAL DIMENSION (inch)	WEIGHT WITH FELT BACKING (psf)	WEIGHT WITHOUT FELT BACKING (psf)
48	0.048	0.375	0.312
60	0.059	0.453	0.390
72	0.071	0.530	0.467
80	0.079	0.582	0.582

For **SI:** 1 inch = 25.4 mm; 1 psf = 47.88 Pa.