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ESR-1661

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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
SECTION: 07 18 13—PEDESTRIAN TRAFFIC COATINGS

REPORT HOLDER:

HILL BROTHERS CHEMICAL COMPANY

**1675 NORTH MAIN STREET
ORANGE, CALIFORNIA 92867**

EVALUATION SUBJECT:

DESERT CRETE SYSTEM AND DESERT BRAND MAGNESITE SYSTEM

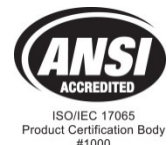


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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 18 13—Pedestrian Traffic Coatings

REPORT HOLDER:

HILL BROTHERS CHEMICAL COMPANY
1675 NORTH MAIN STREET
ORANGE, CALIFORNIA 92867
(626) 333-2251
www.desertbrand.com

EVALUATION SUBJECT:

DESERT CRETE SYSTEM AND DESERT BRAND MAGNESITE SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Residential Code*® (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)[†]

[†]The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated:

- Durability
- Wind resistance
- Fire classification
- Fire resistance

2.0 USES

The Desert Crete System and Desert Brand Magnesite System are cementitious systems used as walking decks and classified roof covering systems for use directly over plywood decks. The systems are also used as components of a one-hour fire-resistance-rated roof assembly as described in Section 4.8 of this report.

3.0 DESCRIPTION

3.1 Desert Crete System Materials:

3.1.1 Desert Crete Liquid Polymer: The polymer is an acrylic liquid admixture to be used with Desert Crete Base and Desert Crete Texture coating, and is supplied in 5- or 55-gallon (18.9 or 97.9 L) containers. Shelf life is one year when the polymer is stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.2 Desert Crete Base: A dry blend of cement and finely graded sand and fillers, supplied in 50-pound (22.7 kg) bags. Shelf life is one year when the product is stored in unopened bags at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.3 Desert Crete Poly Base: A dry blend of Desert Crete Base and a dry polymer admixture, supplied in 50- or 80-pound (22.7 or 36.3 kg) bags. Shelf life is one year when the product is stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.4 Texture Coat:

3.1.4.1 Desert Crete Texture: A dry blend of white cement and finely graded sands, supplied in 50-pound (22.7 kg) bags to be used with Desert Crete Liquid polymer. See Section 3.1.1. Shelf life is one year when the product is stored in unopened bags at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.4.2 Desert Crete PDF: A dry blend of white cement, finely graded sands and a dry polymer admixture, supplied in 80-pound (36.3 kg) bags to be used with water. Shelf life is one year when the product is stored in unopened bags at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.5 Bonder 480: An aqueous all-acrylic polymer supplied in 5- or 50-gallon (18.9 or 97.9 L) containers. Shelf life is one year when the product is stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.6 Desert Brand Sealers CMFPS, Master Seal WB, and Master Seal: Acrylic sealers supplied in 1- and 5-gallon (3.7 and 18.9 L) containers. Shelf life is three years when the products are stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.1.7 Matting: The matting must be fiberglass matting or polyester reinforcing roofing fabric. The fiberglass matting must be manufactured from glass fibers weighing 0.75 oz./ft² (0.23 kg/m²). The polyester fabric must weigh approximately 3 oz./yd² (102 g/m²).

3.2 Desert Brand Magnesite System Materials:

3.2.1 Magnesium Chloride Flake: The product is available in 50-pound (22.7 kg) bags and is mixed with clean water. Shelf life is one year when stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.2.2 Desert Brand TF33-7 Floor and Stair Mix: A magnesium oxide powder packaged in 75-pound (34 kg) bags to be field-mixed into a magnesium chloride premix

solution. Shelf life is one year when stored in unopened bags at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.2.3 Desert Brand Sealers -Classic Sealer and Master Seal: Acrylic sealers supplied in 1- or 5- gallon (3.7 or 18.9 L) containers Shelf life is three years when the products are stored in unopened containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.3 Substrates:

3.3.1 Plywood: Plywood substrates must be a minimum $\frac{5}{8}$ -inch-thick (15.9 mm) exterior-grade plywood complying with US DOC PS-1 or PS-2 (UBC Standard 23-2 or 23-3).

3.3.2 Metal Lath: Metal lath must be a minimum 2.5-pound-per-square-yard (1.36 kg/m²), hot-dipped galvanized lath, complying with ASTM C847.

3.3.3 Staples: For the Desert Crete System, staples must be corrosion-resistant, minimum No. 16 gage staples with $\frac{7}{8}$ -inch (22 mm) or 1-inch (25.4 mm) crowns and minimum $\frac{5}{8}$ -inch-long (15.9 mm) legs, for Desert Crete;

For the Desert Brand Magnesite System, staples must be corrosion-resistant, minimum No.16 gage [0.0598 inch (1.519 inch)] with 1-inch (25.4 mm) crowns and minimum 1-inch-long (25.4 mm) legs.

3.3.4 Metal Flashing: Metal flashing must be a minimum No. 26 gage [0.019-inch (0.483 mm)], corrosion-resistant metal in accordance with IBC Section 1503.2 or IRC Section R903.2, as applicable. Flashings must be rigid enough to avoid excessive deflection and ponding, or must be solidly backed by the plywood substrate.

4.0 INSTALLATION

4.1 General:

Installation of the Desert Crete System and Desert Brand Magnesite System must be in accordance with the manufacturer's published installation instructions, the applicable code and this report. The manufacturer's installation instructions must be available on the jobsite during application.

Substrates must be structurally sound, clean and dry, and must be sloped a minimum of $\frac{1}{4}$ inch per foot (2% slope).

4.2 Preparation of Substrates:

Plywood must be applied to framing in accordance with the requirements of the applicable code. All edges must be blocked. All penetrations through and terminations of the sheathing must be protected with metal flashing in accordance with the requirements of the applicable code and the manufacturer's published installation instructions.

4.3 Desert Crete System:

4.3.1 Metal Lath: Metal lath, as described in Section 3.3.2 of this report, with a minimum 1-inch (25.4 mm) lap at seams, must be fastened to the plywood deck with a minimum of 24 staples per square foot (258 staples per square meter), uniformly distributed. At laps, the staple spacing must not exceed 1 inch (25.4 mm). Metal flashing, when used, must be secured to the plywood deck in accordance with the flashing manufacturer's instructions. The metal lath must overlap the top surface of the horizontal leg of the metal flashing leg attached to the deck by 2 inches (51 mm). The lath on the top surface of the metal flashing must terminate $\frac{1}{4}$ inch (6.4 mm) to $\frac{1}{2}$ inch (12.7 mm) from the vertical leg of the metal flashing.

4.3.2 First Desert Crete Base Application: The first-coat mixture consists of one 50-pound (22.65 kg) bag of

Desert Crete Base and $1\frac{1}{4}$ gallons (4.73 L) of Desert Crete Liquid Polymer. Alternately, one 50-pound (22.65 kg) bag of Desert Crete Poly Base may be mixed with one gallon (3.78 L) of water. The mixture must be troweled into the metal lath at a maximum coverage of 50 square feet (5.9 m²) per 50-pound (22.65 kg) bag. The first coat must completely cover the lath. The mixture must be applied when the ambient temperature is between 50°F (10°C) and 90°F (32.2°C), and the weather is dry. The coating must be dried for at least three hours before the second coat is applied as described in Section 4.3.4 of this report.

4.3.3 Bond Coat: Fiberglass or polyester reinforcing fabric matting must be applied to the first Desert Crete Base application. Matting must be lapped 2 inches (51 mm) over flashing and 1 inch (25.4 mm) at seams. Matting must be cut to fit around posts and drains. Bonder 480 must be applied over the netting, bonding the matting to the first coat. One gallon (3.78 L) of Bonder 480 must be applied to cover approximately 50 square feet (4.6 m²). Bonder 480 must be applied when the surface temperature is between 50°F (10°C) and 90°F (32.2°C), and must be allowed to dry before application of the second coat.

4.3.4 Second Desert Crete Base Application: The second coat must be applied when the matting and Bonder 480 application from the first base coat are hard and dry. The second coat must be identical to the first coat and must be troweled over the dried matting and Bonder 480 at a maximum coverage of 80 square feet (7.4 m²) per 50-pound (22.65 kg) bag. Temperature and weather condition requirements must be the same as those for the first coat.

4.3.5 Textured Coat: A mixture of one 50-pound (22.65 kg) bag of Desert Crete Texture and $1\frac{1}{4}$ gallons (4.73 L) of Desert Crete Liquid Polymer must be applied over the second coat at a maximum coverage of 200 square feet (18.5 m²) per 50-pound (22.65 kg) bag; or a mixture of one 80-pound (36.3 kg) bag of Desert Crete PDF and 2 gallons (7.57 L) of water must be applied over the second coat at a maximum coverage of 320 square feet (29.7 m²), using a pneumatic hopper gun or other method approved by the manufacturer. Within 5 to 10 minutes of application, depending on the temperature, the splattered mixture must be knocked down with a steel trowel. After the coating is dry, a sealer coat must be applied.

The minimum combined thickness of the three coats described in Sections 4.3.2 through 4.3.5 must be $\frac{1}{4}$ inch (6.4 mm). The recommended cure time between the textured coat and the sealer coat must be 24 to 48 hours.

4.3.6 Sealer Coat: The Desert Brand Sealer (CMFPS, Master Seal WB, or Master Seal) must be roller-applied in two coats. The sealer coat must be applied at temperatures from 50°F (10°C) to 90°F (32.2°C), and must not be applied in wet weather. One gallon (3.78 L) of CMFPS has a maximum coverage of 450 square feet (41.8 m²), and one gallon (3.78 L) of Master Seal has a maximum coverage of 300 square feet (27.87 m²). The second coat must be applied when the first coat is dry to the touch; drying time depends upon the weather. The thickness of the sealer coat must be a minimum of 2 mils (6.4 mm).

4.4 Desert Brand Magnesite System:

One layer of Type I (No.15) asphalt-saturated organic felt, complying with ASTM D226, must be placed over the plywood deck. No. 20 gage [0.0359 inch (0.91 mm)], galvanized, woven wire lath with 1-inch (25.4 mm) hexagonal openings complying with ASTM C1032, or metal lath complying with Section 3.2.2 of this report, must

be placed over the felt and stretched tightly. The lath must be secured with staples spaced a maximum of 6 inches (152 mm) on center in a grid pattern, including lath laps. No. 4 blue or 1¹/₂-inch-long (38 mm) galvanized roofing nails may be used in lieu of staples. The lath must be lapped a minimum of 2 inches (51 mm). Metal flashings, as described in Section 3.1.11 of this report, must be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. The magnesium chloride flakes must be mixed with clean water in a clean 55-gallon (208 L) drum at the approximate ratio of 200 pounds (107 kg) of the flakes to 50 gallons (189 L) of water, and the mixture must be stirred until the flakes have completely dissolved. The mixture must be gauged to a Baume hydrometer reading of 22° ± 1¹/₂° corrected to 70°F (21.1°C). The magnesium chloride solution must then be mixed with the Desert Brand TF33-7 Floor and Stair Mix at the rate of approximately 4 gallons (15.1 L) of solution to one 75-pound (34 kg) bag of floor and stair mix, to a lump-free, smooth, plastic consistency. Once properly mixed, the material is ready for immediate use. If the mixture becomes too stiff for application, it must be discarded. No retarder thinners or additional water is permitted. The material must be applied when the ambient temperature is between 50°F (10°C) and 90°F (32.2°C) and the relative humidity is a minimum of 40 percent. If direct sunlight yields an ambient temperature greater than 95°F (35°C), the application area must be adequately shielded. During application, the jobsite must be protected from any wind.

The mixture must then be applied to a thickness of 1¹/₂ inch (12.7 mm) to 5⁵/₈ inch (15.9 mm), including around and under the galvanized lath. The mix must be screeded to a straight, flat and true surface, maintaining proper minimum slope for drainage. After spreading, the material must be floated, troweled and finished to the desired texture. The installation must then be protected from foot traffic for a minimum of 6 to 8 hours. After 24 to 48 hours, four coats of Desert Brand (Classic Sealer or Master Seal) must be applied, with 24 to 48 hours between coats.

4.5 Method of Repair:

The damaged area must be cleared of all existing material, and the materials replaced in the manner described in Section 4.3 (for the Desert Crete System) or Section 4.4 (for the Desert Brand Magnesite System). When substrate damage occurs, the retention of the fire-resistance rating and strength properties must be investigated and the results submitted to the code official.

4.6 Wind Resistance:

The Desert Crete System has an allowable uplift pressure of 48 psf (77 kph) when installed in accordance with this report over plywood substrates. The maximum wind speeds tabulated in Tables 1 through 3 are based on the allowable pressure, the conditions listed in the footnotes, and calculations in accordance with the IBC/IRC and ASCE 7.

The Desert Brand Magnesite System installed over plywood in accordance with this report is limited to buildings with a maximum height of 40 feet (12.2 m) above grade, in Exposure B areas with a maximum ultimate design wind speed of 130 mph (209 kph) under the 2012 IBC and a maximum 3-second-gust basic wind speed of

100 miles per hour under the 2012 IRC and the 2009 and 2006 IBC and IRC.

4.7 Class A Roof Covering Construction:

When Desert Crete System and Desert Brand Magnesite System are applied over 5⁵/₈-inch-thick (15.9 mm), exterior-grade plywood substrates with all edges blocked, the systems have a Class A roof classification, provided the slope is 1¹/₄ inch per foot (2% slope).

4.8 One-hour Fire-resistance-rated Construction:

The Desert Crete System and Desert Brand Magnesite System, when installed over 5⁵/₈-inch-thick (15.9 mm) exterior-grade plywood complying with PS-1, with nominally 2-by-8 joists (51 by 203 mm) spaced at a maximum of 16 inches (406 mm) on center, and all plywood joints blocked, can be recognized as a substitute for the double wood floor described in Assembly 13 of Table 721.1 (3) of the 2012 IBC [Table 720.1(3) of the 2009 and 2006 IBC or Assembly 13 of Table 7-C of the UBC]. When installation is over nominally 2-by-8 joists (51 by 203 mm), the design bending stress assigned to the joists must be limited to 78 percent of the code-prescribed design values. The reduction in bending stress is not required for 2-by-10 (51 by 254 mm) and deeper joists.

5.0 CONDITIONS OF USE

The Desert Crete and Desert Brand Magnesite System described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation must comply with this report, the manufacturer's published installation 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 Installation must be limited to use in areas where the wind speed does not exceed what is specified in Tables 1 through 3, as applicable.
- 5.3 The products are manufactured at the Hill Brothers Chemical Company facility in City of Industry, California, under a quality-control program with inspections by ICC Evaluation Service, LLC.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Walking Decks (AC39), dated April 2011.
- 6.2 Report of small-scale fire tests in accordance with ASTM E119 (UBC Standard 7-1).
- 6.3 Reports of wind-uplift test in accordance with FM I-52 for the Desert Crete System installed over plywood.

7.0 IDENTIFICATION

Individual containers or bags of each component of Desert Crete System and Desert Brand Magnesite System described in this report must bear a label indicating the name and address of Hill Brothers Chemical Company, the product designation, the evaluation report number (ESR-1661), the shelf life, and the batch number keyed to date of manufacture.

TABLE 1—MAXIMUM ULTIMATE DESIGN WIND SPEED FOR THE DESERT CRETE SYSTEMS INSTALLED OVER PLYWOOD SUBSTRATES UNDER THE 2012 IBC^{1,2,3,4} (mph)

MEAN ROOF HEIGHT OF BUILDING (feet)	IBC (V_{ult})					
	Zone 2			Zone 3		
	Exposure B	Exposure C	Exposure D	Exposure B	Exposure C	Exposure D
0-15	160	150	135	135	120	110
20	160	145	130	135	115	105
30	160	140	130	135	110	105
40	155	135	125	130	110	100
50	150	130	120	125	105	100
60	150	130	120	120	105	95

For SI: 1 ft = 304.8 mm 1 mph = 1.6 kph.

¹The tabulated values are based on roofs with slopes less than or equal to 7 degrees from horizontal, and the following conditions.

- GCp = 2.8 for Zone 3
- GCp = 1.8 for Zone 2
- GCpi = +/-0.18
- k_{zt} = 1.0
- k_d = 0.85
- V_{ult} = ultimate design wind speed.

²For a given location, the tabulated values must not exceed that shown in the 2012 IBC wind speed maps.

³For a given location, the tabulated values multiplied by a factor of $\sqrt{0.6}$ must not exceed that shown in the 2012 IRC wind speed map.

⁴Zones 2 and 3 are defined in the IBC, IRC, and ASCE 7.

TABLE 2 —MAXIMUM 3-SECOND GUST WIND SPEED FOR THE DESERT CRETE SYSTEMS INSTALLED OVER PLYWOOD SUBSTRATES UNDER THE 2009 AND 2006 IBC/IRC^{1,2,3} (mph)

MEAN ROOF HEIGHT OF BUILDING (feet)	IBC and IRC (V_{3s})					
	Zone 1 ⁴		Zone 2 ⁴		Zone 3 ⁴	
	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C
0-15	150	140	130	120	100	85
20	150	140	130	110	100	85
30	150	130	130	110	100	-
40	150	130	120	105	90	-
60	140	120	120	100	85	-

For SI: 1 ft = 304.8 mm 1 mph = 1.6 kph.

¹The values are based on roofs with slopes less than or equal to 7 degrees from horizontal, and the following conditions.

- I = 1.0
- GCp = 2.8 for Zone 3
- GCp = 1.8 for Zone 2
- GCp = 1.0 for Zone 1
- GCpi = +/-0.18
- k_{zt} = 1.0
- k_d = 0.85
- V_{3s} = 3-second gust wind speed

²For a given location, the tabulated values must not exceed that shown in the 2009 and 2006 IBC/IRC wind speeds maps.

³Zones 1, 2 and 3 are defined in the IBC, IRC, and ASCE 7.

TABLE 3—MAXIMUM FASTEST MILE WIND SPEED FOR DESERT CRETE SYSTEMS UNDER THE UBC¹ (mph)

MEAN ROOF HEIGHT OF BUILDING (feet)	In the Area of Discontinuities ²				Not in the Area of Discontinuities	
	Exposure B		Exposure C		Exposure B	Exposure C
	V_{fm}		V_{fm}		V_{fm}	V_{fm}
0-15	120		90		120	90
20	120		90		120	90
30	110		90		110	90
40	110		85		110	80
60	100		80		100	80

For SI: 1 ft = 304.8 mm 1 mph = 1.6 kph.

¹ V_{fm} = fastest mile wind speed

² Use in areas with overhangs is outside the scope of this report.

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Desert Crete and Desert Brand Magnesite systems, recognized in ICC-ES master evaluation report ESR-1661, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2010 *California Building Code* (CBC)
- 2010 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Desert Crete and Desert Brand Magnesite systems described in the master report ESR-1661 comply as a Class A roof covering in accordance with CBC Section 1505.1.1, a Class B roof covering in accordance with CBC Section 1505.1.2, and a Class C roof covering in accordance with CBC Section 1505.1.3, provided installation provisions are in accordance with the applicable 2009 *International Building Code*® provisions and the master report.

The walking deck and roof covering systems have not been evaluated under CBC Chapter 7A for use in the exterior design and construction of new buildings located in a Fire Hazard Severity Zone within State Responsibility Areas or any Wildland–Urban Interface Fire Area.

2.2 CRC:

The Desert Crete and Desert Brand Magnesite systems described in the master report ESR-1661 comply as a Class A roof covering in accordance with CRC Section R902.1.1, a Class B roof covering in accordance with CRC Section R902.1.2, and a Class C roof covering in accordance with CRC Section R902.1.3, provided installation provisions are in accordance with the applicable 2009 *International Residential Code*® provisions and the master report.

The walking deck and roof covering systems have not been evaluated under CRC Section R327 for use in the exterior design and construction of new buildings located in a Fire Hazard Severity Zone within State Responsibility Areas or any Wildland–Urban Interface Fire Area.

The products recognized in this supplement have not been evaluated for compliance with the *International Wildland–Urban Interface Code*®.

This supplement expires concurrently with the master report, reissued February 2018.