

ICC-ES Evaluation Report

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DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07180—Traffic Coatings

REPORT HOLDER:

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EVALUATION SUBJECT:

**DESERT CRETE AND DESERT BRAND MAGNESITE
FIRE-RETARDANT WALKING DECK AND ROOF
COVERING SYSTEMS**

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- 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 Fire-Retardant Walking Deck and Roof Covering Systems are walking decks and 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 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: The product is a dry blend of cement and finely graded sand and fillers, and is 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: The product is a dry blend of Desert Crete Base and a dry polymer admixture, and is 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: The product is 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 Sealer: Water-based Desert Brand Concrete/Masonry Floor Paint and Sealer (CMFPS) and solvent-based Desert Brand Master Seal are acrylic sealers supplied in 1- or 5-gallon containers (3.7 or 18.9 L), and provide a finish to the decking system. 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 shall be fiberglass matting or polyester reinforcing roofing fabric. The fiberglass matting shall be manufactured from glass fibers weighing 0.75 oz./ft² (0.23 kg/m²). The polyester fabric shall weigh approximately 3 oz./yd² (102 g/m²).

3.1.8 Magnesium Chloride Flake: The product is available in 80-pound (36.2 kg) and 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).

3.1.9 Desert Brand TF33-7 Floor and Stair Mix: The product is 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).

3.1.10 Desert Brand Sealer: Classic Sealer and Master Seal are acrylic sealers supplied in 1- or 5- gallon (3.7 or 18.9 L) containers, and are applied to the finished system. 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).

3.1.11 Metal Flashing: Metal flashing shall be a minimum No. 26 gage [0.019-inch (0.483 mm)], corrosion-resistant metal. Flashings shall be rigid enough to avoid excessive deflection and ponding, or shall be solidly backed by the plywood substrate.

3.2 Substrates:

3.2.1 Plywood: Plywood shall 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).

3.2.2 Metal Lath: Metal lath shall be a minimum 2.5-pound-per-square-yard (1.36 kg/m²), hot-dipped galvanized lath, complying with ASTM C 847.

3.2.3 Staples: Staples shall 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 Fire Retardant Walking Deck and Roof Covering Systems; and minimum No.16 gage [0.0598 inch (1.519 inch)] staples with 1-inch (25.4 mm) crowns and minimum 1-inch-long (25.4 mm) legs, for Desert Brand Magnesite Fire Retardant Walking Deck System.

4.0 INSTALLATION

4.1 General:

Installation of the Desert Crete and Desert Brand Magnesite Fire-Retardant Walking Deck and Roof Covering Systems shall be in accordance with the manufacturer's published installation instructions, the applicable code and this report. The manufacturer's installation instructions shall be available on the jobsite during application.

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

4.2 Preparation of Substrates:

Plywood shall be applied to framing in accordance with the requirements of the applicable code. All edges shall be blocked. All penetrations through and terminations of the sheathing shall 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 Fire-Retardant Walking Deck and Roof Covering Systems:

4.3.1 Metal Lath: Metal lath, as described in Section 3.2.2 of this report, with a minimum 1-inch (25.4 mm) lap at seams, shall 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 shall not exceed 1 inch (25.4 mm). Metal flashing, when used, shall be secured to the plywood deck in accordance with the flashing manufacturer's instructions. The metal lath shall 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 shall 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 shall 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 shall completely cover the lath. The mixture shall 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 shall be dried for at least three hours before the second coat is applied as described in Section 4.1.4 of this report.

4.3.3 Bond Coat: Fiberglass or polyester reinforcing fabric matting shall be applied to the first Desert Crete Base application. Matting shall be lapped 2 inches (51 mm) over flashing and 1 inch (25.4 mm) at seams. Matting shall be cut to fit around posts and drains. Bonder 480 shall be applied over the netting, bonding the matting to the first coat. One gallon (3.78 L) of Bonder 480 shall be applied to cover approximately 50 square feet (5.9 m²). Bonder 480 shall be applied when the surface temperature is between 50°F (10°C) and 90°F (32.2°C), and shall be allowed to dry before application of the second coat.

4.3.4 Second Desert Crete Base Application: The second coat shall be applied when the matting and Bonder 480 application from the first base coat are hard and dry. The second coat shall be identical to the first coat and shall be troweled over the dried matting and Bonder 480 at a maximum coverage of 80 square feet (5.9 m²) per 50-pound (22.65 kg) bag. Temperature and weather condition requirements shall be the same as those for the first coat.

4.3.5 Third 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 shall be applied over the second coat at a maximum coverage of 200 square feet (14.7 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 shall 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 shall be knocked down with a steel trowel. After the coating is dry, a sealer coat shall be applied.

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

4.3.6 Sealer Coat: The CMFPS or Master Seal shall be roller-applied in two coats. The sealer coat shall be applied at temperatures from 50°F (10°C) to 90°F (32.2°C), and shall 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 shall be applied when the first coat is dry to the touch; drying time depends upon the weather. The thickness of the color coat shall be a minimum of 2 mils (6.4 mm).

4.4 Desert Brand Magnesite Fire-Retardant Walking Deck System Installation:

One layer of Type I (No.15) asphalt-saturated organic felt, complying with ASTM D 226, shall be placed over the plywood deck prepared in accordance with Section 3.3.1 of this report. No. 20 gage [0.0359 inch (0.91 mm)],

galvanized, woven wire lath with 1-inch (25.4 mm) hexagonal openings complying with ASTM C 1032, or metal lath complying with Section 3.2.2 of this report, shall be placed over the felt and stretched tightly. The lath shall 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 shall be lapped a minimum of 2 inches (51 mm). Metal flashings, as described in Section 3.2.11 of this report, shall 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 shall 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 shall be stirred until the flakes have completely dissolved. The mixture shall be gauged to a Baume hydrometer reading of 22° ± 1¹/₂° corrected to 70°F (21.1°C). The magnesium chloride solution shall 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 shall be discarded. No retarder thinners or additional water shall be permitted. The material shall 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 shall be adequately shielded. During application, the jobsite shall be protected from any wind.

The mixture shall 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 shall be screeded to a straight, flat and true surface, maintaining proper minimum slope for drainage. After spreading, the material shall be floated, troweled and finished to the desired texture. The installation shall 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 shall be applied, with 24 to 48 hours between coats.

4.5 Method of Repair:

The damaged area shall 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 shall be investigated and the results submitted to the code official.

4.6 Wind Resistance:

Installation shall be limited to areas where the maximum basic wind speed, mean roof height and exposure comply with Tables 1 and 2 of this report.

4.7 Class A Roof Covering Construction:

When Desert Crete and Desert Brand Magnesite Fire-Retardant Walking Deck and Roof Covering Systems 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 720.1(3) of the 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 shall 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 Fire-Retardant Walking Deck and Roof Covering Systems 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 shall 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 shall govern.
- 5.2 Installation shall be limited to use in areas where the wind speed does not exceed what is specified in Tables 1 and 2 of this report.
- 5.3 The products are manufactured at the Hill Brothers Chemical Company facilities in Los Angeles and City of Industry, California, under a quality control program with inspections by RI Ogawa & Associates (AA-705).

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Walking Decks (AC39), dated May 2008.
- 6.2 Report of small-scale fire tests in accordance with ASTM E 119 (UBC Standard 7-1).

7.0 IDENTIFICATION

Individual containers or bags of each component of Desert Crete and Desert Brand Magnesite Fire-Retardant Walking Deck and Roof Covering Systems described in this report shall 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, the batch number keyed to date of manufacture, and the name of the inspection agency (RI Ogawa & Associates).

TABLE 1—MAXIMUM ALLOWABLE WIND SPEED FOR DESERT CRETE SYSTEMS UNDER THE IBC OR IRC

MEAN ROOF HEIGHT OF BUILDING (feet)	IBC1,2,3					
	Zone 1 ⁴		Zone 2 ⁴		Zone 3 ⁴	
	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C
	V _{3-sec}	V _{3-sec}	V _{3-sec}	V _{3-sec}	V _{3-sec}	V _{3-sec}
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 above values are based on roofs with slopes not exceeding 7 degrees from horizontal, and the following conditions:

- I = 1.0
- G_{pp} = 2.8 for Zone 3
- G_{cp} = 1.8 for Zone 2
- G_{cp} = 1.0 for Zone 1
- G_{cp}i = +/-0.18
- V_{3-sec} = Wind speed, 3-second gust

²Topographic effects, located in any exposure category, shall be designed in accordance with ASCE 7.

³Wind speed in miles/hour.

⁴Zones 1, 2 and 3 are as described in ASCE 7 for the IBC, or IRC Figure R301.1(7).

TABLE 2— MAXIMUM ALLOWABLE WIND SPEED FOR DESERT CRETE SYSTEMS UNDER THE UBC

MEAN ROOF HEIGHT OF BUILDING (feet)	UBC ^{1,2}			
	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.

¹Wind speed in miles/hour, based on fastest mile.

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