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ESR-3458

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This report is subject to renewal 11/2017.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
SECTION: 07 21 00—THERMAL INSULATION

REPORT HOLDER:

CHEMICAL BROTHERS INTERNATIONAL, LLC

**200 INDUSTRIAL BOULEVARD
MCKINNEY, TEXAS 75069**

EVALUATION SUBJECT:

QUADFOAM® 500 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION



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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 21 00—Thermal Insulation

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EVALUATION SUBJECT:

QUADFOAM 500 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012 and 2009 *International Building Code*® (IBC)
- 2012 and 2009 *International Residential Code*® (IRC)
- 2012 and 2009 *International Energy Conservation Code*® (IECC)
- 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.

Properties evaluated:

- Surface-burning characteristics
- Physical properties
- Thermal resistance (*R*-values)
- Attic and crawl space installation

2.0 USES

Quadfoam 500 is used as a nonstructural thermal insulating material in buildings of Type V-B construction (IBC) and nonfire-resistance-rated construction under the IRC. The insulation is for use in wall cavities and floor/ceiling assemblies, and, when installed as described in Section 4.4, in attics and crawl spaces.

3.0 DESCRIPTION

3.1 General:

Quadfoam 500 is a two-component, low-density, open-cell, spray-applied, polyurethane foam plastic insulation. The installed nominal density of Quadfoam 500 is 0.5 pcf (8 kg/m³). The two components of the insulation are polymeric isocyanate (A-component) and a polymeric resin (B-component), which, when stored in unopened containers at temperatures between 40°F and 100°F (4.4°C and 37.8°C), have a shelf life of twelve months.

3.2 Surface Burning Characteristics:

When tested in accordance with ASTM E84, at a maximum thickness of 4 inches (102 mm) and a nominal density of 0.5 pcf (8 kg/m³), Quadfoam 500 has a flame-spread index of 25 or less and a smoke-developed index of 450 or less. Thicknesses of up to 7½ inches (191 mm) for wall cavities and 11½ inches (292 mm) for ceiling cavities are recognized, based on room corner fire testing in accordance with NFPA 286, when the product is covered with minimum ½-inch-thick (13 mm) gypsum wallboard or an equivalent thermal barrier complying with, and installed in accordance with, the applicable code.

3.3 Thermal Resistance, *R*-values:

Quadfoam 500 has thermal resistance (*R*-values) at a mean temperature of 75°F (24°C) as shown in Table 1.

3.4 Intumescent Coatings:

3.4.1 QuadCoat TB Intumescent Coating System: The QuadCoat TB intumescent coating system consists of QuadCoat ICP Primer and QuadCoat TB intumescent Top Coat coatings, manufactured by TPR² Corporation. The coatings are single-component, water-based coatings, supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and having a shelf life of 12 months when stored in factory-sealed containers at temperatures above 50°F (10°C).

3.4.2 TPR² Fireshell® TB Intumescent Coating System: The Fireshell® TB intumescent coating system consists of Fireshell® ICP Primer and Fireshell® TB Top Coat coatings, manufactured by TPR² Corporation. The coatings are single-component, water-based coatings, supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and having a shelf life of 12 months when stored in factory-sealed containers at temperatures above 50°F (10°C).

3.4.3 Quadcoat IB Intumescent Coating: Quadcoat IB intumescent coating, manufactured by TPR² Corporation, is a single-component, water-based coating. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has a shelf life of 12 months when stored in factory-sealed containers at temperatures above 50°F (10°C).

3.4.4 TPR² Fireshell[®] IB Intumescent Coating: Fireshell[®] IB intumescent coating, manufactured by TPR² Corporation, is a single-component, water-based coating. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has a shelf life of 12 months when stored in factory-sealed containers at temperatures above 50°F (10°C).

3.4.5 DC315 Intumescent Coatings: DC315 Primer and DC315 Top Coat are intumescent coatings, manufactured by International Fireproof Technology Inc. The coatings are single-component, water-based coatings, supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and have a shelf life of two years when stored in factory-sealed containers at temperatures between 41°F (5°C) and 95°F (35°C).

4.0 INSTALLATION

4.1 General:

Quadfoam 500 must be installed in accordance with the manufacturer's (Quadrant Urethane Technologies) published installation instructions and this report. The manufacturer's installation instructions and this report must be strictly adhered to, and a copy of the instructions and this evaluation report must be available on the jobsite at all times during installation.

4.2 Application:

The insulation must be applied using spray equipment specified by Quadrant Urethane Technologies. The product must not be used in areas which have a maximum service temperature greater than 180°F (82°C), nor in electrical outlet or junction boxes or in contact with rain or water. The product must be protected from the weather during and after application. The insulation can be installed in a single pass up to a maximum 13¹/₂-inch (343 mm) thickness.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Quadfoam 500 must be separated from the interior of the building by an approved thermal barrier complying with, and installed in accordance with, IBC Section 2603.4 or IRC Section R316.4, as applicable, except where insulation is in an attic or crawl space as described in Section 4.4. Thicknesses up to 7¹/₂ inches (191 mm) for wall cavities and 11¹/₂ inches (292 mm) for ceiling cavities are recognized based on room corner testing in accordance with NFPA 286, when covered with minimum ½-inch-thick (13 mm) gypsum wallboard or an equivalent thermal barrier complying with, and installed in accordance with, the applicable code.

4.3.2 Application without a Prescriptive Thermal Barrier:

4.3.2.1 Application with the QuadCoat TB Intumescent Coating System: The prescriptive, 15-minute thermal barrier may be omitted when installation is in accordance with this section (Section 4.3.2.1). The insulation and coatings may be spray-applied to the interior facing of walls, the underside of roof sheathing or roof rafters, and in crawl spaces, and may be left exposed as an interior finish without a prescribed 15-minute thermal barrier or prescribed ignition barrier. The thickness of the foam plastic applied to the underside of the roof sheathing must not exceed 13¹/₂ inches (343 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 11 inches (279 mm). The foam plastic must be covered on all surfaces with the QuadCoat TB intumescent coating system (QuadCoat ICP Primer and QuadCoat TB Top Coat). The QuadCoat ICP Primer must

be applied at a minimum wet film thickness of 9 mils (0.23 mm) [5-mil (0.13 mm) dry film thickness], at a rate of 0.53 gallon (2 L) per 100 square feet (9.2 m²). After curing, QuadCoat TB Top Coat must be applied at a minimum wet film thickness of 15 mils (0.38 mm) [9-mil (0.23 mm) dry film thickness], at a rate of 1 gallon (3.8 L) per 100 square feet (9.2 m²). The coatings must be applied over the Quadfoam 500 insulation and cured in accordance with the coating manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. Each coating must be applied in one coat by airless spray equipment at ambient temperatures above 50°F (10°C) and relative humidity of less than 70 percent.

4.3.2.2 Application with the TPR² Fireshell[®] TB Intumescent Coating System: The prescriptive 15-minute thermal barrier may be omitted when installation is in accordance with this section (Section 4.3.2.2). The insulation and coatings may be spray-applied to the interior facing of walls, the underside of roof sheathing or roof rafters, and in crawl spaces, and may be left exposed as an interior finish without a prescribed 15-minute thermal barrier or prescribed ignition barrier. The thickness of the foam plastic applied to the underside of the roof sheathing must not exceed 13¹/₂ inches (343 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 11 inches (279 mm). The foam plastic must be covered on all surfaces with the TPR² Fireshell[®] TB intumescent coating system (TPR² Fireshell[®] ICP Primer and Fireshell[®] TB Top Coat). The Fireshell[®] ICP Primer must be applied at a minimum wet film thickness of 9 mils (0.23 mm) [5-mil (0.13 mm) dry film thickness], at a rate of 0.53 gallon (2 L) per 100 square feet (9.2 m²). After curing, Fireshell[®] TB Top Coat must be applied at a minimum wet film thickness of 15 mils (0.38 mm) [9-mil (0.23 mm) dry film thickness], at a rate of 1 gallon (3.8 L) per 100 square feet (9.2 m²). The coatings must be applied over the Quadfoam 500 insulation and cured in accordance with the coating manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. Each coating must be applied in one coat by airless spray equipment at ambient temperatures above 50°F (10°C) and relative humidity of less than 70 percent.

4.3.2.3 Application with the DC 315 Intumescent Coating System: The prescriptive, 15-minute thermal barrier may be omitted when installation is in accordance with this section (Section 4.3.2.3). The insulation and coating system may be spray-applied to the interior facing of walls, the underside of roof sheathing or roof rafters, and in crawl spaces, and may be left exposed as an interior finish without a prescribed 15-minute thermal barrier or prescribed ignition barrier. The thickness of the foam plastic applied to the underside of the roof sheathing must not exceed 12 inches (305 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 8 inches (203 mm). The foam plastic must be covered on all surfaces with the DC 315 intumescent coating system (DC 315 Primer and DC 315 Top Coat). The DC 315 Primer must be applied at a minimum wet film thickness of 4 mils (0.10 mm) [3-mil (0.08 mm) dry film thickness], at a rate of 0.25 gallon (0.95 L) per 100 square feet (9.2 m²). After curing, the DC 315 Top Coat must be applied at a minimum wet film thickness of 16 mils (0.41 mm) [11-mil (0.28 mm) dry film thickness], at a rate of 1 gallon (3.8 L) per 100 square feet (9.2 m²). The coatings must be applied over the Quadfoam 500 insulation and cured in accordance with the coating

manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. Each coating must be applied in one coat, by low-pressure airless spray equipment at ambient and substrate temperatures above 50°F (10°C) and relative humidity of less than 70 percent.

4.4 Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier:

When Quadfoam 500 insulation is installed within attics or crawl spaces, where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 or IRC Sections R316.5.3 and R316.5.4, as applicable. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable code and must be installed in a manner so that the foam plastic insulation is not exposed. Ventilation in the attic or crawl space must be in accordance with the applicable code. The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

4.4.2 Application without a Prescriptive Ignition Barrier:

Where Quadfoam 500 insulation is installed in accordance with Sections 4.4.2.1, 4.4.2.2, 4.4.2.3 or 4.4.2.4, the following conditions apply:

- (a) Entry to the attic or crawl space is only for the service of utilities and no storage is permitted.
- (b) There are no interconnected attic or crawl space areas.
- (c) Air in the attic or crawl space is not circulated to other parts of the building.
- (d) Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806. Under-floor (crawl-space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.
- (e) Combustion air is provided in accordance with IMC (*International Mechanical Code*)[®] Section 701.

4.4.2.1 Application with QuadCoat IB Intumescent Coating:

Quadfoam 500 insulation may be spray-applied, in attics, to the interior facing of walls and to the underside of roof sheathing or roof rafters; and in crawl spaces, as described in this section. The thickness of the insulation applied to the underside of roof sheathing and/or rafters and the underside of wood floors and/or floor joists in crawl spaces must not exceed 11½ inches (292 mm); the thickness of the insulation applied to the vertical surfaces must not exceed 7½ inches (191 mm). The QuadCoat IB intumescent coating must be applied over the insulation in accordance with the coating manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean, and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. The coating is applied with low-pressure airless spray equipment, at a minimum wet film thickness of 4 mils (0.10 mm) [3 mil (0.08 mm) dry film thickness], at a rate of 0.29 gallon (1.10 L) per 100 square feet (9.2 m²). The coating must be applied where ambient and substrate temperature is at least 50°F (10°C). The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

4.4.2.2 Application with TPR² Fireshell[®] IB Intumescent Coating: Quadfoam 500 insulation may be spray-applied, in attics, to the interior facing of walls and to the underside of roof sheathing or roof rafters; and in crawl spaces, as described in this section (Section 4.4.2.2). The

thickness of the insulation applied to the underside of roof sheathing and/or rafters and the underside of wood floors and/or floor joists in crawl spaces must not exceed 11½ inches (292 mm); the thickness of the insulation applied to the vertical surfaces must not exceed 7½ inches (191 mm). The Fireshell[®] IB intumescent coating must be applied over the insulation in accordance with the coating manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean, and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. The coating is applied with low-pressure airless spray equipment, at a minimum wet film thickness of 4 mils (0.10 mm) [3-mil (0.08 mm) dry film thickness], at a rate of 0.29 gallon (1.10 L) per 100 square feet (9.2 m²). The coating must be applied where ambient and substrate temperature is at least 50°F (10°C). The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

4.4.2.3 Application with DC315 Intumescent Coating System:

Quadfoam 500 insulation may be spray-applied, in attics, to the interior facing of walls and to the underside of roof sheathing or roof rafters; and in crawl spaces, as described in this section (Section 4.4.2.3). The thickness of the insulation applied to the underside of roof sheathing and/or rafters and the underside of wood floors and/or floor joists in crawl spaces must not exceed 11½ inches (292 mm); the thickness of the insulation applied to the vertical surfaces must not exceed 7½ inches (191 mm). The DC315 Top Coat intumescent coating must be applied over the insulation in accordance with the coating manufacturer's published instructions and this report. Surfaces to be coated must be dry, clean, and free of dirt, loose debris and other substances that could interfere with adhesion of the coating. The coating is applied with low-pressure airless spray equipment, at a minimum wet film thickness of 4 mils (0.10 mm) [3-mil (0.08 mm) dry film thickness], at a rate of 0.25 gallon (0.95 L) per 100 square feet (9.2 m²). The coating must be applied where ambient and substrate temperature is at least 50°F (10°C). The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

4.4.2.4 Use on Attic Floors:

Quadfoam 500 insulation may be installed at a maximum thickness of 7½ inches (191 mm) between joists in attic floors. The insulation must be covered on all exposed surfaces with QuadCoat IB intumescent coating as described in Section 4.4.2.1, TPR² Fireshell[®] IB intumescent coating as described in Section 4.4.2.2, or the DC315 intumescent coating system as described in Section 4.4.2.3, as applicable. The Quadfoam 500 insulation must be separated from the area beneath the attic by an approved thermal barrier. An ignition barrier in accordance with IBC Section 2603.4.1.6 or IRC Section R316.5.3, as applicable, may be omitted.

5.0 CONDITIONS OF USE

The Quadfoam 500 spray-applied polyurethane insulation described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The insulation and intumescent coatings must be installed in accordance with the report holder's and manufacturer's published installation instructions, this evaluation report and the applicable code. If there is a conflict between the published installation instructions and this report, this report governs.

- 5.2 This evaluation report and the manufacturer's (Quadrant Urethane Technologies) published installation instructions, when required by the code official, must be submitted at the time of permit application.
- 5.3 The insulation must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1, except as noted in when installed as described in Section 4.3.2.
- 5.4 The insulation must not exceed the thicknesses and density noted in Sections 3.2, 4.3 and 4.4 of this report.
- 5.5 The insulation must be protected from the weather during and after application.
- 5.6 A vapor retarder must be installed in accordance with the applicable code.
- 5.7 The insulation must be applied by installers approved by Quadrant Urethane Technologies.
- 5.8 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2012 IBC Section 2603.9, 2009 IBC Section 2603.8 or IRC Section R318.4, as applicable.
- 5.9 Jobsite certification and labeling of the insulation must comply with IRC Sections N1101.4 and N1101.4.1 and IECC Sections 303.1.1 and 303.1.2, as applicable.
- 5.10 The insulation components are manufactured in McKinney, Texas, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC377), dated November 2012 (editorially corrected April 2013), including data in accordance with Appendix X of AC377.
- 6.2 Reports of room corner fire testing in accordance with NFPA 286.

7.0 IDENTIFICATION

All packages and containers of Quadfoam 500 insulation components must be labeled with the Quadrant Urethane Technologies, name and address; the product name (Quadfoam 500); the product type (A- or B-component); the flame spread index and the smoke-developed index; the shelf life and expiration date; the mixing instructions; the density; and the evaluation report number (ESR-3458).

The QuadCoat (ICP Primer, TB Top Coat, IB), Fireshell® (IB) and DC315 (Primer and Top Coat) intumescent coatings must be identified with their respective manufacturer's name and address, the product name and use instructions.

TABLE 1—THERMAL RESISTANCE (R-VALUES^{1,2})

Quadfoam 500

THICKNESS (inches)	R-VALUE (°F·ft ² ·h/Btu)
1	3.6
4	14
6	21
7.5	26
8	28
10	35
11	38
11.5	40
12	42
13	46
13.5	47

For SI: 1 inch = 25.4 mm, 1°F·ft²·h/Btu = 0.176 110K·m²/W.

¹R-values are calculated based on tested k values at 1- and 4-inch thicknesses.

²R-values greater than 10 are rounded to the nearest whole number.