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ESR-3459

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This report is subject to renewal 08/2017.

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 2.0 CLOSED-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 2.0 CLOSED-CELL SPRAY
POLYURETHANE FOAM INSULATION**

1.0 EVALUATION SCOPE

1.1 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
- Air permeability
- Water vapor transmission

1.2 Evaluation to the following green standard:

- 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2008)

Attributes verified:

- See Section 3.1

2.0 USES

Quadfoam 2.0 is used as a nonstructural thermal insulating material in buildings of Type V-B construction (IBC) and nonfire-resistance-rated construction under the IRC. Under the IRC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.4. The insulation is for use in wall cavities and floor/ceiling assemblies, and, when installed as described in Section 4.4, in attic and crawl spaces.

3.0 DESCRIPTION

3.1 General:

Quadfoam 2.0 is a two-component, medium-density, closed-cell polyurethane foam plastic insulation. The installed nominal density of Quadfoam 2.0 is 2.0 pcf. The two components of the insulation are polymeric isocyanate (A-component) and a polymeric resin (B-component). The insulation components are supplied in 55-gallon (208 L) drums, and have a shelf life of twelve months when stored in unopened containers at a temperature between 50°F and 80°F (10°C and 27°C).

The attributes of the insulation have been verified as conforming to the provisions of ICC 700-2008 Section 703.2.1.1.1(c) as an air impermeable insulation. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

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 2.0 pcf, Quadfoam 2.0 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 insulation is covered with minimum ½-inch-thick (13 mm) gypsum wallboard or an equivalent thermal barrier complying with the applicable code.

3.3 Thermal Resistance, *R*-values:

Quadfoam 2.0 has thermal resistance (*R*-values) at a mean temperature of 75°F (24°C) as shown in Table 1.

3.4 Vapor Retarder:

The insulation has a vapor permeance of 1.0 perm [5.7×10^{-11} kg/(Pa·s·m²)] or less when applied at a minimum

thickness of 1.5 inches (38 mm) and tested in accordance with ASTM E96; and qualifies as a Class II vapor retarder under the IBC and IRC.

3.5 Air Permeability:

The insulation, at a minimum thickness of 1.0 inch (25.4 mm), is considered air-impermeable insulation in accordance with 2012 IRC Section R806.5 and 2009 IRC Section R806.4, based on testing in accordance with ASTM E283.

3.6 Intumescent Coating:

3.6.1 QuadCoat TB Intumescent Coating: QuadCoat TB intumescent coating, manufactured by TPR² Corporation, is a single-component, water-based, intumescent coating supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums. The coating has a shelf life of 12 months when stored in factory-sealed containers at temperatures above 45°F (7.5°C).

3.6.2 TPR² Fireshell[®] TB Intumescent Coating: Fireshell[®] TB intumescent coating, manufactured by TPR² Corporation, is a single-component, water-based, intumescent coating supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums. The coating has a shelf life of 12 months when stored in factory-sealed containers at temperatures above 45°F (7.5°C).

3.6.3 DC315 Intumescent Coating: DC315 intumescent coating, manufactured by International Fireproof Technology Inc., is a single-component, water-based, intumescent coating. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has 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 2.0 must be installed in accordance with the manufacturer's 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 soil, rain or water. The product must be protected from the weather during and after application. The insulation can be installed in multiple passes at a maximum of 3 inches (76 mm) per pass. Where multiple passes are required, the cure time between each pass is a minimum of 20 to 30 minutes.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Quadfoam 2.0 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 installation is in an attic or crawl space as described in Section 4.4. Thicknesses up to 7½ inches (191 mm) for wall cavities and 11½ inches (292 mm) for ceiling cavities are recognized based on room corner testing in accordance with NFPA 286.

4.3.2 Application without a Prescriptive Thermal Barrier:

4.3.2.1 Application with QuadCoat TB Intumescent Coating: 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 coating 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 12½ inches (318 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 8½ inches (216 mm). The foam plastic insulation must be covered on all exposed surfaces with QuadCoat TB intumescent coating at a minimum wet film thickness of 18 mils (0.46 mm) [12 mils (0.30 mm) dry film thickness], applied at a rate of 1.08 gallons (4.1 L) per 100 square feet (9.2 m²). The coating must be applied over the Quadfoam 2.0 insulation in accordance with the coating manufacturer's 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 TPR² Fireshell[®] TB Intumescent Coating: 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 coating 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 12½ inches (318 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 8½ inches (216 mm). The foam plastic insulation must be covered on all exposed surfaces with Fireshell[®] TB intumescent coating at a minimum wet film thickness of 18 mils (0.46 mm) [12 mils (0.30 mm) dry film thickness], applied at a rate of 1.08 gallons (4.1 L) per 100 square feet (9.2 m²). The coating must be applied over the Quadfoam 2.0 insulation in accordance with the coating manufacturer's 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 DC315 Intumescent Coating: 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, spray-applied to the interior facing of walls, the underside of roof sheathing or roof rafters, and in crawl spaces, 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 11½ inches (292 mm). The thickness of the foam plastic applied to walls and/or vertical surfaces must not exceed 7½ inches (191 mm). The foam plastic insulation must be covered on all exposed surfaces with DC315 intumescent coating at a minimum wet film thickness of 18 mils (0.46 mm) [13 mils (0.33 mm) dry film thickness], applied at a rate of 1.14 gallons (4.32 L) per 100 square feet (9.2 m²). The coating must be applied over the Quadfoam 2.0 insulation in accordance with the

coating manufacturer's 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.

4.4 Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier:

When Quadfoam 2.0 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 Section R316.5.3 or 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. Quadfoam 2.0 may be installed in unvented attics when the foam plastic is applied at a minimum thickness of 1.0 inch (25.4 mm) in accordance with 2012 IRC Section R806.5 or 2009 IRC Section R806.4, as applicable. 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: Quadfoam 2.0 insulation may be installed in an attic or crawl space without a prescriptive ignition barrier, in accordance with Sections 4.4.2.1 and 4.4.2.2, when all of 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, except that air-impermeable insulation is permitted in unvented attics in accordance with 2012 IRC Section R806.5 or 2009 IRC Section R806.4, as applicable. 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 *International Mechanical Code*[®] (IMC) Section 701.

4.4.2.1 Assembly without a Prescriptive Ignition Barrier: Quadfoam 2.0 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 insulation may be left exposed without a prescriptive ignition barrier. 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 Use on Attic Floors: Quadfoam 2.0 insulation may be installed exposed at a maximum thickness of 7½ inches (191 mm) between joists in attic floors. The insulation must be separated from the area beneath the attic by an approved thermal barrier. The 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 2.0 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 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, except 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.
- 5.5 The insulation must be protected from the weather during and after application.
- 5.6 The insulation must be applied by installers approved by Quadrant Urethane Technologies.
- 5.7 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.
- 5.8 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.
- 5.9 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.
- 6.3 Reports of water vapor transmission testing in accordance with ASTM E96.
- 6.4 Reports of air impermeability testing in accordance with ASTM E283.

7.0 IDENTIFICATION

All packages and containers of Quadfoam 2.0 insulation components must be labeled with the Quadrant Urethane Technologies name and address; the product name (Quadfoam 2.0); 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-3459).

The QuadCoat TB, Fireshell[®] TB and DC315 intumescent coatings are identified with the manufacturer's name and address, the product name and use instructions.

TABLE 1—THERMAL RESISTANCE (R-VALUES^{1,2}) OF QUADFOAM 2.0

THICKNESS (inches)	R-VALUE (°F·ft ² ·h/Btu)
1	6.5
2	13
3	19
3.5	22
4	25
5	31
5.5	35
6	38
7	44
7.5	47
8	50
9	57
9.5	60
10	63
11.5	72
12	75
12.5	79

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.