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ESR-3225

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

REPORT HOLDER:

SPRAY FOAM POLYMERS

POST OFFICE BOX 1182
NEW CANAAN, CONNECTICUT 06840

EVALUATION SUBJECT:

THERMOSEAL 500 AND THERMOSEAL 2100 SPRAY APPLIED POLYURETHANE FOAM INSULATIONS



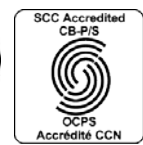
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**DIVISION: 07 00 00—THERMAL AND MOISTURE
PROTECTION**
Section: 07 21 00—Thermal Insulation
REPORT HOLDER:

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EVALUATION SUBJECT:
**THERMOSEAL 500 AND THERMOSEAL 2100 SPRAY
APPLIED POLYURETHANE FOAM INSULATIONS**
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

- Other Codes (see Section 8.0)

Properties evaluated:

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

2.0 USES

ThermoSeal 500 and ThermoSeal 2100 insulations are used as nonstructural thermal insulating materials in buildings of Type V construction (IBC) and dwellings 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 in attic and crawl space installations as described in Section 4.4.

3.0 DESCRIPTION
3.1 General:

3.1.1 ThermoSeal 500: ThermoSeal 500 is a low-density, open-cell, water-blown polyurethane foam plastic insulation system with an installed nominal density of 0.6

pcf (9.6 kg/m³). ThermoSeal 500 is a two-component, spray-applied product. The two components of the insulation are polymeric isocyanate (A-component) and a resin (B-component) which, when stored in unopened containers at a temperature between 65°F and 85°F (18°C and 29°C), have a shelf life of six months.

3.1.2 ThermoSeal 2100: ThermoSeal 2100 is a medium-density, closed-cell, polyurethane foam plastic insulation system with an installed nominal density of 2.4 pcf (38.4 kg/m³). ThermoSeal 2100 is a two-component, spray-applied product. The two components of the insulation are polymeric isocyanate (A-component) and a resin (B-component) which, when stored in unopened containers at a temperature between 65°F and 85°F (18°C and 29°C), have a shelf life of six 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 0.6 pcf (9.6 kg/m³) for ThermoSeal 500 and a nominal density of 2.4 pcf (38.4 kg/m³) for ThermoSeal 2100, the insulations have a flame-spread index of 25 or less and a smoke-developed index of 450 or less.

3.3 Thermal Resistance:

The insulations have a thermal resistance (*R*-value) at a mean temperature of 75°F (24°C) as shown in Tables 1 and 2.

3.4 Air Permeability:

ThermoSeal 500 insulation at a minimum thickness of 3/4 inch (19.1 mm), and ThermoSeal 2100 insulation at a minimum thickness of 1 1/2 inches (38 mm), are considered air-impermeable insulations in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4), based on testing in accordance with ASTM E283.

3.5 Intumescent Coatings:

3.5.1 Pyrodyne (Acry-Tek 5026) Fire-Retardant Acrylic Coating: Pyrodyne (Acry-Tek 5026) Fire-Retardant Acrylic Coating, manufactured by Coating and Foam Solutions, LLC, is a water-based acrylic coating with a specific gravity of 1.29. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums. The coating material has a shelf life of six months when stored in factory-sealed containers at temperatures between 45°F (7.2°C) and 75°F (23.9°C).

4.0 INSTALLATION
4.1 General:

ThermoSeal 500 and ThermoSeal 2100 insulations 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 copies of the instructions and this evaluation report must be available on the jobsite at all times during installation.

4.2 Application:

The ThermoSeal insulations must be applied using spray equipment specified by Spray Foam Polymers. The product must not be used in areas which have a maximum service temperature greater than that specified in the manufacturer's published installation instructions, nor in electrical outlet or junction boxes or in contact with rain or water.

ThermoSeal 500 may be installed in multiple passes at 3.5 to 6 inches per pass (89 to 152 mm) to the maximum thickness. ThermoSeal 2100 may be installed in multiple passes at $\frac{1}{2}$ inch to 2 inches (12.7 to 51 mm) per pass to the maximum thickness. The ThermoSeal 500 insulation passes must be allowed to fully expand and to cure for a minimum of 10 minutes prior to application of an additional pass. The ThermoSeal 2100 insulation passes must be allowed to fully expand and to cure for a minimum of 15 minutes prior to application of an additional pass.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Except as noted in Section 4.4, the ThermoSeal 500 and ThermoSeal 2100 are limited to a maximum thickness of $7\frac{1}{2}$ inches (190.5 mm) in walls and $11\frac{1}{2}$ inches (292 mm) in ceilings. The insulations must be separated from the interior of the building by an approved thermal barrier, such as $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard installed using mechanical fasteners in accordance with the applicable code, or an equivalent 15-minute thermal barrier complying with the applicable code.

4.4 Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier: When the ThermoSeal insulations are 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. ThermoSeal insulation, as described in this section, may be installed in unvented attics in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4).

4.4.2 Application without a Prescriptive Ignition Barrier: The ThermoSeal insulations may be installed in an attic or crawl space without a prescriptive ignition barrier when all of the following conditions apply:

1. Entry to the attic or crawl space is only for the service of utilities and no storage is permitted.
2. There are no interconnected attic or crawl space areas.
3. Air in the attic or crawl space is not circulated to other parts of the building.
4. Combustion air is provided in accordance with IMC (*International Mechanical Code*[®]) Section 701.
5. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, except air-impermeable insulation is permitted in unvented attics in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4).
6. Under-floor (crawl-space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.

4.4.2.1 Application with Intumescent Coating: The insulations may be spray-applied to the underside of roof sheathing and/or rafters in attics, and the underside of wood floors and/or floor joists in crawl spaces, as described in this paragraph. The thickness of the spray foam plastic applied to the underside of the roof sheathing or the underside of floors in crawl spaces must not exceed $11\frac{1}{2}$ inches (292 mm). The thickness of the spray foam plastic insulation applied to vertical wall surfaces must not exceed 8 inches (203 mm). ThermoSeal 500 foam plastic must be covered with Pyrodyne (Acry-Tek 5026) Fire-Retardant Acrylic Coating applied to a thickness of 9.12 mils (0.23 mm) [approximately 1 gallon per 100 square feet (0.40 L/m²)]. ThermoSeal 2100 foam plastic must be covered with Pyrodyne (Acry-Tek 5026) Fire-Retardant Acrylic Coating applied to a minimum thickness of 9.32 mils (0.24 mm) [approximately 1.02 gallons per 100 square feet (0.41 L/m²)]. The intumescent coating must be applied over the insulation in accordance with the coating manufacturer's instructions. 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 a medium size nap roller, soft brush or conventional airless spray equipment.

The coating must be applied when ambient and substrate temperatures are at least 50°F (10°C). The insulation may be installed in unvented attics as described in this section and at the minimum thickness noted in Section 3.4, in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4).

4.4.2.2 Application without Intumescent Coating: ThermoSeal 2100 may be spray-applied to the underside of roof sheathing and/or rafters in attics, and the underside of wood floors and/or floor joists in crawl spaces, as described in this paragraph. The thickness of the foam plastic applied to the underside of the roof sheathing or the underside of floors in crawl spaces must not exceed $11\frac{1}{4}$ inches (286 mm). The thickness of the spray foam plastic insulation applied to vertical wall surfaces must not exceed $7\frac{1}{4}$ inches (184 mm).

The insulation may be installed in unvented attics as described in this section and at the minimum thickness noted in Section 3.4, in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4).

4.4.3 Use on Attic Floors: The ThermoSeal insulations may be installed at a maximum thickness of 8 inches (203 mm) between joists in attic floors when covered with Pyrodyne (Acry-Tek 5026) Fire-retardant Acrylic Coating applied as described in Section 4.4.2.1. ThermoSeal 2100 may be installed at a maximum thickness of $7\frac{1}{4}$ inches (184 mm) without an intumescent coating or ignition barrier. ThermoSeal 2100 may be applied to a maximum thickness of $11\frac{1}{4}$ inches (286 mm) on the attic floor between and/or over the joists when a prescriptive ignition barrier is installed in accordance with IBC Section 2603.4.1.6 or IRC Section R316.5.3. The insulations must be separated from the interior of the building by an approved thermal barrier.

5.0 CONDITIONS OF USE

The ThermoSeal 500 and ThermoSeal 2100 spray-applied polyurethane insulations 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 The insulation must be installed in accordance with the manufacturer's published installation instructions, this evaluation report and the applicable code. If there is a conflict between the installation instructions and this report, this report governs.

- 5.2 The insulation must be separated from the interior of the building by an approved 15-minute thermal barrier, except when installation is in attics and crawl spaces as described in Section 4.4.
- 5.3 The insulation must not exceed the thickness and density noted in Sections 3.2, 4.3 and 4.4.
- 5.4 The insulation must be protected from the weather during and after application.
- 5.5 The insulation must be applied by professional spray polyurethane foam installers approved by Spray Foam Polymers, or by the Spray Polyurethane Foam Alliance (SPFA) for the installation of spray polyurethane foam insulation.
- 5.6 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2012 IRC Section 2603.9 (2009 IRC Section 2603.8) or IRC Section R318.4, as applicable.
- 5.7 Jobsite certification and labeling of the insulation must comply with 2012 IRC Section N1112 (2009 IRC Section N1101.4) and 2012 IECC Sections C303.1 and R303.1 (2009 IECC Section 303.1), as applicable.
- 5.8 A vapor retarder must be installed in accordance with the applicable code.
- 5.9 The insulations are manufactured 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 reports of tests in accordance with Appendix X.
- 6.2 Reports of air permeance testing in accordance with ASTM E283.

7.0 IDENTIFICATION

All packages and containers of ThermoSeal 500 and ThermoSeal 2100 must be labeled with the Spray Foam Polymers, name and address; the product name; the flame spread index and the smoke-developed index; the date of manufacture; and the evaluation report number (ESR-3225).

Intumescent coatings must be identified with the manufacturer's name and address, the product trade name and use instructions.

8.0 OTHER CODES

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

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2006 *International Energy Conservation Code*® (2006 IECC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 2003 *International Energy Conservation Code*® (2003 IECC)

The products comply with the above-mentioned codes as described in Sections 2.0 through 7.0 of this report, with the revisions noted below:

- **Application with a Prescriptive Thermal Barrier:** See Section 4.3.1, except the approved thermal barrier must be installed in accordance with Section R314.4 of the 2006 IRC or Section R314.1.2 of the 2003 IRC, as applicable.
- **Application with a Prescriptive Ignition Barrier:** See Section 4.4.1, except an ignition barrier must be installed in accordance with Section R314.2.3 of the 2003 IRC, or Section R314.5.3 or R314.5.4 of the 2006 IRC.
- **Application without a Prescriptive ignition Barrier:** See Section 4.4.2, except that combustion air is provided in accordance with Sections 701 and 703 of the 2006 IMC.
- **Protection against Termites:** See Section 5.6, except use of the insulation in areas where the probability of termite infestation if "very heavy" must be in accordance with Section 320.4 of the 2003 IRC or Section R320.5 of the 2006 IRC.
- **Jobsite Certification and Labeling:** See Section 5.7, except jobsite certification and labeling must comply with Section 102.5.1 of the 2003 IECC, or Sections 102.1.1 and 102.1.11, as applicable, of the 2006 IECC.

TABLE 1—THERMOSEAL 500 THERMAL RESISTANCE (R-VALUES)^{1,2}

THICKNESS (inches)	R-VALUE (°F·ft ² ·h/Btu)
1	3.7
2	7.4
3	11
3.5	13
4	14
5	19
5.5	20
6	22
7	26
7.5	28
8	30
9	33
9.5	35
10	37
11.5	43

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

¹R-values are calculated based on tested *K* values at 1-, 3.5- and 4-inch thicknesses.

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

TABLE 2—THERMOSEAL 2100 THERMAL RESISTANCE (R-VALUES)^{1,2}

THICKNESS (inches)	R-VALUE (°F·ft ² ·h/Btu)
1	5.8
2	12
3	19
3.5	23
4	27
5	34
5.5	37
6	40
7	47
7.5	50
8	54
9	60
9.5	64
10	67
11.5	77

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

¹R-values are calculated based on tested *K* values at 1-, 3.5- and 4-inch thicknesses.

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