

ICC-ES Evaluation Report**ESR-3493**

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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:**ICYNENE PROSEAL ECO (MD-R-210) CLOSED-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)
- Other Codes (see Section 8.0)

Properties evaluated:

- Surface-burning characteristics
- Physical properties
- Thermal resistance (*R*-values)
- Attic and crawl space installation
- Air permeability
- Vapor permeability
- Fire resistance
- Exterior walls of Types I-IV construction

2.0 USES

Icynene ProSeal Eco (MD-R-210) spray foam is used as a nonstructural thermal insulating material in Types I, II, III, IV and V construction under the IBC and dwellings under the IRC. The insulation is for use in wall cavities, floor assemblies, ceiling assemblies, or attics and crawl spaces when installed in accordance with Section 4.4. Under the IRC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.5, and as a vapor retarder when installed in accordance with

Section 3.4. Icynene ProSeal Eco (MD-R-210) spray foam may be used in fire-resistance-rated construction when installed in accordance with Section 4.5, and in Types I through IV construction when installed in accordance with Section 4.6.

3.0 DESCRIPTION**3.1 ProSeal Eco (MD-R-210) Insulation:**

Icynene ProSeal Eco (MD-R-210) foam plastic insulation is a two-component, closed-cell, water blown, spray-applied foam plastic insulation with a nominal density of 2.2 pcf. The two components of the insulation are Icynene Base Seal MDI isocyanate (A-component) and Icynene ProSeal Eco (MD-R-210) resin (B-component) which, when stored in unopened factory-sealed containers at a temperature between 60°F and 85°F (4.4°C and 37.8°C), have a shelf life of six months.

3.2 Surface Burning Characteristics:

The Icynene ProSeal Eco (MD-R-210) insulation, at a maximum thickness of 4 inches (102 mm) and a nominal density of 2.2 pounds per cubic foot, has a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84.

3.3 Thermal Resistance, *R*-values:

Icynene ProSeal Eco (MD-R-210) insulation has a thermal resistance (*R*-value) at a mean temperature of 75°F (24°C) as shown in Table 1.

3.4 Vapor Retarder:

Icynene ProSeal Eco (MD-R-210) insulation has a vapor permeance of less than 1 perm [5.7×10^{-11} kg/(Pa·s·m²)], in accordance with ASTM E96, when applied at a minimum thickness of 2.4 inches (60 mm), and qualifies as a Class II vapor retarder under the IRC.

3.5 Air Permeability:

Icynene ProSeal Eco (MD-R-210) spray-applied polyurethane foam insulation, at a minimum thickness of 1.4 inches (35 mm), is considered air-impermeable insulation in accordance with 2012 IRC Section R806.5 (2009 IRC Section R806.4), based on testing in accordance with ASTM E2178.

3.6 DC315 Intumescent Coating:

DC315 Intumescent Coating, manufactured by International Fireproof Technology Inc., is a single-component, water-based, liquid-applied 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:

Icynene ProSeal Eco (MD-R-210) 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 insulations must be applied using spray equipment specified by Icynene Inc. 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. Where Icynene ProSeal Eco (MD-R-210) is used as an air-impermeable barrier, such as in unventilated attic spaces regulated by IRC Section R806, the insulation must be installed at a minimum thickness of 1.4 inches (35 mm). The insulation may be installed in multiple passes at maximum of 2 inches (51 mm) per pass to the maximum thickness. Where multiple passes are required, the cure time between passes is in accordance with the manufacturer's published installation instructions.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Icynene ProSeal Eco (MD-R-210) must be separated from the interior of the building by an approved thermal barrier, such as 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, and installed in accordance with, IBC Section 2603.4 or IRC Section R316.4, as applicable. When installation is within an attic or crawl space as described in Section 4.4, a thermal barrier is not required between the foam plastic and the attic or crawl space, but is required between the insulation and the interior of the building. There is no thickness limit when installation is behind a code-prescribed thermal barrier except as noted in Section 4.4.2.3.

4.3.2 Application without a Prescriptive Thermal Barrier: Icynene ProSeal Eco (MD-R-210) may be installed without the 15-minute thermal barrier prescribed in the IBC Section 2603.4 and IRC Section R316.4, when installation is in accordance with this section. The insulation 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 15-minute thermal barrier or ignition barrier. The thickness of the insulation applied to the underside of ceilings or roof sheathing must not exceed 10 inches (254 mm). The thickness of the insulation applied to vertical wall surfaces must not exceed 6 inches (152 mm). The insulation must be covered on all surfaces with DC 315 coating at a minimum wet film thickness of 22 wet mils (0.56 mm) [14 dry mils (0.36 mm)], at a rate of 1 gallon (3.8 L) per 73 square feet (6.8 m²). The coating must be applied over the Icynene ProSeal Eco (MD-R-210) 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. The coating is applied in one coat with low-pressure airless spray equipment.

4.4 Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier:

When Icynene ProSeal Eco (MD-R-210) 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.

4.4.2 Application without a Prescriptive Ignition Barrier:

4.4.2.1 General: Where Icynene ProSeal Eco (MD-R-210) insulation is installed without a prescriptive ignition barrier as described in Sections 4.4.2.2 and 4.4.2.3, 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. Under-floor (crawl-space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.
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. Combustion air is provided in accordance with IMC (*International Mechanical Code*[®]) Section 701.

4.4.2.2 Use with DC315 Intumescent Coating: In attics, the insulation may be spray-applied to the underside of roof sheathing or roof rafters, and/or vertical surfaces, and in crawl spaces the insulation may be spray-applied to the underside of floors and/or vertical surfaces as described in this section. The thickness of the foam plastic applied to the underside of roof sheathing and/or rafters in attics, and the underside of floors as described in this section, must not exceed 14 inches (356 mm), and the thickness applied to vertical surfaces must not exceed 8 inches (203 mm). The insulation must be covered on all surfaces with DC 315 coating at a minimum wet film thickness of 6 wet mils (0.15 mm) [4 dry mils (0.10 mm)], at a rate of 1 gallon (3.8 L) per 268 square feet (6.8 m²). The coating must be applied over the Icynene ProSeal Eco (MD-R-210) 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. The coating is applied in one coat with low-pressure airless spray equipment.

4.4.2.3 Use on Attic Floors: When used on attic floors, Icynene ProSeal Eco (MD-R-210) insulation may be installed at a maximum thickness of 10 inches (254 mm) between and over the joists in attic floors. The insulation must be separated from the interior of the building by an approved thermal barrier. The ignition barrier in accordance with the IBC Section 2603.4.1.6 and IRC Section R316.5.3 may be omitted.

4.4.3 Unvented Attics and Crawlspace: Icynene ProSeal Eco (MD-R-210) insulation when installed in accordance with Section 4.3.2 may be installed in unvented attics in accordance with 2012 IRC Section

R806.5 (2009 IRC Section R806.4) and unvented crawl spaces in accordance with IRC Section R408.3

4.5 Fire-resistance-rated Wall Assemblies:

4.5.1 Two-hour Non-load-bearing Fire-resistance-rated Wall Assembly:

4.5.1.1 Exterior Face: Nominally 6-inch-deep, No. 18 gage galvanized steel studs, spaced 16 inches (406 mm) on center, are fastened to No. 18 gage galvanized steel floor and ceiling tracks. One layer of ½-inch-thick (12.7 mm) Georgia Pacific DensGlass® Gold Exterior Sheathing is installed with the long edge parallel to steel studs with vertical joints offset a minimum of 16 inches (406 mm) from the vertical joints of the interior Type X gypsum board, and the horizontal joints offset a minimum of 24 inches (610 mm) from the horizontal joints of the gypsum board. The sheathing is attached using 1¼-inch-long (32 mm) self-drilling drywall screws spaced 8 inches (203 mm) on center around the perimeter and in the field. Hohmann & Barnard DW-10 brick ties, 6 inches (152 mm) long by 1½ inches (38 mm) wide, are spaced 16 inches (406 mm) on center vertically on each steel stud, and secured using two 1⅝-inch-long (41 mm) self-drilling screws, through 4-inch (102 mm) red clay brick [(3½ inches (88.9 mm) by 2¼ inches (57 mm) by 7¾ inches (197 mm)], laid in a running bond pattern with Type S mortar, leaving a nominally 1-inch air gap between the brick and the exterior sheathing. The stud cavity is filled with Icynene ProSeal Eco (MD-R-210) insulation to a maximum nominal thickness of 6 inches (152 mm).

4.5.1.2 Interior Face: One layer of Type X gypsum board, ⅝ inch (15.9 mm) thick and complying with ASTM C1396, is applied to the interior side with the long edge parallel to steel studs, and is secured using 1¼-inch-long (32 mm), self-drilling drywall screws spaced 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The gypsum board joints must be treated with vinyl or casein, dry or premixed joint compound applied in two coats to cover all exposed screw heads and gypsum board butt joints. A minimum 2-inch-wide (51 mm) paper, plastic, or fiberglass tape is embedded in the first layer of compound over butt joints of the gypsum board.

4.5.2 Three-hour Non-load-bearing Fire-resistance-rated Wall Assembly:

4.5.2.1 Exterior Face: Nominally 6-inch-deep, No. 18 gage galvanized steel studs, spaced 16 inches (406 mm) on center, are fastened to No. 18 gage galvanized steel floor and ceiling tracks. One layer of ½-inch-thick (12.7 mm) Georgia Pacific DensGlass® Gold Exterior Sheathing is installed with the long edge parallel to steel studs with vertical joints offset a minimum of 16 inches (406 mm) from the vertical joints of the interior Type X gypsum board, and the horizontal joints offset a minimum of 24 inches (610 mm) from the horizontal joints of the gypsum board. The sheathing is attached using 1¼-inch-long (32 mm) self-drilling drywall screws spaced 8 inches (203 mm) on center around the perimeter and in the field. Hohmann & Barnard DW-10 brick ties, 6 inches (152 mm) long by 1½ inches (38 mm) wide, are spaced 16 inches (406 mm) on center vertically on each steel stud, and secured using two 1⅝-inch-long (41 mm) self-drilling screws, through 4-inch (102 mm) red clay brick [(3½ inches (89 mm) by 2¼ inches (57 mm) by 7¾ inches (197 mm)], laid in a running bond pattern with Type S mortar, leaving a nominally 1-inch air gap between the brick and the exterior sheathing. The stud cavity is filled with Icynene ProSeal Eco (MD-R-210) insulation to a maximum nominal thickness of 6 inches.

4.5.2.2 Interior Face: Two layers of Type X gypsum board, ⅝ inch (15.9 mm) thick and complying with ASTM C1396, are applied to the interior side with joints offset from each other a minimum of 16 inches (406 mm) and with the long edge parallel to steel studs. The gypsum board is secured using 1¼-inch-long (32 mm), self-drilling drywall screws spaced 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The gypsum board joints must be treated with vinyl or casein, dry or premixed joint compound applied in two coats to cover all exposed screw heads and gypsum board butt joints. A minimum 2-inch-wide (51 mm) paper, plastic, or fiberglass tape is embedded in the first layer of compound over butt joints of the gypsum board.

4.6 Exterior Walls in Type I, II, III and IV Construction:

4.6.1 General: When used on exterior walls of Types I, II, III or IV construction, the assembly must comply with IBC Section 2603.5 and this section, and the Icynene ProSeal Eco (MD-R-210) insulation must be installed at a maximum thickness of 6 inches (152 mm). The potential heat of Icynene ProSeal Eco (MD-R-210) insulation is 2099 Btu/ft² (23838 kJ/m²) per inch of thickness, when tested in accordance with NFPA 259.

4.6.2 Exterior Face: Nominally 6-inch-deep, No. 18 gage, galvanized steel studs, spaced 16 inches (406 mm) on center, are fastened to No. 18 gage galvanized steel floor and ceiling track using No. 8, ⅞-inch-long (22 mm), self-tapping, pan head framing screws. Georgia Pacific DensGlass Gold Exterior Sheathing, ½ inch (12.7 mm) thick, is installed over the exterior side of steel studs with the long end perpendicular to the steel studs, using No. 6, Type S, 1¼-inch (32 mm), self-tapping bugle head screws spaced 8 inches (203 mm) on center around the perimeter and in the field. The stud cavity is filled with Icynene ProSeal Eco (MD-R-210) insulation to a maximum nominal thickness of 6 inches.

4.6.3 Interior Face: Type X gypsum board, ⅝ inches (15.9 mm) thick and complying with ASTM C1396, is installed, with the long dimension perpendicular to steel studs, with No. 6, Type S, 1¼-inch-long (32 mm), self-tapping bugle head screws spaced 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) in the field. The gypsum board joints must be treated with vinyl or casein, dry or premixed joint compound applied in two coats to cover all exposed screw heads and gypsum board butt joints. A minimum 2-inch-wide (51 mm) paper, plastic, or fiberglass tape is embedded in the first layer of compound over butt joints of the gypsum board.

4.6.4 Exterior Wall Covering: Details of the exterior wall covering must be provided to the code official by the report holder, designer or specifier, with an engineering analysis demonstrating that (1) the exterior wall covering conforms to IBC Section 2603.5.7 and (2) the addition of the wall covering to the assembly described in this section does not negatively affect conformance of the assembly with the requirements of IBC Section 2603.5.

5.0 CONDITIONS OF USE

The Icynene ProSeal Eco (MD-R-210) 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 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 installed as described in Section 4.3.2. The insulation must be protected with an ignition barrier when installation is in attics and crawl spaces, except when installation is as described in Section 4.4.
- 5.3 The insulation must not exceed the thickness and density noted in Sections 3.2, 4.3, 4.4, 4.5 and 4.6 of this report.
- 5.4 The insulation must be protected from the weather during and after application.
- 5.5 The insulation must be applied by installers certified by Icynene Inc.
- 5.6 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.
- 5.7 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.
- 5.8 The A and B components of the insulation are produced under a quality control program with inspections by QAI Laboratories Inc. (AA-723).

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, including reports of tests in accordance with Appendix X of AC377.
- 6.2 Reports of room corner fire testing in accordance with NFPA 286.
- 6.3 Report of air permeance testing in accordance with ASTM E2178.
- 6.4 Report of vapor permeance test in accordance with ASTM E96.
- 6.5 Reports of fire-resistance tests in accordance with ASTM E119.
- 6.6 Report of fire tests in accordance with NFPA 285, and related engineering analysis.
- 6.7 Report of potential heat tests in accordance with NFPA 259.
- 6.8 Report of critical radiant flux test in accordance with ASTM E970.

7.0 IDENTIFICATION

Containers of Icynene ProSeal Eco (MD-R-210) components are identified with a label bearing the Icynene Inc. name and address; the product trade name

[Icynene ProSeal Eco (MD-R-210)]; the lot number; the flame spread and smoke developed indices; mixing instructions; density; the shelf life and the expiration date; the evaluation report number (ESR-3493); and the name of the inspection agency (QAI Laboratories Inc.).

Intumescent coatings are identified with the manufacturer's name and address, the product trade name and usage instructions.

8.0 OTHER CODES

In addition to the codes referenced in Section 1.0, the products described in this report have also been evaluated for compliance with the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2006 *International Energy Conservation Code*® (2006 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 2006 IRC Section R314.4.
- **Application with a Prescriptive Ignition Barrier:** See Section 4.4.1, except attics must be vented in accordance with 2006 IBC Section 1203.2, and crawl space ventilation must be in accordance with 2006 IBC Section 1203.3 or 2006 IRC Section R408, as applicable. Additionally, an ignition barrier must be installed in accordance with 2006 IRC Section R314.5.3 or R314.5.4.
- **Application without a Prescriptive ignition Barrier:** See Section 4.4.2, except attics must be vented in accordance with 2006 IBC Section 1203.2, and crawl space ventilation must be in accordance with 2006 IBC Section 1203.3 or 2006 IRC Section R408, as applicable. Combustion air must be provided in accordance with Sections 701 and 703 of the 2006 *International Mechanical Code*®.
- **Protection against Termites:** Replace Section 5.6 with the following: Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2006 IBC Section 2603.8 or 2006 IRC Section R320.5.
- **Jobsite Certification and Labeling:** See Section 5.7, except jobsite certification and labeling must comply with 2006 IECC Sections 102.1.1 and 102.11, as applicable.

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

THICKNESS (inches)	R-VALUE (°F·ft ² ·h/Btu)
1	4.9
3.5	17
4	19
5.5	26
6	28
7.5	35
8.5	40
9.5	45
10	47
11.25	53
14	66

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.