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ICC-ES Evaluation Report

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DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07210—Building Insulation

REPORT HOLDER:

ICYNENE, INC.
6747 CAMPOBELLO ROAD
MISSISSAUGA, ONTARIO L5N 2L7
CANADA
(905) 363-4040
www.icynene.com

EVALUATION SUBJECT:

ICYNENE LD-C-50™ (formerly known as The Icynene Insulation System®)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 *International Building Code®* (2009 IBC)
- 2009 *International Residential Code®* (2009 IRC)
- 2009 *International Energy Conservation Code®* (2009 IECC)
- Other Codes (see Section 8.0)

Properties evaluated:

- Surface burning characteristics
- Physical properties
- Thermal performance (R-values)
- Attic installation
- Fire resistance
- Air permeability

2.0 USES

Icynene LD-C-50™ is used to provide thermal insulation in buildings and to seal areas such as plumbing and wiring penetrations against air infiltration, in Type III and Type V construction (IBC) and dwellings under the IRC. The Icynene Insulation System may be used in fire-resistance-rated construction when installed in accordance with Section 4.5.

3.0 DESCRIPTION

3.1 General:

Icynene LD-C-50™ is a low-density, open-cell, polyurethane foam plastic insulation and air barrier system that is 100 percent water-blown with an installed nominal density of 0.5 pcf (8 kg/m^3). Icynene LD-C-50 is a two-component, spray-applied product. The two components of the insulation are Base Seal®, a polyisocyanate, and Gold Seal®, a resin. Base Seal® must be stored at a temperature of 50°F (10°C) or greater, and has a shelf life of six months. Gold Seal® must be stored at temperatures below 100°F (37.8°C), and has a shelf life of six months.

3.2 Surface Burning Characteristics:

When tested in accordance with ASTM E 84, at a thickness of 5.5 inches (140 mm) and a nominal density of 0.5 pcf (8 kg/m^3), Icynene LD-C-50 has a flame spread index of 25 or less and a smoke-developed index of 450 or less. Thicknesses of up to 7$^1/_2$ inches (190.5 mm) for wall cavities and 11$^1/_2$ inches (292 mm) for ceiling cavities are recognized based on room corner fire testing in accordance with NFPA 286, when covered with minimum $^1/_2$-inch-thick (13 mm) gypsum board or an equivalent thermal barrier complying with, the applicable code.

3.3 Thermal Resistance:

Icynene LD-C-50 has thermal resistance (R-values) at a mean temperature of 75°F (24°C) as shown in Table 1.

3.4 Air Permeability:

Based on testing in accordance with ASTM E 283, Icynene LD-C-50, at a minimum thickness of 3.5 inches (89 mm), is considered air-impermeable.

3.5 Intumescent Coatings:

3.5.1 CAMAX2/ShelterShield Intumescent Coating: CAMAX2/ShelterShield intumescent coating, supplied by Icynene, is a water-based coating supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has a shelf life of six months when stored in a factory-sealed container at temperatures of 60°F (16°C) or above.

3.5.2 No Burn Plus XD: No Burn Plus XD intumescent coating is a latex-based coating supplied in 1-gallon (4L) and 5-gallon (19L) pails and 55-gallon (208 L) drums. The coating material has a shelf life of 12 months when stored in factory-sealed containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

3.5.3 ALDOCOAT 800: ALDOCOAT 800 intumescent coating is a water-based latex coating supplied in 5-gallon (18.9 L) pails. The coating material has a shelf life of six months when stored in factory-sealed containers at temperatures between 40°F (4.4°C) and 90°F (32.2°C).

4.0 DESIGN AND INSTALLATION

4.1 General:

The manufacturer's published installation instructions and this report must be strictly adhered to and a copy of these instructions and this evaluation report must be available on the jobsite at all times during installation.

4.2 Application:

Icynene LD-C-50 must be applied using spray equipment specified by Icynene, Inc. Icynene LD-C-50 must not be used in areas which have a maximum service temperature greater than 180°F (82°C). The foam plastic must not be used in electrical outlet or junction boxes or in contact with rain or water, and must be protected from the weather during and after application. Where Icynene LD-C-50 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 3.5 inches (89 mm). Icynene LD-C-50 can be installed in one pass to the maximum thickness. Where multiple passes are required, the cure time between passes is negligible. Icynene LD-C-50 must only be installed by licensed dealers, certified by Icynene, Inc., to install Icynene LD-C-50.

4.3 Thermal Barrier:

Icynene LD-C-50 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 the applicable code. 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 foam and the interior of the building. Thicknesses of up to $7^1/_2$ inches (190.5 mm) for wall cavities and $11^1/_2$ inches (292 mm) for ceiling cavities are recognized based on room corner fire testing in accordance with NFPA 286, when covered with minimum $^1/_2$-inch-thick (13 mm) gypsum board or equivalent thermal barrier complying with, the applicable code.

4.4 Attics:

4.4.1 Application with a Prescriptive Ignition Barrier: When Icynene LD-C-50 is installed within attics where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 and 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. Icynene LD-C-50 may be installed in unvented attics in accordance with IRC Section R806.4.

4.4.2 Application without a Prescriptive Ignition Barrier: Where Icynene LD-C-50 is installed in an attic without a prescriptive ignition barrier, in accordance with Sections 4.4.2.1 and 4.4.2.2, the following conditions apply:

1. Entry to the attic is only for the service of utilities and no storage is permitted.
2. There are no interconnected attic or basement areas.
3. Air in the attic is not circulated to other parts of the building.
4. Combustion air is provided in accordance with IMC Section 701.
5. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, or as required, except when air-impermeable insulation is permitted in unvented attics in accordance with Section R806.4 of IRC.

4.4.2.1 Assembly No. 1: Icynene LD-C-50 insulation may be spray-applied to the underside of the roof sheathing and/or rafters, as described in this section. The thickness of the foam plastic applied to the underside of the roof sheathing must not exceed 14 inches (356 mm). The thickness of the spray foam insulation applied to vertical wall surfaces must not exceed $5^1/_2$ inches (140 mm). The foam plastic must be covered on the vertical surfaces with one of the coatings described in Section 3.5. The coating must be applied over the Icynene LD-C-50 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. The coatings must be applied to a thickness as follows:

- CAMAX 2/ShelterShield at a minimum wet film thickness of 12 mils
- No Burn Plus XD at a minimum wet film thickness of 14 mils
- Aldocoat 800 at a minimum wet film thickness of 16 mils

The coating must be applied when ambient and substrate temperature is at least 60°F (16°C) and no more than 95°F (35°C). All other surfaces (including glass) must be protected against damage from the coating. Icynene LD-C-50 insulation may be installed in unvented attics when the foam plastic is applied at a minimum thickness of 3.5 inches (89 mm) as described in this section in accordance with IRC Section R806.4.

4.4.2.2 Assembly No. 2: Icynene LD-C-50 insulation may be spray-applied to the underside of the roof sheathing and/or rafters, as described in this section. The thickness of the foam plastic applied to the underside of the roof sheathing must not exceed 14 inches (356 mm). The thickness of the spray foam insulation applied to vertical wall surfaces must not exceed $3^1/_2$ inches (88.9 mm). The foam plastic is not required to be coated.

4.4.3 Use on Attic Floors: Icynene LD-C-50 insulation may be installed at a maximum thickness of $5^1/_2$ inches (152 mm) between joists in attic floors when covered with one of the coatings applied as described in Section 4.4.2.1. The insulation may be installed at a maximum thickness of $3^1/_2$ inches (88.9 mm) without a covering. The Icynene LD-C-50 insulation must be separated from the interior of the building by an approved thermal barrier.

4.5 One-hour Fire-resistance-rated Assemblies:

4.5.1 Assembly 1 (Limited Load-bearing Wood Stud Wall): Minimum nominally 2-by-4 [$1^1/_2$ by $3^1/_2$ inches (38 mm by 89 mm)] southern pine (G = 0.55), No. 2 grade studs spaced 16 inches (406 mm) on center with a base layer of $^1/_2$-inch-thick (12.7 mm) wood fiber sound board installed horizontally on each face with vertical joints located over the studs, attached with 6d box nails, 2 inches (51 mm) long and spaced 24 inches (610 mm) on center along the studs, and a second layer of $^5/_8$-inch-thick (15.9 mm) Type X gypsum wallboard installed vertically on each face, attached with 8d box nails, $2^1/_2$ inches (64 mm) long and spaced 7 inches (178 mm) on center along the studs. The stud cavity contains Icynene insulation nominally 2 inches (51 mm) thick.

Axial loads applied to the wall assembly must be limited to the least of the following:

- 1,805 pounds (8029 N) per stud.
- Design stress of 0.78 F'_c.
- Design stress of 0.78 F'_c at a maximum l_e/d of 33.

4.5.2 Assembly 2 (Limited Load-bearing Wood Stud Wall): Minimum nominally 2-by-4 [$1^1/_2$ by $3^1/_2$ inches (38 mm by 89 mm)] southern pine (G = 0.55), No. 2 grade studs spaced 16 inches (406 mm) on center with two layers of $^1/_2$-inch-thick (12.7 mm) Type X gypsum wallboard installed vertically with joints staggered on each face, attached with 8d box nails, $2^1/_2$ inches (64 mm) long and spaced 7 inches (178 mm) on center along the studs for the face layer and 6d cement coated box nails, 2 inches (51 mm) long and spaced 24 inches (610 mm) on center along the studs. The stud cavity contains Icynene insulation nominally 2 inches (51 mm) thick.

Axial loads applied to the wall assembly must be limited to the least of the following:

- 1,805 pounds (8029 N) per stud.
- Design stress of 0.78 *F′*c.
- Design stress of 0.78 *F′*c at a maximum l_e/d of 33.

4.5.3 Assembly 3 (Floor/Ceiling): Minimum nominally 2-by-10 [$1^1/_2$ by $9^1/_4$ inches (38 mm by 235 mm)] Douglas fir, No. 2 grade wood joists spaced 24 inches (610 mm) on center, with minimum 1-by-3 [$^3/_4$ by $2^1/_2$ inches (19.1 by 64 mm)] spruce bridging at mid-span. Floor decking must be minimum $^1/_2$-inch-thick (12.7 mm) exterior grade plywood installed perpendicular to joists and fastened with 2-inch-long (51 mm) ring shank nails 6 inches (152 mm) on center at the joints and 12 inches (305 mm) on center at the intermediate joists. Plywood joints must occur over joists. Icynene insulation must be applied to the underside of the plywood deck between the joists to a depth of 5 inches (127 mm). Two layers of minimum $^5/_8$-inch-thick (15.9 mm), Type X gypsum wallboard must be attached perpendicular to the joists on the ceiling side of the assembly. The first layer must be attached with $1^1/_4$-inch-long (32 mm), Type W drywall screws, spaced 24 inches (610 mm) on center. The second layer must be applied perpendicular to the joists, offset 24 inches (610 mm) from the base layer. The second layer must be attached with 2-inch-long (51 mm), Type S drywall screws spaced 12 inches (305 mm) on center. Additional fasteners must be installed along the butt joints of the second layer, securing the two layers together. These fasteners must be $1^1/_2$-inch-long (38 mm), Type G drywall screws placed 2 inches (51 mm) back from each end of the butt joint and spaced 12 inches (305 mm) on center. The wallboard joints on the exposed side must be treated with paper tape embedded in joint compound and topped with an added coat of compound, and the fastener heads must be coated with joint compound in accordance with ASTM C 840 or GA-216.

5.0 CONDITIONS OF USE

The Icynene LD-C-50 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 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.

5.2 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.

5.3 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.

5.4 The insulation must not exceed the thickness 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 certified by Icynene, Inc.

5.7 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with IRC Section R318.4 or IBC Section 2603.8, 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 A vapor retarder must be installed in accordance with the applicable code.

5.10 Icynene LD-C-50 is manufactured in Mississauga, Ontario, Canada, under a quality control program with inspections by Intertek Testing Services (AA-691).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC377), dated November 2009, Including reports of tests in accordance with Section A1.2.2 of AC377 (Sections 4.4.2.2 and 4.4.2.3).

6.2 Test report on air leakage rate in accordance with ASTM E 283.

6.3 Reports of room corner fire testing in accordance with NFPA 286.

6.4 Test reports in accordance with ASTM E 119.

7.0 IDENTIFICATION

All packages and containers of Icynene LD-C-50 must be labeled with the Icynene, Inc., name and address; the product name; the flame spread index and the smoke-developed index; the shelf life expiration date; the label of the inspection agency (Intertek Testing Services); and the evaluation report number (ESR-1826).

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

8.0 OTHER CODES

8.1 Scope:

The products recognized 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)

8.2 Uses:

See Section 2.0.

8.3 Description:

See Section 3.0.

8.4 Installation:

8.4.1 General: See Section 4.1.

8.4.2 Application: See Section 4.2.

8.4.3 Thermal Barrier: Icynene LD-C-50 must be separated from the interior of the building by an approved thermal barrier, such as 0.5-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, except where installation is within an attic or crawl space as described in Section 8.4.4.

8.4.4 Attics and Crawl Spaces:

8.4.4.1 Application with a Prescriptive Ignition Barrier: When Icynene LD-C-50 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 2006 IBC Section 2603.4.1.6, 2006 IRC Sections R314.5.3 and R314.5.4, 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.

8.4.4.2 Application without a Prescriptive Ignition Barrier: See Section 4.4.2.

8.4.5 One-hour Fire-resistance-rated Assemblies: See Section 4.5.

8.5 Conditions of Use:

The Icynene LD-C-50 described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 8.1 of this report, subject to Conditions of Use 5.1 through 5.6 and 5.8 through 5.10.

8.6 Evidence Submitted:

See Section 6.0.

8.7 Identification:

See Section 7.0.

TABLE 1—THERMAL RESISTANCE (*R*-VALUES)

THICKNESS (inches)	*R*-VALUE (°F·ft^2·h/Btu)
ASTM C 518 Tested Values	
1	3.7
3.5	13
Calculated *R*-Values[1]	
2	7
3	11
4	14
5	18
5.5	20
6	22
7	25
7.5	27
8	29
9	32
9.5	34
10	36
11.5	41
14	50

For **SI:** 1 inch = 25.4 mm, 1°F·ft^2·h/Btu = 0.176 110°K·m^2/W.

[1]Calculated *R*-values are based on tested *K* values at a 3.5-inch thickness.