ICC-ES Evaluation Report

ESR-1826

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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:

- 2006 *International Building Code®* (IBC)
- 2006 *International Residential Code®* (IRC)
- 2006 *International Energy Conservation Code®* (IECC)
- Other Codes (see Section 8.0)

Properties evaluated:

- Surface burning characteristics
- Physical properties
- Thermal performance (R-values)
- Attic and crawl space 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.

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 is considered air-impermeable.

3.5 Intumescent Coatings:

3.5.1 FireFree 88: FireFree 88 is a water-based intumescent coating manufactured by International Fire Resistant Systems, Inc. FireFree 88 is supplied in 5-gallon (19 L) buckets and has a shelf life of one year when stored in a factory-sealed container at temperatures between 35°F (1.7°C) and 85°F (29°C).

3.5.2 SafeCoat Latex: SafeCoat Latex Fire Retardant Coating is a latex-based intumescent coating manufactured by Magna Coatings Technology Inc. SafeCoat Latex is supplied in 1-gallon (3.8 L), 5-gallon (19 L) and 50-gallon (189 L) quantities and has a shelf life of 24 months when stored in a factory-sealed container at temperatures above 50°F (10°C).

3.5.3 Aldocoat 757: Aldocoat 757 intumescent ignition barrier coating is a water-based acrylic coating manufactured by Aldo Products Company, Inc. Aldocoat 757 is 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 between 40°F (4.5°C) and 90°F (32°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.

4.4 Attics and Crawl Spaces:

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 IBC Section 2603.4.1.6 and 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. 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 or crawl space without a prescriptive ignition barrier, in accordance with Sections 4.4.2.1 through 4.4.2.5, the following conditions apply:

1. Entry to the attic or crawl space is only for the service of utilities.
2. There are no interconnected attic or basement 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 Section 701.4.2 of the *International Mechanical Code*®.

4.4.2.1 Assembly No. 1: Icynene LD-C-50 is applied to the underside of the solid roof sheathing between rafters in attics and to the underside of the floor deck between floor joists over crawl spaces, to a maximum thickness of 10 inches (254 mm). The insulation is not installed on vertical surfaces. See Figure 1.

4.4.2.2 Assembly No. 2: Icynene LD-C-50 is applied to the underside of the roof deck between rafters in attics, and to the underside of the floor deck between floor joists over crawl spaces, to a maximum thickness of 10 inches (254 mm), and to vertical wall surfaces to a maximum thickness of $3^1/_2$ inches (89 mm). See Figure 1.

4.4.2.3 Assembly No. 3A: Icynene LD-C-50 is applied to the underside of the roof deck between rafters in attics, and to the underside of the floor deck between floor joists over crawl spaces, to a maximum thickness of 10 inches (254 mm); and to vertical wall surfaces to a maximum thickness of 6 inches (152 mm). The insulation on the vertical wall surfaces is covered with Aldocoat 757 or Safecoat Latex, described in Section 3.5, or a prescriptive ignition barrier as described in Section 4.4.1. The intumescent coatings must be installed in accordance with the coating manufacturers' published installation instructions. Aldocoat 757 coating must be spray-applied at a rate of 1 gallon per 100 ft^2 (0.00025 L/m^2). Safecoat Latex must be spray-applied at a rate of 1 gallon per 80 ft^2 (0.00031 L/m^2). See Figure 1.

4.4.2.4 Assembly No. 3B: Icynene LD-C-50 is applied to the underside of the roof deck between rafters in attics, and to the underside of the floor deck between floor joists over crawl spaces, to a maximum thickness of 10 inches (254 mm); and to vertical wall surfaces to a maximum thickness of 6 inches (152 mm). The insulation is covered with FireFree 88, described in Section 3.5. The intumescent coating must be installed in accordance with the coating manufacturer's published installation instructions. FireFree 88 coating must be applied at a rate of 1 gallon per 100 ft^2. See Figure 1.

4.4.2.5 Assembly No. 4: Icynene LD-C-50 is applied to the top of the ceiling, between joists in attic floors, to a maximum thickness of 6 inches (152 mm). See Figure 1.

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.

4.5.1.1 Axial Design: 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.

4.5.2.1 Axial Design: 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

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 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 Icynene LD-C-50 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 Icynene LD-C-50 must be separated from the interior of the building by an approved 15-minute thermal barrier. When installation is in attics and crawl spaces in accordance with Section 4.4, a thermal barrier is not required on the attic or crawl space face of the insulation.

5.4 Icynene LD-C-50 must not exceed the thickness and density noted in Section 3.2 of this report, except as permitted for attics and crawl spaces as described in Section 4.4.

5.5 Icynene LD-C-50 must be protected from the weather during and after application.

5.6 Icynene LD-C-50 must be applied by installers certified by Icynene, Inc.

5.7 Use of Icynene LD-C-50 in areas where the probability of termite infestation is "very heavy" must be in accordance with IRC Section R320.5 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 102.1.1 and 102.1.11, 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 May 2008.

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

6.3 Comparative crawl space tests and related analysis, to justify attic and crawl space assemblies.

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).

8.0 OTHER CODES

8.1 Scope:

The products recognized in this report have also been evaluated for compliance with the following codes:

- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 2003 *International Energy Conservation Code*® (2003 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 2003 IBC Section 2603.4.1.6, 2003 IRC Section R314.2.3, 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, 5.8, 5.10 and 5.12.

8.6 Evidence Submitted:

See Section 6.0.

8.7 Identification:

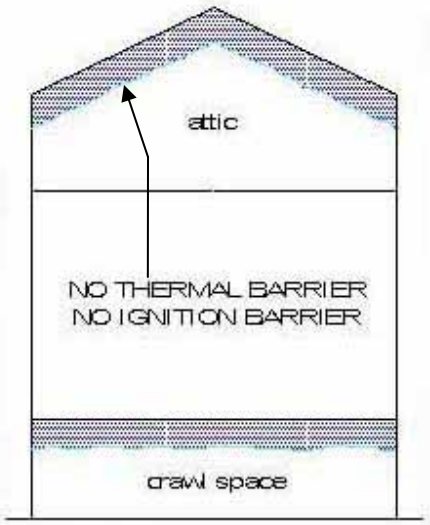
See Section 7.0.

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

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

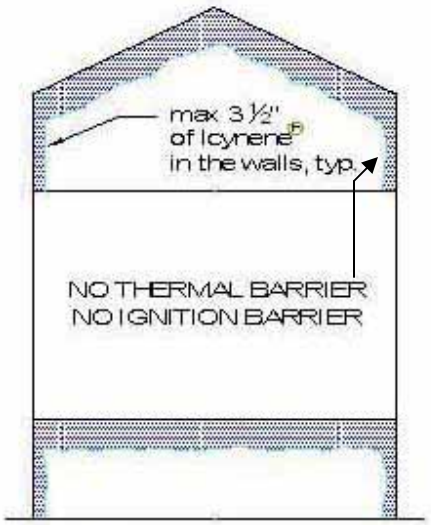
[1]Calculated *R*-values are based on tested *K* values at a 3.5-inch thickness.



Icynene® installed without a thermal or ignition barrier:

- under the roof sheathing.
- under the floor sheathing.
- no insulation on vertical walls.

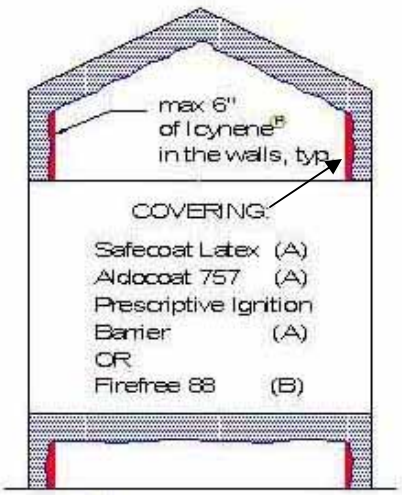
Assembly No. 1



Icynene® installed without a thermal or ignition barrier:

- under the roof sheathing.
- under the floor sheathing.
- on vertical walls.

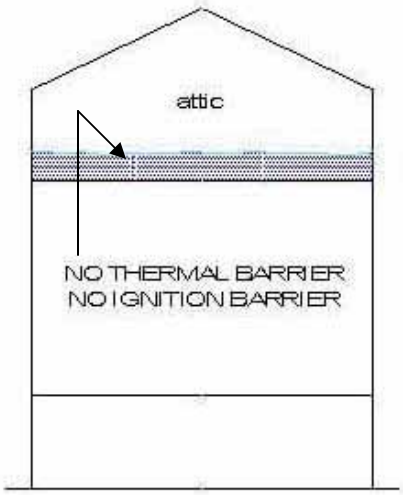
Assembly No. 2



Icynene® installed:
- under the roof sheathing.
- under the floor sheathing.
- on vertical walls.

(A) Only Icynene on the walls needs to be covered, or
(B) Firefree 88 needs to cover all foam surfaces.

Assembly No. 3



Icynene® installed without a thermal or ignition barrier:

- on the floor of the attic space.

Assembly No. 4

See Section 4.4.2 for general requirements

FIGURE 1—ATTIC AND CRAWL SPACE INSTALLATION WITHOUT A PRESCRIPTIVE IGNITION BARRIER