# ICC-ES Evaluation Report

**ESR-2715***

*Reissued February 1, 2012*
*This report is subject to renewal February 1, 2013.*

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

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

**REPORT HOLDER:**

**ICYNENE INC.**
**6747 CAMPOBELLO ROAD**
**MISSISSAUGA, ONTARIO L5N 2L7**
**CANADA**
**(905) 363-4040**
**(800) 758-7325**
**www.icynene.com**

**EVALUATION SUBJECT:**

**ICYNENE LD-R-50™ SPRAY-APPLIED POLYURETHANE 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
- Attic and crawl space installation
- Air permeability
- Fire resistance

## 2.0 USES

Icynene LD-R-50™ polyurethane spray foam plastic insulation is used as a thermal insulating material in Type V construction under the IBC and in dwellings under the IRC. The insulation is for use in wall cavities and floor assemblies or ceiling assemblies, and in attic and crawl space installations as described in Section 4.4. The insulation may be used in fire-resistance-rated construction when installed in accordance with Section 4.5. Under the IRC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.4.

## 3.0 DESCRIPTION

### 3.1 General:

The Icynene LD-R-50™ foam plastic insulation is two-component, open cell, spray-applied, foam plastic with a nominal density of 0.5 pcf (8.0 kg/m$^3$). The polyurethane foam is produced by combining a polymeric isocyanate (A component) and proprietary resin, LD-R-50 (B component). The products have a shelf life of six months when stored in factory-sealed containers at a temperature of 50°F (10°C) or greater.

### 3.2 Surface-burning Characteristics:

The insulation at a maximum thickness of 6 inches (152 mm) and a nominal density of 0.5 pcf (8.0 kg/m$^3$) has a flame-spread index of less than 25 and smoke–developed index of less than 450 when tested in accordance with ASTM E84 (UL 723).

### 3.3 Thermal Resistance (*R*-values):

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

### 3.4 Air Permeability:

Icynene LD-R-50™ foam plastic insulation, at a minimum thickness of $5^1/_2$ inches (140 mm), is considered air-impermeable insulation in accordance with 2009 IRC Sections R202 and R806.5, based on testing in accordance with ASTM E283.

### 3.5 Intumescent Coatings:

**3.5.1 FlameSeal TB™ Intumescent Coating:** FlameSeal TB™, manufactured by Flame Seal Products Inc., is a two-component, four-to-one-by-volume, liquid-applied, water-based polymer intumescent coating. The coating is supplied in 6-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 and 90°F (4.4°C and 32°C).

**3.5.2 DC 315 Intumescent Coating:** DC 315 intumescent coating is a water-based coating supplied in 5-gallon (19L) pails and 55-gallon (208L) drums. The coating material has a shelf life of 24 months when stored in factory-sealed containers at temperatures between 41°F (5°C) to 95°F (35°C).

**3.5.3 No Burn Plus XD Intumescent Coating:** No Burn Plus XD intumescent coating is a latex-based coating supplied in 1-gallon (4L) and 5-gallon (19L) pails and 55-gallon (208L) 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°C).

## 4.0 INSTALLATION

### 4.1 General:

Icynene LD-R-50™ polyurethane foam plastic insulation must be installed in accordance with the manufacturer's published installation instructions and this report. A copy of the manufacturer's published installation instructions must be available at all times on the jobsite during installation.

### 4.2 Application:

The insulation is spray-applied on the jobsite using a two-component, 1-to-1 ratio, high-pressure metering pump capable of operating at pressures up to 2000 psi (13800 kPa), as described in the Icynene user's manual. The insulation can be installed in one pass up to the maximum thicknesses specified in Sections 3.2, 4.4 and 4.5. The insulation may be used in areas where the maximum service temperature is no greater than 160°F (71°C). The foam plastic must not be sprayed onto a substrate that is wet, or covered with frost or ice, loose scales, rust, oil or grease. The insulation must be applied when the temperature is at or above 50°F (10°C) and be protected from the weather during and after application.

### 4.3 Thermal Barrier:

**4.3.1 Application with a Prescriptive Thermal Barrier:** Icynene LD-R-50™ polyurethane foam plastic insulation must be separated from the interior of the building by an approved thermal barrier of $^1/_2$-inch-thick (12.7 mm) gypsum wallboard 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.

### 4.4 Attics and Crawl Spaces:

**4.4.1 Application with a Prescriptive Ignition Barrier:** When Icynene LD-R-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 R316.5.5.3 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-R-50™ may be installed in unvented attics when the foam plastic is applied at a minimum thickness of 5.5 inches (140 mm) in accordance with 2012 IRC Section R806.5 or 2009 IRC Section R806.4, as applicable.

**4.4.2 Application without a Prescriptive Ignition Barrier:** Where Icynene LD-R-50™ insulation is installed in accordance with Sections 4.4.2.1, 4.4.2.2 and 4.4.2.3, the following conditions apply:

a. Entry to the attic or crawl space is to service 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 when 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 IMC (*International Mechanical Code*) Section 701.

**4.4.2.1 Attics and Crawl Spaces:** In attics and crawl spaces, Icynene LD-R-50 insulation may be spray-applied to the underside of the roof sheathing and/or rafters, the underside of wood floors, and vertical surfaces, as described in this section. The thickness of the foam plastic applied to the underside of the top of the space must not exceed $13^1/_2$ inches (343 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 all surfaces with one of the coatings described in Section 3.5. The coating must be applied over the Icynene LD-R-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 coating must be applied to a thickness as follows:

- No Burn Plus XD at a minimum wet film thickness of 10 mils
- DC 315 at a minimum wet film thickness of 8 mils
- FlameSeal TB at a minimum wet film thickness of 12 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-R-50 insulation may be installed in unvented attics when the foam plastic is applied at a minimum thickness of 5.5 inches (140 mm) as described in this section, in accordance with 2012 IRC Section R806.5 or 2009 IRC Section R806.4, as applicable.

**4.4.2.2 Crawl Spaces:** In crawl spaces, Icynene LD-R-50 insulation may be spray-applied to vertical walls and the underside of floors, as described in this section. The thickness of the foam plastic applied to the underside of the floors 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 does not require an ignition barrier or a coating.

**4.4.2.3 Use on Attic Floors:** Icynene LD-R-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 must be separated from the interior of the building by an approved thermal barrier.

### 4.5 One-hour Non-load-bearing Fire-resistance-rated Assembly:

Nominally 6-inch-deep (152 mm) deep, No. 18 gage, galvanized steel studs spaced 16 inches (406 mm) on center, are friction-fit into No. 18 gage galvanized steel floor and ceiling track with a layer of $^5/_8$-inch-thick (15.9 mm), Type X gypsum board installed to the interior side with the long edge parallel to steel studs and secured using No. 6, $1^1/_4$-inch-long (31.7 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, with a minimum 2-inch-wide (51 mm) paper, plastic, or fiberglass tape embedded in the first layer of compound over butt joints of the gypsum board. The stud cavity is filled with Icynene insulation up to 6 inches (152 mm) thick. DensGlass® Gold Exterior Sheathing, $^1/_2$ inch (12.7 mm) thick, is installed parallel to steel studs with vertical joints offset a minimum of 16 inches (406 mm) from the vertical joints of the 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 No. 6, $1^1/_4$-inch-long (31.7 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 $1^1/_2$ inches (38 mm) wide and spaced 16 inches (406 mm) on center vertically on each steel stud, are secured, using two $1^5/_8$-inch-long (41.3 mm) self-drilling screws, through 4-inch (102 mm) red clay brick [$3^1/_2$ inches (88.9 mm) by $2^1/_4$ inches (57.1 mm) by $7^3/_4$ inches (197 mm)] laid in a running bond pattern with Type S mortar. A nominally 1-inch (25.4 mm) air gap is left between the brick and the exterior sheathing.

Optional: It is permitted to add code-complying EPS, XPS, foil-faced, rigid polyurethane board stock or polyurethane spray foam on the exterior of the wall (between the DensGlass Gold sheathed wall and the brick), while maintaining the 1-inch (25.4 mm) air space. The length of the brick ties must be increased to account for the thickness of the insulation.

## 5.0 CONDITIONS OF USE

The Icynene LD-R-50™ foam plastic 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 system must be installed in accordance with the manufacturer's published installation instructions, this evaluation report and the applicable code. If there are any conflicts between the manufacturer's published 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 as described in Section 4.4.2.

**5.3** The insulation must not exceed the nominal density and thicknesses noted in Sections 3.2 and 4.4 and 4.5 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 contractors certified by Icynene.

**5.6** Use of insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 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 insulation is produced in Mississauga, Ontario, Canada, under a quality control program with inspections by Intertek Testing Services NA Ltd. (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 June 2011, including reports of tests in accordance with Appendix X (Section 4.4.2.1) and Appendix C (Section 4.4.2.2).

**6.2** Reports of air leakage testing in accordance with ASTM E283.

**6.3** Test report in accordance with ASTM E119.

**6.4** Reports of room corner fire tests in accordance with NFPA 286.

## 7.0 IDENTIFICATION

Containers of the Icynene LD-R-50™ foam plastic insulation components are identified with the manufacturer's name (Icynene Inc), address and telephone number; the product names (Icynene LD-R-50™ foam plastic insulation, Component A or Component B); use and application instructions; the density and the flame spread and smoke development indices; the thermal resistance (*R*-values); the evaluation report number (ESR-2715); and the name of the inspection agency (Intertek Testing Services NA Ltd).

Intumescent coatings are 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 recognized in this report have also been 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 Section 2.0 through 7.0 of this report, except as 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 attics must be vented in accordance with Section 1203.2 of the 2006 and 2003 IBC or Section R806 of the 2003 IRC, and crawl space ventilation must be in accordance with Section 1203.3 of the 2006 and 2003 IBC or Section R408 of the IRC, as applicable. Additionally, an ignition barrier must be installed in accordance with Section R314.5.3 or R314.5.4 of the 2006 IRC or Section R314.2.3 of the 2003 IRC, as applicable.
- **Application without a Prescriptive Ignition Barrier**: See Section 4.4.2, except attics must be vented in accordance with Section 1203.2 of the 2006 and 2003 IBC or Section R806 of the 2003 IRC, and crawl space ventilation must be in accordance ith Section 1203.3 of the 2006 and 2003 IBC or Section R408 of the IRC, as applicable. Combustion air must be provided in accordance with Sections 701 and 703 of the 2006 and 2003 International Mechanical Code®.
- **Protection against Termites**: See Section 5.6, except use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with Section R320.5 of the 2006 IRC or Section R320.4 of the 2003 IRC.
- **Jobsite Certification and Labeling**: See Section 5.7, except jobsite certification and labeling must comply with Sections 102.1.1 and 102.1.11, as applicable, of the 2006 IECC.

**TABLE 1—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 | 18 |
| 5.5 | 20 |
| 6 | 22 |
| 7 | 25 |
| 8 | 29 |
| 9 | 32 |
| 9.5 | 34 |
| 10 | 36 |
| 11.5 | 41 |
| 13.5 | 49 |
| 14 | 50 |

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

[1] *R*-values are calculated based on tested *K* values at 1- and 3.5-inch thicknesses.
[2] *R*-values greater than 10 are rounded to the nearest whole number.