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

REPORT HOLDER:
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EVALUATION SUBJECT:
ICYNENE LD-C-50™ (formerly known as The Icynene Insulation System®)

1.0 EVALUATION SCOPE
Compliance with the following codes:
- 2009 International Residential Code® (2009 IRC)
- 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-resistant 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 0.5pcf (8 kg/m³). 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 0.5pcf (8 kg/m³), 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. When installation is within a wall, the foam
plastic must be separated from the interior of the building.
Thicknesses of up to 7/12 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 meet 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
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 with one of the coatings described in Section 3.5.
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.

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 Fc.
- Design stress of 0.78 Fc at a maximum l/d of 33.
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 Residential Code® (2006 IRC)

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>
<thead>
<tr>
<th>TABLE 1—THERMAL RESISTANCE (R-VALUES)</th>
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<tr>
<td><strong>THICKNESS (inches)</strong></td>
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<td><strong>ASTM C 518 Tested Values</strong></td>
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For SI: 1 inch = 25.4 mm, 1°F·ft²·h/Btu = 0.176 110°K·m²/W.

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