

# ICC-ES Evaluation Report

## ESR-4501

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### DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

#### Section: 07 21 00—Thermal Insulation

#### REPORT HOLDER:

ICYNENE-LAPOLLA

#### EVALUATION SUBJECT:

FOAM-LOK™ FL2000-3G

### 1.0 EVALUATION SCOPE

#### 1.1 Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)
- 2018, 2015, 2012 and 2009 *International Energy Conservation Code*® (IECC)

#### Properties evaluated:

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

#### 1.2 Evaluation to the following green standard:

- 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2008)

#### Attributes verified:

- See Section 3.1

### 2.0 USES

Foam-LOK FL2000-3G 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 and the 2018 and 2015 IBC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.4, and as a vapor retarder when installed in

accordance with Section 3.5. Foam-LOK FL2000-3G 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. The insulation may be used as an alternative to the water-resistive barrier required in IBC Section 1404.2 and IRC Section R703.2 when installed as described in Section 4.7.

### 3.0 DESCRIPTION

#### 3.1 Foam-LOK FL2000-3G Insulation:

Foam-Lok FL2000-3G foam plastic insulation is a two-component, medium-density, closed-cell, spray-applied foam plastic with a nominal density of 2.4 pcf. The polyurethane foam is produced by combining Icnene Based Seal MDI isocyanate (the A component) and Icnene ProSeal resin (the B component). The product has a shelf life of 12 months when stored in factory-sealed containers at temperatures between 60°F and 85°F (16°C and 29°C).

The attributes of the insulation have been verified as conforming to the requirements of ICC 700-2008 Section 703.2.1.1.1(c) as an air impermeable insulation. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

#### 3.2 Surface Burning Characteristics:

The Foam-LOK FL2000-3G insulation, at a maximum thickness of 4 inches (102 mm) and a nominal density of 2.4 pcf, 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 (UL 723).

#### 3.3 Thermal Resistance:

Foam-LOK FL2000-3G insulation has a thermal resistance, *R*-value, at a mean temperature of 75°F (24°C) as shown in Table 1.

#### 3.4 Air Permeability:

Foam-LOK FL2000-3G insulation, at a minimum 1.4-inch (35.6 mm) thickness, is considered air-impermeable insulation in accordance with 2018 IBC Section 1202. (2015 IBC Section 1203.3) and 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4), based on testing in accordance with ASTM E2178.

#### 3.5 Vapor Permeability:

Foam-LOK FL2000-3G insulation has a vapor permeance of less than 1 perm (5.7x10<sup>-11</sup> kg/Pa-s-m<sup>2</sup>) at a minimum

thickness of 1.5 inches (38.1 mm) and may be used where a Class II vapor retarder is required by the applicable code.

### 3.6 Coatings:

**3.6.1 DC 315:** DC 315 Coating ([ESR-3702](#)), manufactured by International Fireproof Technology, Inc. / Paint to Protect Inc., is a water-based coating supplied in 5-gallon (19 L) 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 50°F (10°C) and 80°F (27°C).

## 4.0 DESIGN AND INSTALLATION

### 4.1 General:

Foam-LOK FL2000-3G must be installed in accordance with the manufacturer's published installation instructions, this report and the applicable code. The manufacturer's published 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:

Foam-Lok FL2000-3G must be applied using spray equipment specified by Icynene-Lapolla. The insulation must not be used in areas having a maximum service temperature greater than 180°F (82°C), 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 Foam-Lok FL2000-3G is used as an air-impermeable barrier, such as in unventilated attic spaces regulated by 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4) or 2018 IBC Section 1202.3 (2015 IBC Section 1203.3), the insulation must be installed at a minimum thickness of 1.4 inches (35.6 mm). The insulation is applied to the intended thickness, with the first pass being at the maximum thickness set forth in the manufacturer's published installation instructions. Where multiple passes are required, the cure time between each pass is in accordance with the manufacturer's instructions.

### 4.3 Thermal Barrier:

**4.3.1 Application with a Prescriptive Thermal Barrier:** Foam-Lok FL2000-3G spray foam insulation must be separated from the interior of the building by an approved thermal barrier. 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 Sections 4.4.2.1, 4.4.2.2 and 4.4.3.

**4.3.2 Application without a Prescriptive Thermal Barrier with DC 315 Coating:** Foam-Lok FL2000-3G may be installed without the approved thermal barrier prescribed in IBC Section 2603.4 and IRC Section R316.4, when the installation is in accordance with this section. The Foam-Lok FL2000-3G and the DC 315 Coating 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 the roof sheathing must not exceed 14 inches (356 mm). The thickness of the insulation applied to vertical wall 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 24 mils wet (0.61 mm) [16 mils dry (0.41 mm)] at an application rate of 1 gallon (3.8 L) per 66.8 square feet (6.15 M<sup>2</sup>). The coating must be

applied over the Foam-LOK FL2000-3G insulation in accordance with the coating manufacturer's instructions, [ESR-3702](#) 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 Foam-LOK FL2000-3G 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 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. Foam-Lok FL2000-3G insulation may be installed in unvented attics in accordance with 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) or 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4).

**4.4.2 Application without a Prescriptive Ignition Barrier:** Where Foam-LOK FL2000-3G is installed in an attic or crawl space 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 or crawl space is only for the service of utilities and no storage is permitted.
2. There are no interconnected attic, crawl space 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 IMC (*International Mechanical Code*<sup>®</sup>) Section 701.
5. Attic ventilation is provided when required by 2018 IBC Section 1202.2.1 (2015, 2012 and 2009 IBC Section 1203.2) or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) or 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4).
6. Under-floor (crawl space) ventilation is provided when required by 2018 IBC Section 1202.4 [2015 IBC Section 1203.4 (2012 and 2009 IBC Section 1203.3)] or IRC Section R408.1, as applicable.

**4.4.2.1 Attics and Crawl Spaces – Uncoated:** The thickness of the Foam-LOK FL2000-3G foam plastic applied to the underside of the roof sheathing and/or rafters, or the underside of floors, must not exceed 8 inches (203 mm). The thickness of the spray foam insulation applied to vertical wall surfaces must not exceed 6 inches (152 mm). The insulation does not require a code-prescribed ignition barrier or coating.

**4.4.2.2 Attic and Crawl Spaces – Coated:** The thickness of the Foam-LOK FL2000-3G foam plastic applied to the underside of the roof sheathing and/or rafters, or the underside of floors, must not exceed 14 inches (356 mm). The thickness of the spray foam insulation applied to vertical wall surfaces must not exceed 8 inches (203 mm).

The Foam-Lok FL2000-3G must be covered on all surfaces with DC 315 Coating at a minimum dry film thickness of 3 mils (0.08 mm) [wet film thickness of 4 mils (0.10 mm)] at a rate of 401 square feet (37 m<sup>2</sup>) per gallon (3.8 L).

The DC 315 Coating must be applied over the Foam-Lok FL2000-3G 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.

**4.4.3 Use on Attic Floors:** Foam-LOK FL2000-3G insulation may be installed exposed at a maximum thickness of 14 inches (356 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. An ignition barrier in accordance with the IBC Section 2603.4 and IRC Section R316.5.3 may be omitted.

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

**4.5.1 Exterior Face:** Nominally 6-inch-deep (152 mm), 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 1/2-inch-thick (12.7 mm) Georgia Pacific DensGlass® Gold Exterior Sheathing is installed parallel to the 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 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, are spaced 16 inches (406.4 mm) on center vertically on each steel stud, and secured using two 1 5/8-inch-long (41.3) self-drilling screws, through 4-inch (102 mm) red clay brick [3 1/2 inches (89 mm) by 2 1/4 inches (57 mm) by 7 3/4 inches (197 mm)], laid in a running bond pattern with Type S mortar, leaving a nominally 1-inch (25.4 mm) air gap between the brick and the exterior sheathing. The stud cavity is filled with Foam-LOK FL2000-3G to a maximum nominal thickness of 6 inches.

**4.5.2 Interior Face:** Type X gypsum board, 5/8 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 1 1/4-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 Foam-LOK FL2000-3G insulation must be installed at a maximum thickness as described in Table 2. The potential heat of Foam-LOK FL2000-3G insulation is 2288 Btu/ft<sup>2</sup> (25995 kJ/m<sup>2</sup>) per inch of thickness, when tested in accordance with NFPA 259.

**4.6.2 Specific Wall Assemblies:** Wall assemblies complying with Section 4.6 must be as described in Table 4.

#### **4.7 Water-resistive Barrier:**

Foam-Lok FL2000-3G insulation may be used as an alternative to the water-resistive barrier prescribed in IBC Section 1404.2 and IRC Section R703.2, when installed on

exterior walls as described in this section the insulation must be spray-applied to the exterior side of sheathing, masonry or other suitable exterior wall substrates to form a continuous layer of 1 inch (25.4 mm) minimum thickness. All construction joints and penetrations are to be completely sealed with Foam-Lok FL2000-3G.

## **5.0 CONDITIONS OF USE**

The Foam-LOK FL2000-3G spray foam 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 product must be installed in accordance with the manufacturer's published installation instructions, this evaluation report and the applicable code. In the event of a conflict 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 thermal barrier in accordance with IBC Section 2603.4, except when installation is as described in Section 4.3.2 or in attics and crawl spaces as described in Section 4.4.2.
- 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-Lapolla.
- 5.6** 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 2018, 2015 and 2012 IBC Section 2603.9 (2009 IBC Section 2603.8), as applicable.
- 5.7** Jobsite certification and labeling of the insulation must comply with 2018 or 2015 IRC Sections N1101.10.1 and N1101.10.1.1 (2012 IRC Sections N1101.12.1 and N1101.12.1.1 or 2009 IRC Sections N1101.4 and N1101.4.1) and 2018, 2015 and 2012 IECC Sections C303.1.1, C303.1.1.1, R303.1.1 and R303.1.1.1 (2009 IECC Sections 303.1.1 and 303.1.1.1), as applicable.
- 5.8** The A and B components of the insulation are produced under a quality-control program with inspections by ICC-ES.

## **6.0 EVIDENCE SUBMITTED**

- 6.1** Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation, (AC377), dated April 2016 (editorially revised April 2018), including reports of tests in accordance with Appendix X of AC377.
- 6.2** Report of air permeance test in accordance with ASTM E2178.
- 6.3** Report of vapor permeance test in accordance with ASTM E96.
- 6.4** Engineering analysis of a fire-resistance test in accordance with ASTM E119.
- 6.5** Engineering analysis of a fire test in accordance with NFPA 285.
- 6.6** Report of a room corner fire test in accordance with NFPA 286.
- 6.7** Report of a potential heat test in accordance with NFPA 259.

- 6.8 Report of a critical radiant flux test in accordance with ASTM E970.
- 6.9 Reports of tests in accordance with applicable sections of the ICC-ES Acceptance Criteria for Foam Plastic Sheathing Used as Water-resistive Barriers (AC71), dated February 2013 (editorially revised January 2018).

**7.0 IDENTIFICATION**

- 7.1 Containers of Foam-LOK FL2000-3 components are identified with a label bearing the Icynene-Lapolla, name and address; the product trade name [Foam-LOK FL2000-3G]; the lot number; the flame spread and smoke developed indices; mixing instructions; density; the shelf life and the expiration date; and the evaluation report number (ESR-4501).

The International Fireproof Technology Inc. / Paint To Protect, Inc., DC 315 intumescent coating is identified with the manufacturer's name, the product trade name and address, use date of manufacture, shelf life or expiration date, manufacturer's instructions and evaluation report number (ESR-3702).

- 7.2 The report holder's contact information is the following:

**ICYNENE-LAPOLLA**  
**15402 VANTAGE PARKWAY EAST, SUITE 322**  
**HOUSTON, TEXAS 77032**  
**(281) 219-4100**  
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[www.lapolla.com](http://www.lapolla.com)

**TABLE 1—THERMAL RESISTANCE (R-VALUES) FOAM-LOK FL2000-3G**

THICKNESS (inches)	R-VALUE (°F.ft².h/Btu)
1.0	7.1
3.5	24
4.0	28
5.5	38
6.0	42
7.5	52
8.5	59
9.5	66
10.0	69
11.25	78

For SI: 1 inch= 25.4 mm; 1°F.ft².h/Btu = 0.176110°K.m².h/W.

<sup>1</sup>R-values are calculated based on tested K-values at 1- and 3.5-inch thicknesses.

TABLE2—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES

WALL COMPONENT	MATERIALS
Base Wall System – Use either 1, 2 or 3	1 – Concrete wall. 2 – Concrete masonry wall. 3 – Minimum 3 <sup>5</sup> / <sub>8</sub> -inch-deep (92 mm), No. 20 gage, C-shaped steel studs, spaced a maximum of 24 inches on center with lateral bracing every 4 feet (1219 mm) as required by code. Sheathing shall be as described in Exterior Sheathing below.
Floorline Firestopping	Minimum 4 pcf mineral wool in each stud cavity at each floorline, attached with Z-clips. Thickness must match stud cavity depth.
Cavity Insulation – Use either 1, 2, 3, 4 or 5	1 – None. 2 – Partial cavity fill with a maximum air space of 2 inches (51 mm) or full cavity depth not exceeding 7 <sup>5</sup> / <sub>8</sub> inches (194 mm) of Foam-Lok FL450 (ESR-4242) or Foam-LOK FL2000-3G (ESR-4501). 3 – Any insulation qualified as noncombustible in accordance with ASTM E136. 4 – Glass fiber batt insulation <sup>a</sup> . 5 – Mineral fiber insulation <sup>a</sup> . <sup>a</sup> Insulation must comply with the applicable requirements of 2015 or 2012 IBC Section 720.2 (2009 IBC Section 719.2).
Exterior Sheathing – Only for Base Wall System No.3 – Use either 1 or 2	1 – Minimum 1/2-inch-thick (12.7 mm), glass mat gypsum sheathing complying with ASTM C1177. 2 – Sheathing shall be attached with No. 6, 1 1/4-inch-long (32 mm) self-tapping screws located 8 inches (203 mm) on center along the perimeter and 12 inches (302 mm) on center in the field of wallboard. Joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216.
Exterior Insulation	Maximum thickness of 5 1/2 inches (140 mm) Foam-LOK FL2000-3G (ESR-4501).
Exterior Wall Covering – Use either 1, 2, 3, 4, 5, 6 or 7	1 – Brick - standard nominally 4-inch-thick (102 mm) clay brick; brick veneer anchors – standard types installed a maximum of 24 inches OC vertically on each stud <sup>b</sup> . 2 – Stucco - minimum 3/4-inch-thick (19.1 mm), exterior cement plaster and lath with a secondary water-resistive barrier may be installed between the exterior insulation and the lath. 3 – Natural stone (limestone, granite, marble, sandstone), minimum 2-inch-thick (51 mm) <sup>c</sup> . 4 – Cast artificial stone, minimum 1 1/2-inch-thick (38 mm), complying with AC51 and subject of a current ICC-ES evaluation report <sup>c</sup> . 5 – Terracotta cladding, minimum of 1 1/4-inch-thick (32 mm) <sup>c</sup> . 6 – Precast concrete panels, minimum of 1 1/2-inch-thick (32 mm) <sup>c</sup> . 7 – Concrete masonry units (CMU), minimum of 1 1/2-inch-thick (38 mm) <sup>c</sup> . <sup>b</sup> The maximum air gap between exterior insulation and cladding shall be 2 inches (51 mm). <sup>c</sup> Any standard non-open-jointed installation technique such as shiplap, etc., may be used.