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# ICC-ES Report

## ESR-3647

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Reissued 09/2015  
This report is subject to renewal 09/2016.

**DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION**  
**SECTION: 07 21 00—THERMAL INSULATION**  
**SECTION: 07 25 00—WATER-RESISTIVE BARRIERS/WEATHER BARRIERS**

**REPORT HOLDER:**

**HENRY COMPANY, LLC**

**336 COLD STREAM ROAD  
KIMBERTON, PENNSYLVANIA 19442**

**EVALUATION SUBJECT:**

**PERMAX 2.0X & PERMAX 2.0X FAST CLOSED CELL SPRAY-APPLIED POLYURETHANE  
FOAM INSULATION**



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# ICC-ES Evaluation Report

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**DIVISION: 07 00 00—THERMAL AND MOISTURE  
PROTECTION**
**Section: 07 21 00—Thermal Insulation**
**Section: 07 25 00—Water-Resistive Barriers/Weather  
Barriers**
**REPORT HOLDER:**

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**EVALUATION SUBJECT:**
**PERMAX 2.0X AND PERMA 2.0X FAST CLOSED CELL  
SPRAY-APPLIED POLYURETHANE FOAM 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)
- 2013 *Abu Dhabi International Building Code* (ADIBC)<sup>†</sup>

<sup>†</sup>The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

- Other Codes (see Section 8)

**Properties evaluated:**

- Surface-burning characteristics
- Physical properties
- Thermal resistance
- Attic and crawl space installation
- Air permeability
- Vapor permeance
- Water-resistive barrier
- Exterior walls in Types I through IV construction

**2.0 USES**

Permax 2.0X and Permax 2.0X Fast Closed Cell spray foam insulations are used as thermal insulating material in Type I, II, III, IV and V construction under the IBC and dwellings under the IRC. See Section 4.6 for use in Type I, II, III and IV construction. The insulations are for use in wall

cavities, floor assemblies or ceiling assemblies, or attics and crawl spaces when installed in accordance with Section 4.0. When installed in accordance with Section 4.5, the insulations may be used as an alternative to water-resistive barriers required in IBC Section 1404.2 and IRC Section R703.2.

**3.0 DESCRIPTION**
**3.1 Permax 2.0X and Permax 2.0X FastClosed Cell  
Foam Plastic Insulation:**

Permax 2.0X and Permax 2.0X Fast Closed Cell spray-applied polyurethane foam insulations are medium-density polyurethane foam plastics intended to be installed as a component of floor/ceiling and wall assemblies. The material is a two-component, closed cell, one-to-one-by-volume spray foam insulation with a nominal density of 1.9 pcf. The insulation is produced in the field by combining a polymeric isocyanate (A component) with a polymeric resin blend (B component). The insulation liquid components have a shelf life of six months, are supplied in nominally 55-gallon (208 L) drums and must be stored at temperatures between 70°F (21°C) and 80°F (27°C) a minimum of 48 hours prior to use.

**3.2 Surface-burning Characteristics:**

Permax 2.0X and Permax 2.0X Fast at a maximum thickness of 4 inches (102 mm) and a nominal density of 1.9 pcf have a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84. Thicknesses of up to 8 inches (203 mm) for wall cavities and 12 inches (305 mm) for ceiling cavities are recognized based on room corner fire testing in accordance with NFPA 286, when covered with a minimum 1/2-inch-thick (13 mm) gypsum board or an equivalent thermal barrier complying with, and installed in accordance with, the applicable code.

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

The insulations have thermal resistances (*R*-values) at a mean temperature of 75°F (24°C) as shown in Table 1.

**3.4 Vapor Permeance:**

The foam plastics have a vapor permeance of less than 1 perm ( $5.7 \times 10^{-11}$  kg/Pa-s-m<sup>2</sup>) when applied at a minimum thickness of 1 inch (25.4 mm) and may be used where a Class II vapor retarder is required by the applicable code.

**3.5 Air Permeability:**

Permax 2.0X and Permax 2.0X Fast Closed Cell spray-applied foam insulation is air-impermeable in accordance with Section R806.4 of the IRC, at a minimum thickness of

$\frac{3}{4}$ -inches (19.1 mm), based on testing in accordance with ASTM E283.

### 3.6 Flame Seal® TB Intumescent Coating:

Flame Seal® 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 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 and 90°F (4°C and 32°C).

### 3.7 TPR<sup>2</sup> Fireshell® BMS-TC Intumescent Coating:

TPR<sup>2</sup> Fireshell® BMS-TC intumescent coating, manufactured by TPR<sup>2</sup> Corporation, is a one-component, water-based polymer coating. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has a shelf life of one year when stored in factory-sealed containers at temperatures of 50°F (10°C) and above.

### 3.8 Paint to Protect® DC-315 Intumescent Coating:

Paint to Protect® DC-315 intumescent coating, manufactured by International Fireproof Technology, Inc., is a one-component, water-based coating. The coating is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums and has a shelf life of two years when stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (27°C).

## 4.0 INSTALLATION

### 4.1 General:

Permax 2.0X and Permax 2.0X Fast Closed Cell spray foam insulations must be installed in accordance with the report holder's published installation instructions and this report. A copy of the report holder'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 volumetric positive displacement pumps as identified in the Henry Company's application instructions. The maximum service temperature must not exceed that specified in the report holder's published installation instructions. The foam plastic must not be used in electrical outlet or junction boxes or in contact with water. 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 may be applied at a maximum thickness of 2 inches (51 mm) per pass up to the maximum total thickness as specified in Sections 3.2, 4.3 and 4.4. Additional passes may be applied after ten minutes or more of curing time.

### 4.3 Thermal Barrier:

**4.3.1 Application with a Prescriptive Thermal Barrier:** Permax 2.0X and Permax 2.0X Fast Closed Cell spray foam insulation must be separated from the interior of the building by an approved thermal barrier of  $\frac{1}{2}$ -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. Thicknesses of up to 8 inches (203 mm) for wall cavities and 12 inches (305 mm) for ceiling cavities are recognized, based on room corner fire testing in accordance with NFPA 286.

**4.3.2 Application without a Prescriptive Thermal Barrier:**

**4.3.2.1 Application with Flame Seal® TB Intumescent Coating:** The prescribed 15-minute thermal barrier may be

omitted when installation is in accordance with this section. The Permax Closed Cell insulation and Flame Seal® TB system may be used in lieu of the prescribed 15-minute thermal barrier. The foam plastic insulation thickness must not exceed 6 inches (152 mm) in walls and ceilings, and the insulation must be covered with 18 dry mils (0.46 mm) of Flame Seal® TB intumescent coating applied at a minimum rate of 1.6 gallons (6 L) per 100 square feet (9.3 m<sup>2</sup>). The substrate must be dry, clean and free of dirt and loose debris or other substances that could interfere with the adhesion of the coating. Flame Seal® TB may be applied by airless sprayer at ambient temperatures between 50°F and 115°F (10°C and 46°C) and relative humidity of less than 70 percent.

### 4.3.2.2 Application with TPR<sup>2</sup> Fireshell® BMS-TC Intumescent Coating:

The prescribed 15-minute thermal barrier may be omitted when installation is in accordance with this section. The Permax Closed Cell insulation and TPR<sup>2</sup> Fireshell® BMS-TC intumescent coating system may be used in lieu of the prescribed 15-minute thermal barrier. The foam plastic insulation thickness must not exceed  $7\frac{1}{4}$  inches (184 mm) in walls and  $9\frac{1}{4}$  inches (235 mm) in ceilings, and the insulation must be covered with 12 dry mils (0.30 mm) [20 wet mils (0.51 mm)], at a minimum rate of 1.24 gallons (4.7 L) per 100 square feet (9.3 m<sup>2</sup>). The substrate must be dry, clean and free of dirt and loose debris or other substances that could interfere with the adhesion of the coating. TPR<sup>2</sup> Fireshell® BMS-TC intumescent coating may be applied by airless sprayer, conventional spray, medium knap roller or brush at ambient temperatures between 62°F and 95°F (16°C and 35°C) and relative humidity of less than 70 percent.

### 4.3.2.3 Application with Paint to Protect® DC-315 Intumescent Coating:

The prescribed 15-minute thermal barrier may be omitted when installation is in accordance with this section. The Permax Closed Cell insulation and Paint to Protect® DC-315 intumescent coating system may be used in lieu of the prescribed 15-minute thermal barrier. The foam plastic insulation thickness must not exceed  $7\frac{1}{4}$  inches (184 mm) in walls and in ceilings and the insulation must be covered with 12 dry mils [18 wet mils (0.45 mm)], at a minimum rate of 1.12 gallons (4.23 L) per 100 square feet (9.3 m<sup>2</sup>). The substrate must be dry, clean and free of dirt and loose debris or other substances that could interfere with the adhesion of the coating. Paint to Protect® DC-315 intumescent coating may be applied by airless sprayer at ambient temperatures between 50°F and 105°F (10°C and 41°C) and relative humidity of less than 80 percent.

**4.3.2.4 Use as Interior Finish:** The Permax 2.0X and Permax 2.0X FastClosed Cell spray-applied polyurethane foam insulation and intumescent coating systems, as described in Section 4.3.2.1, 4.3.2.2 or 4.3.2.3 may be used as an interior finish in all construction types under the IBC and dwellings under the IRC.

## 4.4 Attics and Crawl Spaces:

### 4.4.1 Application with a Prescriptive Ignition Barrier:

When Permax Closed Cell 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 the foam plastic insulation is not exposed. The insulation as described in this section may be installed in unvented attics in accordance with 2012 IRC Section R806.5 or the 2009 IRC Section R806.4.

#### 4.4.2 Application without a Prescriptive Ignition Barrier:

**4.4.2.1 General:** Where Permax Closed Cell insulation is installed without a prescriptive ignition barrier as described in Section 4.4.2.2, 4.4.2.3, 4.4.3.1 or 4.4.3.2, in attics and crawl spaces, the following conditions apply:

- Entry to the attic or crawl space is only to service utilities and no storage is permitted.
- There are no interconnected attic or crawl space areas.
- Air in the attic or crawl space is not circulated to other parts of the building.
- Under-floor (crawl space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.
- 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 Section R806.5 or 2009 IRC Section R806.4.
- Combustion air must be provided in accordance with Section 701 of the 2009 *International Mechanical Code*® (IMC).

**4.4.2.2 Application of Permax 2.0X and Permax 2.0X FastClosed Cell Insulation without Intumescent Coating:** Permax 2.0X or Permax 2.0X Fast Closed Cell insulation may be spray-applied to the underside of roof sheathing and/or rafters and the underside of wood floors and/or floor joists in crawl spaces as described in this section. The thickness of the foam plastic applied to the underside of the wood floor or roof sheathing must not exceed 1 1/4 inches (286 mm).

The thickness of the foam plastic insulation applied to vertical surfaces in attics and crawl spaces must not exceed 7/4 inches (184 mm). Permax 2.0X or Permax 2.0X Fast Closed Cell insulation, as described in this section, may be installed in unvented attics in accordance with 2012 IRC Section R806.5 or 2009 IRC Section R806.4.

When Permax 2.0X or Permax 2.0X FastClosed Cell insulation is installed in accordance with this section, the ignition barrier in accordance with IBC Section 2603.4 and IRC Section R316.5.3 may be omitted.

#### 4.4.3 Attic Floors:

**4.4.3.1 Use of Permax 2.0X or Permax 2.0X Fast Closed Cell Insulation on Attic Floors without Intumescent Coating:** Permax 2.0X or Permax 2.0X FastClosed Cell insulation may be installed exposed at a maximum thickness of 7/4 inches (184 mm) between and over joists in attic floors without a code-prescribed ignition barrier or intumescent coating. The insulation must be separated from the interior of the building by an approved thermal barrier. The ignition barrier in accordance with IBC Section 2603.4.1.6 and IRC Section R316.5.3 may be omitted.

#### 4.5 Water-resistive Barrier:

Permax 2.0X or Permax 2.0X FastClosed Cell spray-applied polyurethane foam insulation may be used as 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 the 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 Permax 2.0X or Permax 2.0X Fast Closed Cell insulation. Optionally, self-adhering flexible flashing materials complying with ICC-ES Acceptance Criteria for Flexible Flashing (AC148), dated February 2011, may be installed around penetrations and openings prior to application of the Permax 2.0X or Permax 2.0X Fast Closed Cell spray-applied insulation.

#### 4.6 Exterior Walls in Types I, II, III and IV Construction:

When used on walls of Type I, II, III and IV construction, the assembly in which the Permax 2.0X or Permax 2.0X FastClosed Cell spray-applied polyurethane insulation is used must comply with Section 2603.5 of the IBC and must be installed at a maximum thickness of 3.25 inches (82.6 mm) in accordance with the manufacturer's published installation instructions and this report. The potential heat of the Permax 2.0X and Permax 2.0X FastClosed Cell spray-applied polyurethane insulation is 1838 Btu/ft<sup>2</sup> (20.9 MJ/m<sup>2</sup>) per inch of thickness when tested in accordance with NFPA 259. Wall assemblies complying with this section must be as described in Table 2.

#### 5.0 CONDITIONS OF USE

The Permax 2.0X and Permax 2.0X Fast Closed Cell spray-applied foam plastic insulations described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The products must be installed in accordance with the report holder's published installation instructions, this evaluation report and the applicable code. The instructions within this report govern if there are any conflicts between the report holder's published installation instructions and this report.
- 5.2 The insulation must be separated from the interior of the building by an approved 15-minute thermal barrier, except when installation is as described in Sections 4.3.2 and 4.4.
- 5.3 The insulation must not exceed the thicknesses noted in Sections 3.2, 4.3 and 4.4 of this report.
- 5.4 The insulation must be protected from prolonged exposure to weather during application.
- 5.5 The insulation must be applied by contractors certified by Henry Company.
- 5.6 When use is on buildings of Types I, II, III and IV construction, construction must be as described in Section 4.6 and Table 2.
- 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 Use of the insulations in fire-resistance-rated construction is outside the scope of this report.
- 5.10 Permax 2.0X and Permax 2.0X FastClosed Cell spray-applied foam insulations 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 June 2012, including reports of tests in accordance with Appendix X.

- 6.2 Reports of room corner tests in accordance with NFPA 286 and UL 1715.
- 6.3 Report of potential heat of foam plastics tests in accordance with NFPA 259.
- 6.4 Report of air leakage tests in accordance with ASTM E283.
- 6.5 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water-resistive Barriers (AC71), dated February 2003 (editorially revised March 2011).
- 6.6 Report of water vapor transmission testing in accordance with ASTM E96.
- 6.7 Report of fire propagation characteristics testing in accordance with NFPA 285.
- 6.8 An engineering analysis supporting the report of testing in accordance with NFPA 285.

## 7.0 IDENTIFICATION

Components for Permax 2.0X and Permax 2.0X FastClosed Cell spray-applied foam plastic insulations are identified with the report holder's name (Henry Company), address and telephone number; the product name (Permax 2.0X or Permax 2.0X Fast); mixing instructions; the density; the flame-spread and smoke-development indices; and the evaluation report number (ESR-3647).

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

## 8.0 OTHER CODES

In addition to the codes referenced in Section 1.0, the products described in this report were evaluated for compliance with the requirements of the following codes:

- 2006 *International Building Code*<sup>®</sup> (2006 IBC)
- 2006 *International Residential Code*<sup>®</sup> (2006 IRC)
- 2006 *International Energy Conservation Code*<sup>®</sup> (2006 IECC)

- 2003 *International Building Code*<sup>®</sup> (2003 IBC)
- 2003 *International Residential Code*<sup>®</sup> (2003 IRC)
- 2003 *International Energy Conservation Code*<sup>®</sup> (2003 IECC)

The products comply with the above-mentioned codes as described in Sections 2.0 through 7.0 of this report, with the revisions 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 IBC Section 1203.3 of the 2006 and 2003 IBC or IRC Section R408, as applicable. Additionally, an ignition barrier must be installed in accordance with Sections 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 4.3.2, 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 with IBC Section 1203.3 of the 2006 and 2003 IBC or IRC Section R408, as applicable.
- **Protection against Termites:** See Section 5.7, 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 5.9, except jobsite certification and labeling must comply with Sections 102.1.1 and 102.1.1.1, as applicable, of the 2006 IECC.

**TABLE 1—THERMAL RESISTANCE (R-VALUES)<sup>1</sup>**

THICKNESS (inches)	R-VALUE (°F.ft <sup>2</sup> .h/Btu)
1	6.9
2	14
3	21
3.5	24
4	28
5	34
5.5	38
6	41
7	48
7.5	52
8	55
9	62
10	69
11	76
12	83

For **SI**: 1 inch = 25.5 mm; 1°F.ft<sup>2</sup>.h/Btu = 0.176 110°K.m<sup>2</sup>/W.

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

**TABLE 2—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 – 1 layer 5/8-inch-thick Type X gypsum wallboard complying with ASTM C36 or C1396 on the interior, installed over minimum 3 7/8-inch-deep, No. 20 gage, C-shaped steel studs, spaced a maximum of 24 inches on center with lateral bracing every 4 feet vertically. Gypsum wallboard must be attached with No. 6, 1 1/4-inch-long self-tapping screws located 8 inches on center along the perimeter and in the field of wallboard. Gypsum wallboard joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216
Floorline Firestopping	4 pcf mineral wool (e.g., Thermafiber) in each stud cavity at each floorline, attached with Z-clips
Cavity Insulation – Use either 1, 2 or 3	1 – None 2 – Fiberglass batt insulation (faced or unfaced) 3 – Permax 2.0X or Permax 2.0X Fast closed cell insulation
Exterior Sheathing – Use either 1 or 2	1 – 1/2-inch-thick, exterior-type gypsum sheathing 2 – 5/8-inch-thick, exterior-type gypsum sheathing
Exterior Insulation	Permax 2.0X or Permax 2.0X Fastclosed cell SPF, up to a maximum nominal thickness of 3 inches
Exterior Wall Covering – Use either 1, 2 or 3	1 – Brick - standard nominally 4-inch-thick clay brick; brick veneer anchors – standard types installed a maximum of 24 inches OC vertically on each stud – Maximum 2-inch air gap between exterior insulation and brick 2 – Stucco - minimum 3/4-inch-thick, exterior cement plaster and lath. A secondary water-resistive barrier may be installed between the exterior insulation and the lath. The secondary water-resistive barrier must not be full-coverage asphalt or butyl- based self-adhered membranes 3 – Minimum 2-inch-thick limestone. Any standard non-open-jointed installation technique such as ship-lap, etc., may be used

For **SI**: 1 inch = 25.4 mm; 1 pcf = 16.018 kg/m<sup>3</sup>.