



### BARNHARDT MANUFACTURING INC. DBA - NCFI POLYURETHANES

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### INSULSTAR®1.7 SPRAY POLYURETHANE FOAM INSULATION SYSTEM

#### CSI Section:

07 21 19 Foamed-in-Place Insulation

#### 1.0 RECOGNITION

InsulStar®1.7 Spray Polyurethane Foam Insulation System as described in this report has been evaluated for use as thermal insulation and for use in Type I through V construction. The physical properties, thermal resistance, surface burning characteristics, air permeability, water resistance, fire-resistance rating, attic and crawl space installations were evaluated for compliance with the following codes:

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

#### 2.0 LIMITATIONS

Use of the InsulStar®1.7 spray-applied polyurethane foam plastic insulation described in this report is subject to the following limitations:

**2.1** The insulation shall 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, the more restrictive shall govern.

**2.2** In accordance with Sections 4.7.2 and 4.7.3 of this report, the insulation shall be separated from the interior of the building by a code-complying thermal barrier or ignition barrier as appropriate.

**2.3** The insulation shall not exceed the nominal density and thickness for the installation conditions described in this report.

**2.4** The insulation shall be installed by professional spray polyurethane foam installers approved by NCFI Polyurethanes, or by the Spray Polyurethane Foam Alliance (SPFA).

**2.5** Use of the insulation in areas of “very heavy” termite infestation probability shall be in accordance with 2018 and 2015 IBC Section 2603.8, 2012 IBC Section 2603.9, or 2018, 2015 and 2012 IRC Section R318.4, as applicable.

**2.6** Labeling and jobsite certification of the insulation and coatings shall comply with the following code sections as applicable:

- 2018, 2015 or 2012 IBC Section 2603.2
- 2018, 2015 or 2012 IRC Section R316.2
- 2018, 2015 IRC Section N1101.10.1.1
- 2012 IRC Section N1101.12.1.1
- 2018, 2015 or 2012 IECC Sections C303.1.1.1 or R303.1.1.1

**2.7** InsulStar®1.7 is produced by NCFI Polyurethanes in Mount Airy, NC under a quality control program with inspections under the supervision of IAPMO UES.

#### 3.0 PRODUCT USE

InsulStar®1.7 is a non-structural, closed-cell, spray-applied, polyurethane foam plastic insulation complying with IBC Section 2603, IRC Section R316, 2018, 2015 and 2012 IECC Sections C303, C402, R303, and R402. When installed in accordance with Section 4.0 of this report, the foam plastic insulation may be used in wall cavities, floor assemblies or ceiling assemblies, and/or in attics and crawl spaces as nonstructural thermal insulation material. InsulStar®1.7 insulation is used in Type V construction under the IBC and in one- and two-family dwellings under the IRC. InsulStar®1.7 insulation may also be used in Types I, II, III or IV construction when installed in accordance with Section 4.8 of this report.

#### 4.0 PRODUCT DESCRIPTION

**4.1 General:** InsulStar®1.7 is a two-component, spray-applied, closed-cell, polyurethane foam plastic insulation having a nominal core density of 1.7 lb/ft<sup>3</sup> (27.2 kg/m<sup>3</sup>). The foam plastic insulation is generated by combining the isocyanate (NCFI A2-000 series A-component) and a polymeric resin (NCFI B-11-033 series B-component) through a dual component, volumetric, positive-displacement proportioner, on site, in a one to one volumetric ratio as specified in the manufacturer's installation instructions.

**4.2 Thermal Resistance (R-Values):** InsulStar®1.7 spray-applied polyurethane foam plastic insulation has thermal resistance (R-Value) at a mean temperature of 75°F (24°C) as shown in Table 1 of this report.

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.





| Thickness (Inch) <sup>2</sup> | R-Value (°F·ft <sup>2</sup> ·hr/Btu) <sup>2</sup> |
|-------------------------------|---|
| 1.0                           | 7.0   |
| 2.0                           | 14  |
| 3.0                           | 20  |
| 3.5                           | 23  |
| 5.5                           | 37  |
| 6.0                           | 40  |
| 7.0                           | 47  |
| 8.0                           | 53  |
| 9.0                           | 60  |

<sup>1</sup>R-values are calculated based on the k-factor test results at 1- and 3.5-inch thicknesses and rounded to the nearest whole number.

<sup>2</sup>1 inch = 25.4 mm; and 1°F·ft<sup>2</sup>·hr/Btu = 0.176110 K·m<sup>2</sup>·hr/W.

**4.3 Surface Burning Characteristics:** At a maximum thickness of 4 inches (102 mm) and a nominal density of 1.7 lb/ft<sup>3</sup> (27.2 kg/m<sup>3</sup>), the InsulStar<sup>®</sup>1.7 spray-applied polyurethane foam plastic insulation has a flame spread index of 25 or less and smoke-developed index of 450 or less when tested in accordance with ASTM E84. Greater thicknesses, depending on the end use, are recognized as noted in Section 4 of this report.

**4.4 Water Vapor Resistance:** InsulStar<sup>®</sup>1.7 has a vapor permeance of less than 1 perm (57 ng/Pa·s·m<sup>2</sup>) at a thickness of 1.0 inch (25 mm) when tested per ASTM E96 Procedure A and qualifies as a Class II vapor retarder as defined in IBC Section 202 or IRC Section R202.

**4.5 Air Permeability:** InsulStar<sup>®</sup>1.7 exhibits a maximum total air leakage rate of 0.0048 L/s·m<sup>2</sup> when tested per ASTM E2178 at a thickness of 0.5 inches (12.7 mm) and a pressure differential of 75 Pa, and qualifies per 2018 and 2015 IBC section 202 or IRC R202 as an air-impermeable insulation for use in unvented attics and cathedral ceilings.

**4.6 VOC:** InsulStar<sup>®</sup>1.7 is a low VOC insulation per CDPH/EHLB/Standard Method Version 1.2, 2017.

### 4.7 Installation

**4.7.1 General:** All materials recognized in this report shall be stored in their original containers which shall be kept out of direct sunlight and away from heat and moisture. When stored unopened and indoors at a temperature between 50°F (10°C) and 80°F (27°C), the shelf life for InsulStar<sup>®</sup>1.7 is 6 months. InsulStar<sup>®</sup>1.7 shall not be applied to areas where the maximum service temperature is greater than 180°F (82°C). It shall be applied to substrates that are clean, dry, and free from frost, ice, loose debris or contaminants that will interfere with the adhesion of the spray foam insulation. It shall not be applied in electrical outlets, in junction boxes, to substrates over 120°F (49°C) or in direct contact with water. InsulStar<sup>®</sup>1.7 may be applied in passes of uniform thickness from a minimum of ½ inch (12.7 mm) to a

maximum of 4 inches (101 mm) per pass. The maximum total thickness shall be as specified in Sections 4.7.2, 4.7.3 and 4.8 of this report.

### 4.7.2 Thermal Barrier

**4.7.2.1 General:** InsulStar<sup>®</sup>1.7 shall be separated from the interior of the building with a thermal barrier except as specifically excluded by the applicable code.

**4.7.2.2 Application with a Prescriptive Thermal Barrier:** InsulStar<sup>®</sup>1.7 may be installed to any thickness in ceiling cavities and in wall cavities when separated from the interior of the building by a prescriptive thermal barrier (minimum 1/2-inch [12.7 mm] thick gypsum board or other material tested per NFPA 275). The gypsum board shall be installed in accordance with the applicable provisions of IBC Section 2508 or IRC Section R702.3 in such a manner that the foam plastic is not exposed.

**4.7.2.3 Alternative Thermal Barrier Assemblies:** When InsulStar<sup>®</sup>1.7 is coated with DC315 intumescent coating, it may be installed without a prescriptive thermal barrier. The thickness of the foam on vertical wall surfaces is limited to a maximum of 5.5 inches (140 mm). The thickness on the underside or roof sheathing is limited to a maximum of 9.5 inches (241 mm). The foam must be covered on all exposed surfaces with a minimum of 14 mils wet film thickness (9 dry mils) of DC315. The DC315 coverage rate is 115 square feet per gallon.

**4.7.2.3.1 DC315 Fire Protective Coatings:** DC315 Intumescent Coating, recognized in IAPMO [ER 499](#), is a water-based, latex, intumescent coating manufactured by International Fireproof Technology, Inc. and is supplied in 5-gallon (19 L) pails and 55-gallon (208 L) drums. When stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (27°C), the coating has a shelf life of 12 months.

**4.7.2.3.2 AZZ Enclosure Systems:** The AZZ metal modular equipment structure constructed with a maximum of 3-inch (76 mm) thick walls and 6-inch (152 mm) ceiling cavities, with each cavity covered on the interior and exterior by 16 gage steel (approximately 1/16-inch, 1.6 mm) and ¼-inch (6.4 mm) steel plate flooring is approved for up to full cavity thickness (maximum 3 inches, 76 mm) of InsulStar<sup>®</sup>1.7 insulation in the wall, and up to 5-inches (127 mm) maximum in ceiling and underfloor cavities. No additional thermal barrier is required over the foam in the walls, ceiling or floor.

### 4.7.3 Installation in Attics or Crawl Spaces

**4.7.3.1 General:** When installing InsulStar<sup>®</sup>1.7 in attics and/or crawl spaces and a thermal barrier is omitted in accordance with IBC Section 2603.4.1.6, IRC Sections R316.5.3 or R316.5.4, installation shall comply with either Section 4.7.3.3 or 4.7.3.4 of this report.



**4.7.3.2 Unvented Attics:** InsulStar®1.7 qualifies as an air-impermeable insulation, and, when installed in accordance with Section 4.7.3.3 or 4.7.3.4 of this report, may be used to insulate unvented attics and unvented cathedral ceilings in accordance with 2018 IBC Section 1202.3 (2015 Section 1203.3) or IRC Section R806.5 (2012 IRC Section R806.4).

**4.7.3.3 Application with a Prescriptive Ignition Barrier:** When InsulStar®1.7 is installed within attics and crawl spaces, at a maximum of 4 inches (102 mm) thick, where entry is made only to service utilities, the insulation shall be protected by an ignition barrier in accordance with IBC Section 2603.4.1.6 or IRC Sections R316.5.3 and R316.5.4 as applicable. The ignition barrier shall be consistent with the construction type of the building. The ignition barrier shall be installed in accordance with the provisions applicable to the material referenced in the IBC or IRC in such a manner that the foam plastic is not exposed.

**4.7.3.4 Alternative Ignition Barrier Assemblies:** When InsulStar®1.7 insulation is installed without a prescriptive ignition barrier the following conditions apply:

- a) Entry to the attic or crawl space is only to service utilities, and no storage is permitted.
- b) Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, except when an air-impermeable insulation is permitted in unvented attics in accordance with 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) or IRC Section R806.5. Under-floor (crawl space) ventilation is provided when required by 2018 IBC Section 1202.4 (2015 IBC Section 1203.4 and 2012 IBC Section 1203.3) or IRC Section R408 as applicable.
- c) The foam plastic insulation is limited to the maximum thickness and density stated in section 4.7.3.4.1 of this report.
- d) Combustion air is provided in accordance with the Uniform Mechanical Code (UMC) Section 701.1 or International Mechanical Code (IMC) Section 701 as applicable.
- e) Attic and crawl spaces do not have interconnected areas.
- f) Air in the attic or crawl space is not circulated to other parts of the building.

**4.7.3.4.1 Attic and Crawl Space Overhead and Vertical Surfaces without an Ignition Barrier:** InsulStar®1.7 can be installed without an ignition barrier or a coating when installed as limited in this section. It may be spray-applied in attics to the underside of roof sheathing, roof rafters, vertical surfaces and in crawl spaces to the underside of floors and vertical surfaces. When applied to the underside of the top of the space, the thickness of the InsulStar®1.7 insulation shall not exceed 10 inches (254 mm) and when applied to vertical surfaces, the maximum thickness shall not exceed 8 inches (203 mm).

**4.8 Exterior Walls of Types I, II, III and IV Construction (IBC)**

**4.8.1 General:** When used on exterior walls of Type I, II, III and IV construction, InsulStar®1.7 shall comply with Section 2603.5 of the IBC and Section 4.8.2 of this report and may be installed at a maximum thickness of 4 inches (102 mm). The potential heat of InsulStar®1.7 is 1508 BTU/ft<sup>2</sup> (17.1 MJ/m<sup>2</sup>) per inch of thickness when tested in accordance with NFPA 259.

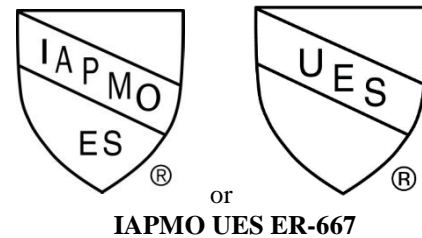
**4.8.2 Specific Wall Assemblies:** Wall assemblies shall be constructed as described in Tables 2 or 3 of this report.

**5.0 IDENTIFICATION**

Job site labeling and certification of the insulation shall comply with IBC Section 2603.2, IRC Section 1101.10.1 (2012 IRC Section 1101.12.1) and IECC Sections C303.1.1 and R303.1.1 as applicable. The B-component for the InsulStar®1.7 is identified with the following:

- Manufacturer's name, address and telephone number
- Product trade name
- Flame spread and smoke developed indices
- Evaluation report number and the name of the inspection agency

Either Mark of Conformity may be used as shown below:



**6.0 SUBSTANTIATING DATA**

**6.1** Data in accordance with ICC-ES Acceptance Criteria for Spray-Applied Foam Plastic Insulation (AC377) Approved April 2016.

**6.2** Reports of room corner fire testing in accordance with NFPA 286.

**6.3** Reports on air leakage tests in accordance with ASTM E2178.

**6.4** Reports on flame spread index and smoke developed index in accordance with ASTM E84.



**6.5** Analysis to define various NFPA 285 Complying Interior Wall Constructions.

**6.6** Reports on Potential Heat tests in accordance with NFPA 259.

**6.7** Reports of testing in accordance with AC377 Appendix X.

**6.8** Report on AZZ Enclosure System tested per NFPA 286.

**6.9** Priest & Associates Engineering Evaluation of AZZ's Enclosure System tested per NFPA 286.

**6.10** Reports on VOC tests per CDPH/EHLB/Standard Method Version 1.2, 2017.

**6.11** Reports on water vapor transmission tests in accordance with ASTM E96.

## 7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research carried out by IAPMO Uniform Evaluation Service on NCFI Polyurethanes InsulStar®1.7 to assess its conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product's certification. Products are manufactured under a quality control program with periodic inspections under the supervision of IAPMO UES.

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For additional information about this evaluation report please visit [www.uniform-es.org](http://www.uniform-es.org) or email us at [info@uniform-es.org](mailto:info@uniform-es.org)





| <b>TABLE 2 -- NFPA 285 COMPLYING EXTERIOR WALLS – NCFI INSULSTAR®1.7 CLOSED-CELL SPF ON EXTERIOR</b> |  |
|--|--|
| <b>WALL COMPONENT</b>  | <b>MATERIALS</b>   |
| Base wall system – Use either 1, 2 or 3  | 1 - Concrete wall – minimum 2-inch thick<br>2 - Concrete Masonry wall<br>3 - One layer – 5/8-inch thick Type X Gypsum wallboard on interior, installed over steel studs: minimum 3 5/8-inch depth, minimum 20-gauge at a maximum of 24-inch OC with lateral bracing every 4 ft. vertically.  |
| Floorline Firestopping   | 4 lb/cu ft. mineral wool (e.g., Thermafiber) in each stud cavity and at each floor-line – attached with Z-clips or equivalent. Mineral wool not required in stud cavities at floor-lines when infill stud-wall construction <sup>1</sup> is employed for exterior wall construction.   |
| Cavity Insulation – Use either 1, 2, or 3  | 1 - None<br>2 - Full cavity depth or less of InsulStar®1.7 (ID No. 11-033) spray polyurethane foam applied using sheathing as substrate and covering the width of the cavity and inside the stud flange<br>3 - Any noncombustible insulation (if batts, can be either faced or unfaced)  |
| Exterior sheathing – Use either 1 or 2   | 1 – 1/2.-inch thick, exterior type gypsum sheathing<br>2 - 5/8-inch thick, exterior type gypsum sheathing  |
| Exterior insulation – Use either 1 or 2  | 1 - None<br>2 - InsulStar®1.7 (ID No. 11-033) spray polyurethane foam – Total thickness to be a maximum of nominal 4 inches  |
| Exterior Veneer – Use either 1, 2, 3, 4 or 5   | 1 - Brick – Standard nominal 4-inch thick, clay brick. Installed with brick veneer anchors – standard types – installed maximum 24 inches OC vertically on each stud. Maximum 2-inch air gap between exterior insulation and brick<br>2 - Stucco – Minimum 3/4-inch thick, exterior cement plaster and lath. A secondary water-resistive barrier can be installed between the exterior insulation and the lath. The secondary water-resistive barrier shall not be full-coverage asphalt or butyl-based self-adhered membranes.<br>3 - Minimum 2-inch thick Limestone, natural stone or minimum 1 1/2 -inch thick cast artificial stone. Any standard non-open-jointed installation technique such as ship-lap, etc. can be used.<br>4 - Terracotta cladding – Use any terracotta cladding system in which the terracotta is minimum 1 1/4 -inch. Any standard non-open-jointed installation technique such as ship-lap, etc. can be used.<br>5 – Minimum 1-inch thick, Clark Pacific glass-fiber-reinforced-concrete (GFRC) panels. Standard installation technique can be used. InsulStar®1.7 is sprayed onto the interior face of the GFRC panels up to a maximum of 4-inches (101 mm).<br>6 – Minimum 1-inch thick, Gates Precast Lites precast concrete panels. Standard installation technique can be used. InsulStar®1.7 is sprayed onto the interior face of the precast concrete panels up to a maximum of 4-inches (101 mm). |

<sup>1</sup> - Infill studwall construction refers to the condition where the stud framing of an exterior wall is interior to the floorline slab edges, effectively terminating the stud cavity at each floorline and creating sectioned stud bays in between sequential floors.



**TABLE 3 --NFPA 285 COMPLYING WALLS – NCFI INSULSTAR® 1.7 CLOSED-CELL SPF IN WALL CAVITY ONLY**

| WALL COMPONENT  | MATERIALS   |
|---|---|
| Base wall system – Use either: 1 with interior, steel studs, minimum 3½-inch depth, minimum 20-gauge at a maximum of 24-inch on center with lateral bracing every 4 ft. vertically, or 2 or 3 | 1 - 1 layer of ½-inch thick Type X exterior gypsum sheathing installed on the exterior side of the steel studs<br>2 - Concrete wall – minimum 2-inch thick<br>3 - Concrete Masonry wall   |
| Floorline Firestopping  | 4 lb/ft <sup>3</sup> mineral wool (e.g., Thermafiber) friction fit in each wall stud cavity at each floorline. Mineral wool not required in stud cavities at floorlines when infill studwall construction <sup>1</sup> is employed for exterior wall construction.  |
| Cavity Insulation – Use either 1, or 2 or any combination of 2 and 3  | 1 - None<br>2 - Full cavity depth or less of InsulStar® 1.7 (ID No. 11-033) spray polyurethane foam applied using sheathing or concrete or masonry as substrate and covering the width of the cavity and inside the stud flange<br>3 - Any noncombustible insulation (if batts, can be either faced or unfaced)   |
| Interior gypsum wallboard   | Minimum ½-inch thick Type X gypsum wallboard  |
| Exterior Wall Covering – Use either 1, 2 or 3   | 1 - Any non-combustible exterior wall covering material<br>2 - Any combustible exterior wall covering system that has successfully been tested in accordance with NFPA 285<br>3 - Any combustible exterior wall covering system up to a maximum wall height of 40 ft. above grade plane. If the combustible material is fire retardant treated wood, the maximum wall height can be 60 ft. above grade plane<br>4 - For base wall 2 or 3, a covering is optional but not required. Use an Exterior wall covering as described in 1, 2 or 3 above. |

<sup>1</sup> - Infill studwall construction refers to the condition where the stud framing of an exterior wall is interior to the floorline slab edges, effectively terminating the stud cavity at each floorline and creating sectioned stud bays in between sequential floors