Code Compliance Research Report
CCRR-1124

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION
Section: 07 21 00 – Thermal Insulation
Section: 07 21 19 – Foamed-In-Place Insulation

REPORT HOLDER:
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REPORT SUBJECT:
Handi-Foam® HVLP LD 0.5 Spray-applied Polyurethane Foam Insulation

1.0 SCOPE OF EVALUATION

This Research Report addresses 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)
- 2017 *Florida Building Code* – see Section 8.0
- 2016 *California Building Code* – see Section 8.0

Handi-Foam® HVLP LD 0.5 Open-Cell Spray Polyurethane Foam Insulation have been evaluated for the following properties:

- Physical properties
- Surface-burning characteristics
- Thermal resistance
- Air permeability
- Alternatives to thermal barriers
- Alternatives to ignition barriers
- Use in Types I, II, III and IV construction
- Use in Type V construction
- Use in fire-resistance-rated construction

See Table 1 for applicable Code sections related to these properties.

NOTE: This report references 2018 Code sections. Section numbers may be different for earlier versions of the codes.

2.0 USES

2.1 HANDI-FOAM® HVLP LD 0.5:

Handi-Foam® HVLP LD 0.5 insulation is intended for use as nonstructural thermal insulating materials on or in interior and exterior walls, floors, and the underside of roofs, in all types of construction under the IBC and dwellings under the IRC. When used in exterior walls of Types I, II, III, or IV construction, the construction must be as described in Section 4.5. Under the IRC, the insulation may be used as air-impermeable insulation as described in Section 3.2.3. The insulation may be used in attics and crawl spaces without the use of a prescriptive ignition barrier when installed as described in Section 4.4.2. The insulation may be applied without the use of a prescriptive thermal barrier when installed as described in Section 4.3.2.

3.0 DESCRIPTION

3.1 Insulation:

3.1.1 HANDI-FOAM® HVLP LD 0.5: Handi-Foam® HVLP LD 0.5 is a two-component, open-cell, water-blown polyurethane foam plastic insulation. The insulation complies with the mandatory requirements for low-density insulation applications described in Section 3.1.1 and Table 1 of ICC-ES AC377. The insulation is produced in the field by professional contractors combining an isocyanate component "A" with a resin component "B". Handi-Foam® HVLP LD 0.5 uses an A component designated as Handi-Foam® HVLP LD 0.5 A-Side and uses a proprietary blend for the B component. The B component has a shelf life of six months and the A component has a shelf life of nine months, when stored in factory-sealed containers at temperatures between 50˚F and 80˚F.

3.2 Intumescent Coatings:

3.2.1 No Burn® Plus XD: No Burn® Plus XD intumescent coating, manufactured by No Burn, Inc., is a latex-based

coating supplied in 5-gallon pails and 55-gallon drums. The coating material has a shelf life of thirty-six months, when stored in factory-sealed containers at temperatures between 40˚F and 90˚F.

3.2.2 DC315 Intumescent Coating: DC315 intumescent coating, manufactured by International Fireproof Technology Inc., is a single-component, water-based, liquid-applied intumescent coating. The coating is supplied in 5-gallon pails and 55-gallon drums, and has a shelf life of twenty-four months when stored in factory-sealed containers at temperatures between 41˚F and 95˚F. DC315 complies with ICC-ES AC456 as recognized in IAPMO Uniform Evaluation Service Report ER-0499.

3.2.3 TPR² FIRESHELL® (IB-4) Coating: TPR² FIRESHELL® (IB-4) intumescent coating is a proprietary, water-based, one-part, nonflammable coating manufactured by TPR² Corporation. The coating is supplied in 5-gallon pails and 55-gallon drums, and has a shelf life of twelve months when stored in factory-sealed containers at temperatures between 45˚F and 75˚F.

3.2.4 TPR² FIRESHELL® (F10E) Coating: TPR² FIRESHELL® (F10E) intumescent coating is a proprietary, water-based, one-part, coating manufactured by TPR² Corporation. The coating is supplied in 5-gallon pails and 55-gallon drums, and has a shelf life of twelve months when stored in factory-sealed containers at temperatures between 45˚F and 75˚F. Fireshell® F10E complies with ICC-ES AC456 as recognized in ICC Evaluation Service Report ESR-3997.

3.3 Performance Characteristics:

3.3.1 Surface Burning Characteristics: Handi-Foam® HVLP LD 0.5 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 at a maximum thickness of 4.2 inches. Based on diversified large scale tests, the insulation may be installed at greater thicknesses as described in Sections 4.3 and 4.4. When the insulation is separated from the interior living space of the building with minimum 1/2 inch thick gypsum board, or an equivalent thermal barrier, the maximum insulation thickness is not limited. Under the 2018 and 2015 IRC, a thermal barrier of minimum 23/32 inch thick wood structural panel is also permitted and the maximum insulation thickness is not limited.

3.3.2 Thermal Resistance: The insulation have thermal resistance (*R*-values) at a mean temperature of 75˚F as shown in Table 2.

3.3.3 Air Permeability: Handi-Foam® HVLP LD 0.5 (at a minimum thickness of 3-1/2 inches) is considered air-impermeable insulation in accordance with 2018 and 2015 IBC Section 202 and IRC Section R202, based on testing in accordance with ASTM E283. Air permeability was not defined in the 2012 and 2009 IBC.

3.3.4 Air Barrier: Handi-Foam® HVLP LD 0.5 (at a minimum thickness of 3-1/2 inches) is considered air barrier materials in accordance with IECC Section C402.5.1.2.1.

4.0 INSTALLATION

4.1 General:

The insulation must be installed in accordance with the manufacturer's published installation instructions, the applicable Code, and this Research Report. The manufacturer's published installation instructions and this Research Report must be strictly adhered to, and a copy of the instructions must be available on the jobsite during installation.

4.2 Application:

The insulation is spray-applied on the jobsite using plural-component metering and processing equipment as recommended in the manufacturer's published installation instructions. The insulation must not be used in areas that have a maximum continuous service temperature greater than 180°F or in contact with heat-producing appliances. The foam plastic insulation must not be used in electrical outlet or junction boxes. The substrate must be free of moisture, frost or ice, loose scales, rust, oil, and grease or other surface contaminants. The insulation must be protected from the weather during and after application. The insulation can be installed in multiple passes, up to 6 inches per pass, to the maximum specified thickness. Where multiple passes are required, each insulation pass must be allowed to fully expand, cure, and cool for a minimum of 5 minutes prior to application of a subsequent pass.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: The insulation must be separated from the interior of the building by an approved thermal barrier, such as minimum 1/2 inch gypsum wallboard, installed using mechanical fasteners in accordance with applicable Code, or an equivalent 15-minute thermal barrier complying with IBC Section 2603.4 or IRC Section R316.4, as applicable, with exceptions as described in Sections 4.3.2 and 4.4, or when applied to a sill plate or header of Type V construction at a maximum insulation thickness of 3-1/4 inches as permitted by IRC Section R316.5.11. When the insulation is separated from the interior living space of the building with minimum 1/2 inch thick gypsum board, the maximum insulation thickness is not limited. Under the 2018 and 2015 IRC, a thermal barrier of minimum 23/32 inch thick wood structural panel is also permitted and the maximum insulation thickness is not limited.

4.3.2 Application without a Prescriptive Thermal Barrier: Handi-Foam® HVLP LD 0.5 may be installed without the 15-minute thermal barrier prescribed in the IBC Section 2603.4 and IRC Section R316.4, subject to the following conditions:

a. All surfaces of the Handi-Foam® HVLP LD 0.5 insulation must be covered with Fireshell F10E or DC315 intumescent coating as follows:
   - Fireshell F10E: minimum application rate of 18 wet mils (1.18 gallons per 100ft^2)
   - DC315: minimum application rate of 18 wet mils (1.12 gallons per 100ft^2)
b. The Handi-Foam® HVLP LD 0.5 insulation shall have a maximum installed thickness as follows:
   - Fireshell F10E: 9-1/2 inches in vertical walls and 11-1/2 inches in ceilings.
   - DC315: 7-1/2 inches in vertical walls and 14-1/2 inches in ceilings.

4.4 Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier: When the 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 Section R316.5.3 or 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.

4.4.2 Application without a Prescriptive Ignition Barrier: The insulation may be installed in an attic or crawl space without the prescriptive ignition barrier described in IBC Section 2603.4.1.6 and IRC Sections R316.5.3 and R316.5.4, when all of the following conditions apply:

a. Entry to the attic or crawl space is only for the service of 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 1202.2 or IRC Section R806, except air-impermeable insulation is permitted in unvented attics in accordance with IBC Section 1202.3 or IRC Section R806.5.
e. Under-floor (crawl space) ventilation is provided when required by IBC Section 1202.4 or IRC Section R408.1, as applicable.
f. Combustion air is provided in accordance with IMC (*International Mechanical Code*®) Section 701.

4.4.2.1 Attics and Crawl Spaces: In attics, the insulation may be spray-applied to the underside of roof sheathing or roof rafters, and/or vertical surfaces provided the assembly conforms to one of the assemblies described in Table 3. In crawl spaces, the insulation may be spray-applied to the underside of floors and/or vertical surfaces provided the assembly conforms to one of the assemblies described in Table 3. When an intumescent coating is used, surfaces to be coated must be dry, clean, and free of dirt, loose debris, and any other substances that could interfere with adhesion of the coating. The intumescent coating must be applied to all surfaces in accordance with the respective coating manufacturer's installation instructions. The coating must be applied

when ambient and substrate temperatures are above of 50°F unless otherwise permitted by the intumescent coating manufacturer's installation instructions. The insulation may be installed in unvented attics as described in this section and in accordance with IBC Section 1202.3 or IRC Section R806.5 at a minimum thickness of 3-1/2 inches.

4.4.2.2 Unvented Attics: BASF Corporation has conducted end use configuration testing (per IBC Section 2603.9 and IRC Section R316.6) and analysis to qualify the use of Handi-Foam® HVLP LD 0.5 insulation without a prescriptive ignition barrier or intumescent coating in unvented attics conforming with IBC Section 1202.3 or IRC Section R806.5. (Note that unvented attics were not addressed in the 2012 and earlier versions of the IBC). The testing and analysis is described in Priest & Associates EEV 10706, dated January 18, 2019. The conclusions of that evaluation are as follows: When Handi-Foam® HVLP LD 0.5 is applied in unvented attics conforming to IBC Section 1202.3 or IRC Section R806.5, the insulation may be applied to the underside of roof sheathing and/or rafters and to vertical surfaces to a minimum thickness of 3-1/2 inches. Rafters may be left without foam coverage or may be covered with foam up to the maximum thickness allowed. Maximum thickness on the underside of roof sheathing or on vertical wall surfaces is 16 inches. The insulation may be left exposed to the attic without a prescriptive ignition barrier or an intumescent coating. The attic must have attic access complying with IRC Section R807, horizontally placed in the attic floor and opening outward toward the living space. For items penetrating the roof deck or walls, such as skylight wells or vents, the penetrating item exposed in the attic must be covered with a minimum of 1-1/2 inches of Handi-Foam® HVLP LD 0.5 insulation.

4.4.2.3 Use on Attic Floors: Handi-Foam® HVLP LD 0.5 insulation may be installed exposed (without a protective covering) in attic floors, between and over joists, at a maximum thickness of 6 inches. Handi-Foam® HVLP LD 0.5 may also be installed in attic floors, between and over joists, with intumescent coatings and maximum thickness as indicated in Table 3. The ignition barrier required in IBC Section 2603.3.1.6 or IRC Section R316.5.3 may be omitted. The insulation must be separated from the interior of the building by an approved thermal barrier.

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

Handi-Foam® HVLP LD 0.5 insulation may be installed in or on the interior side of exterior walls of buildings of Types I, II, III, and IV construction complying with IBC Section 2603.5 and as described in this section. The maximum thickness of the foam plastic is 6 inches when installed in stud cavities. The maximum potential heat of Handi-Foam® HVLP LD 0.5 is 656 Btu/ft^2 per inch of thickness. The tested wall assembly was extended through a third-party engineering analysis to include additional wall constructions described in Table 4.

5.0 CONDITIONS OF USE

The spray-applied polyurethane foam insulation described in this Research 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 Installation must comply with this Research Report, the manufacturer's published installation instructions, and the applicable Code. In the event of a conflict between the manufacturer's 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 as described in Section 4.3.1, except as described in Sections 4.3.2 and 4.4.

5.3 The installed thickness must not exceed that noted in Sections 3.2, 4.3, 4.4, and 4.5.

5.4 The insulation must be protected from the weather during and after application.

5.5 The insulation must be applied by professional spray polyurethane foam installers approved by BASF Corporation or by the Spray Polyurethane Foam Alliance (SPFA) for the installation of spray polyurethane foam insulation.

5.6 When Handi-Foam® HVLP LD 0.5 insulation is installed under the conditions of Section 4.4.2.2 of this report, the following conditions apply:

5.6.1 Since the performance of Handi-Foam® HVLP LD 0.5, when installed in unvented attics without a Code-prescribed ignition barrier or an intumescent coating, are based on fire performance of an unvented attic, the installation must be approved by the Code official. The installation must conform with the provisions of Section 4.4.2.2 and Conditions a. through c., and Condition f. of Section 4.4.2. A copy of the Priest & Associates Engineering Evaluation (referenced in Section 6.6) must be provided to the Code official upon request.

5.6.2 Signage shall be permanently affixed in the attic and shall be visible from all points within the attic. The sign shall state *"Caution, this is an unvented attic by design. No modification may be made to this unvented condition. The attic shall not be vented. Holes into the unvented attic shall be immediately repaired and sealed. Penetrations of the ceiling or wall membrane between the unvented attic and living space, other than the horizontal access hatch, must be protected in an approved manner. This unvented attic shall not be used for storage. See Intertek Code Compliance Research Report CCR-1124 on the Intertek Website."*

5.7 Use of the 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.

5.8 Jobsite certification and labeling of the insulation must comply with IRC Section N1101.10, N1101.14 and IECC Sections C303.1 or R303.1 and R403.1, as applicable.

5.9 A vapor retarder must be installed in accordance with the applicable Code.

5.10 The insulation components are manufactured in Houston, Texas under a quality control program with inspection by Intertek Testing Services NA, Inc.

6.0 SUPPORTING EVIDENCE

6.1 Reports of tests in accordance with ASTM C518, ASTM E84, ASTM E283, ASTM E970, ASTM E2178, NFPA 259, NFPA 285, and NFPA 286.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC377), dated April 2016, including reports of tests in accordance with Appendix X.

6.3 Research Reports for evaluation of data in accordance with ICC-ES Acceptance Criteria for Fire-protective Coatings Applied to Spray-applied Foam Plastic Insulation Installed without a Code-prescribed Thermal Barrier (AC456), dated October 2015.

6.4 Intertek Listing Report ""Handi-Foam® HVLP LD 0.5".

6.5 Hughes Associates, Inc. letters, dated April 14, 2014 and October 07, 2014, Re: HAI Project 1JJB00019.001.

6.6 Priest & Associates Engineering Evaluation 10706, dated January 18, 2019, entitled "For Approval of Handi-Foam® HVLP LD 0.5 SPF Insulation in Unvented Attics without an Ignition Barrier in an Intertek CCRR."

7.0 IDENTIFICATION

Each container of components A and B of the insulation bears a label with the BASF Corporation name and address; the product name; the flame- spread and smoke-developed indices; the expiration date, the Intertek Mark; and the Research Report number (CCRR-1032). Intumescent coatings are identified with the manufacturer's name and address, the product trade name and use instructions.

8.0 OTHER CODES

8.1 Florida Building Code:

8.1.1 Scope of Evaluation: Handi-Foam® HVLP LD 0.5has been evaluated under the 2017 *Florida Building Code–Building* and 2017 *Florida Building Code–Residential*.

8.1.2 Conclusions: The products described in Sections 2.0 through 7.0 comply with the 2017 *Florida Building Code–Building*, and the 2017 *Florida Building Code–Residential*, including High-Velocity Hurricane Zones, subject to the following conditions:

8.1.2.1 Installation is as described in Sections 2.0 through 7.0 of this Research Report.

8.1.2.2 The products are under a quality assurance program audited by Intertek.

8.2 California Building Code:

8.2.1 Scope of Evaluation: Handi-Foam® HVLP LD 0.5 has been evaluated under the 2016 *California Building Code* (CBC), 2016 *California Residential Code* (CRC) and 2016 *California Energy Code* (CEC).

8.2.2 Conclusions: The products described in Sections 2.0 through 7.0 comply with the 2013 *California Building Code* (CBC), 2016 *California Residential Code* (CRC) and 2016 *California Energy Code* (CEC), subject to the following conditions:

8.2.2.1 In accordance with Section 110.8 of the 2016 *California Energy Code*, verification of certification by the Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, must be provided to the Code official, demonstrating that the insulation thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material".

8.2.2.2 The insulation has not been evaluated under CBC Chapter 7A or CRC Section R327, for use in the exterior design and construction of new buildings located in a Fire Hazard Zone within a State Responsibility Area or any Wildland–Urban Interface Fire Area.

8.2.2.3 The insulation has not been evaluated for compliance with the *International Wildland-Urban Interface Code®*.

9.0 CODE COMPLIANCE RESEARCH REPORT USE

9.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

9.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

9.3 Reference to the https://bpdirectory.intertek.com is recommended to ascertain the current version and status of this report.

TABLE 1 – PROPERTIES EVALUATED

PROPERTY	2018 IBC SECTION[1]	2018 IRC SECTION[1]	2018 IECC SECTION[1]
Physical properties	Not required	Not required	Not required
Surface-burning characteristics	2603.3	R316.3	Not applicable
Alternative to thermal barrier/ignition barrier	2603.4	R316.4	Not applicable
Air permeability	1202.3	R806.5	C402.5 R402.4
Fire-resistance-rated construction	703	R302	Not applicable
Exterior walls in Types I-IV construction	2603.5	Not applicable	Not applicable
Thermal resistance	1301	N1101.10 N1102	C303.1.1 C303.1.4 R303.1.1 R303.1.4

[1] Section numbers may be different for earlier versions of the International Codes.

TABLE 2 – THERMAL RESISTANCE[1,2,3]

THICKNESS (inches)	R-VALUE (°F·ft²·h/Btu)
	Handi-Foam® HVLP LD 0.5
1	3.9
2	7.6
3	11
3.5	13
4	15
5	19
5.5	21
6	22
7	26
7.5	28
8	30
9	33
9.5	35
10	37
11.5	43
12	45
16	59

[1] R-values are calculated based on the test *K* vales at 1-and 4-inch thicknesses.

[2] R-values greater than 10 are rounded to the nearest whole number.

[3] To determine R values for thickness not listed:

a. Between 1 inch and 4 inch can be determined through linear interpolation; or,

b. Greater than 4 inches can be calculated based on R 3.71/inch

TABLE 3 – USE OF INSULATION IN ATTICS AND CRAWL SPACES WITHOUT A PRESCRIPTIVE IGNITION BARRIER

INSULATION TYPE	MAXIMUM THICKNESS (inches) (Wall Cavities and Attic Floor)	MAXIMUM THICKNESS (inches) (Underside of Roof Sheathing/ Rafters and Floors)	INTUMESCENT COATING, MINIMUM THICKNESS & TYPE (Applied to all Exposed Foam Surfaces)	MINIMUM APPLICATION RATE OF INTUMESCENT COATING	TEST SUBMITTED (AC377)
Handi-Foam® HVLP LD 0.5	9-1/2	11-1/2	FIRESHELL® (IB-4) 5 wet mils (3.5 dry mils)	0.31 gal / 100 ft²	Appendix X
	11-1/4	16	No Burn Plus XD 6 wet mils (4 dry mils)	0.37 gal / 100 ft²	Appendix X
	11-1/2	15-1/2	DC315 4 wet mils (3 dry mils)	0.25 gal / 100 ft²	Appendix X

TABLE 4 – NFPA 285 COMPLYING WALLS –HANDI-FOAM® HVLP LD 0.5 IN INTERIOR WALL CAVITY

Wall Component	Materials
Base wall system – Use either 1, 2 or 3	1 - Concrete wall 2 - Concrete Masonry wall 3 - One layer of 5/8-inch thick Type X gypsum wallboard installed on the interior side of minimum 3-5/8 inch deep minimum 20 gauge thick steel studs spaced a maximum of 24-inch on center. Lateral bracing installed minimum every 4 ft. vertically or as required. Wall stud cavities shall be filled at each floor line with minimum 4 lb/ft^3 mineral wool (e.g. Thermafiber) friction fit between steel wall studs.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with IBC Section 715.4 [714.4] shall be installed, as applicable, to fill the linear gap between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5	1 - None 2 - Maximum 6-inch thickness of Handi-Foam® HVLP LD 0.5 applied to interior surface of Base Wall System 1 and 2 (See Note 1) 3 - Full wall stud cavity depth or less of Handi-Foam® HVLP LD 0.5 applied using exterior gypsum sheathing of Base Wall System 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange. 4 - Fiberglass batt insulation (faced or unfaced) 5 - Mineral wool insulation (faced or unfaced)
Exterior sheathing	5/8-inch thick Type X exterior type gypsum sheathing (for Base Wall System 3 above)
Exterior Wall Covering – Use either 1, 2 or 3 (See Note 3)	1 - Any non-combustible exterior wall covering material using any standard installation technique 2 – Any non-combustible exterior wall covering system with a combustible WRB that has successfully been tested in accordance with NFPA 285 3 – Any combustible exterior wall covering system with or without a combustible WRB that has been successfully been tested in accordance with NFPA 285
Flashing of window, door and other exterior wall penetrations.	As an option, flash around window, door and other exterior penetrations with limited amounts of maximum 12-inch wide flashing tape (acrylic, asphalt or butyl-based) or liquid applied membrane material with or without fiber mesh reinforcement.

Note 1: Fireblocking per IBC Section 718 and thermal barrier material requirements must be met for Base Wall Systems 1 and 2, as required by specific wall construction details when combustible concealed space is created on interior side of exterior wall assembly.

Note 2: Combustible exterior wall coverings shall be installed in accordance with manufacturer's requirements.