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EVALUATION SUBJECT: HY-FI REFLECTIVE INSULATION

REPORT HOLDER:

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CSI Division: 07 00 00 – THERMAL AND
MOISTURE PROTECTION
CSI Section: 07 21 00 – Thermal Insulation

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes & regulations:

- 2015, 2012, 2009 and 2006 International Building Code® (IBC)
- 2015, 2012, 2009 and 2006 International Residential Code® (IRC)
- 2015, 2012, 2009 and 2006 International Energy Conservation Code® (IECC)
- 2014, 2010 and 2007 Florida Building Code, Building (FBC-Building) and 2014, 2010 and 2007 Florida Building Code, Residential (FBC-Residential) – see attached supplement

1.2 Evaluated in accordance with:

- ICC-ES AC02 – Acceptance Criteria for Reflective Insulation, approved June 2011, editorially revised August 2013

1.3 Properties assessed:

- Thermal Resistance
- Surface Burning Characteristics
- Permeability

2.0 PRODUCT USE

HY-Fi is used as reflective insulation intended for use on framed walls complying with the following: Section 720 of the 2015 and 2012 IBC, 719 of the 2009 and 2006 IBC, Section N1101 of the 2015, 2012, 2009 and 2006 IRC, and Sections C303 and R303 of the 2015, 2012, 2009 or 2006 IECC.

3.0 PRODUCT DESCRIPTION

HY-Fi is a multi-layer reflective insulation for use on frame walls. It is available in both non-perforated and perforated versions and in rolls either 16 inches (406 mm) or 24 inches

(610 mm) wide containing 500 square feet (46.5 m²) each. The outer layer consists of 35 pound (15.9 kg) blue kraft paper coated with polyethylene, an inner layer of minimum 0.00035 inch (0.00889 mm) aluminum foil and an inner layer of 30 pounds (13.6 kg) natural kraft paper laminated to a minimum 0.00025 inch (0.00635 mm) aluminum foil reinforced with fiberglass scrim. Upon installation, the layers open using internal expanders that form internal airspace ranging between ¼ inch (6.4 mm) and ¾ inch (19 mm).

3.1 HY-Fi has a flame-spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E84.

3.2 HY-Fi non-perforated version has a water vapor permeance of less than 1.0 perm (grains/ft²·h·inch Hg) when tested in accordance with Procedure A of ASTM E96 desiccant method at 73.4° F (23° C).

3.3 HY-Fi perforated version has a water vapor permeance of 2.6 perms (grains/ft²·h·inch Hg) when tested in accordance with Procedure A of ASTM E96 desiccant method at 73.4° F (23° C).

4.0 DESIGN AND INSTALLATION

4.1 R-Values

4.1.1 HY-Fi in a 1-inch (24 mm) enclosed airspace 16 inches (406 mm) on center for the standard or non-perforated insulation has an R-value of 5.1 hr ft² °F/Btu and the perforated type yielded an R-value of 5.0 hr ft² °F/Btu at a mean temperature of 75°F (24°C).

4.1.2 HY-Fi in a 1.5-inch (38 mm) enclosed airspace 16 inches (406 mm) on center for the standard or non-perforated insulation at a mean temperature of 75°F (24°C) yielded an R-value of 7.1 hr ft² °F/Btu and the perforated type yielded an R-value of 7.0 hr ft² °F/Btu at a mean temperature of 75°F (24°C).

4.1.3 HY-Fi Hybrid Insulation has a calculated R-value of 7.2 hr ft² °F/Btu when modeled in a vertical wall panel, with a horizontal heat flow as follows; total thickness is 1 ½ inches; consisting of three ½ inches air spaces, HY-Fi

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 provisions 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.

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Hybrid Insulation itself has two 1/2 air space and the third is beyond the HY-Fi. The calculation was performed in accordance with ASTM STP 1116.

4.2 Hybrid Insulation Assemblies: Hy-Fi Hybrid Insulation has a thermal emittance of the reflective surfaces of 0.034, while the thermal emittance of the non-reflective surfaces is 0.9. This results in an effective emittance of 0.0339 for the enclosed reflective air spaces.

4.2.1 The total R-value is calculated for 2-by-4-inch and 2-by-6-inch walls as shown in Table 4 of this report. The foam thermal resistance ranges from 3.5 to 6.8 ft² °F/Btu per inch, which includes open-cell and closed-cell spray-applied polyurethane foam insulations with the indicated R-value. The calculations were performed at a mean temperature of 75°F (24°C) as shown in Table 3 of this report and in accordance with ASTM STP 1116.

4.2.2 HY-Fi Hybrid Insulation Assembly has a total R-value that is calculated from Fiberglass Batt insulation of 13 and 15 hr ft² °F/Btu in a 2-by-6-inch framed walls placed in a 16- or 24-inch (406 mm or 610 mm) on center wall cavity at a mean temperature of 75°F (24°C) with the indicated total R-value as shown in Table 2 of this report. The 3.5-inch (88.9 mm) thick fiberglass batt insulation, installed on the exterior side of the cavity, forms three enclosed reflective air spaces as shown in Figure 1 of this report. The calculation was performed in accordance with ASTM STP 1116.

4.3 Installation: HY-Fi Reflective insulation shall be installed in accordance with this evaluation report and the manufacturer's installation instructions, which are available at the following link: [Hy-Fi Installation Instructions](#).

5.0 LIMITATIONS

HY-Fi Reflective 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, with the following conditions:

5.1 Installation shall comply with this report; the manufacturer's published installation instructions and the applicable code. In the event of a conflict between this report and the installation instructions, the more restrictive shall apply.

5.2 HY-Fi Reflective Insulation is manufactured in Auburndale, FL, under a quality control program with inspections by IAPMO UES.

5.3 If foam plastic insulation is used, it shall be referenced in a code compliant evaluation report and separated from

the wall cavity by a thermal barrier.

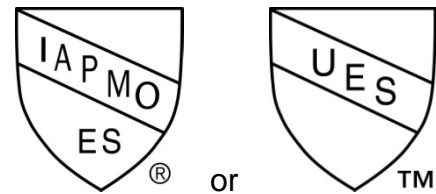
6.0 SUBSTANTIATING DATA

Data and test reports submitted for this report are from laboratories recognized as being in compliance with ISO/IEC 17025 and the following:

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Reflective Insulation (AC02), approved June 2011, editorially revised August 2013.

7.0 IDENTIFICATION

A label shall be affixed on at least one of the following: product, packaging, installation instructions or descriptive literature. The label shall include the company name or trademark, model number, and the IAPMO Uniform ES Mark of Conformity the name of the inspection agency (when applicable) and the Evaluation Report Number (ER-358) to identify the products recognized in this report. A die-stamp label may also substitute for the label. Either Mark of Conformity may be used as shown below:



IAPMO ER #358

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For additional information about this evaluation report please visit www.uniform-es.org or email at info@uniform-es.org



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Table 1. Temperatures at Interface Between Fiberglass Batt and HY-Fi Reflective Insulation

<u>Fiberglass Batt R</u>	<u>Interface Temperature (°F)</u>
13	72.54
15	71.55

Table 2. Calculated R-values (ft²·h·°F/Btu) for Hybrid Insulations

<u>Fiberglass Batt R-value</u>	<u>R-value of HY-Fi</u>		<u>Total R</u>		<u>Rounded R</u>	
	<u>16 in. OC</u>	<u>24 in. OC</u>	<u>16 in. OC</u>	<u>24 in. OC</u>	<u>16 in. OC</u>	<u>24 in. OC</u>
13	8.72	8.93	21.72	21.93	22	22
15	8.76	8.97	23.76	23.97	24	24



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Table 3: Temperatures at Interface Between Foam and HY-Fi Reflective Insulation

<u>Nominal 2 by 4 in. Framing</u>	R* foam (ft ² ·h·°F/Btu·in.)				
	<u>3.50</u>	<u>4.00</u>	<u>6.00</u>	<u>6.20</u>	<u>6.80</u>
1.0-inch of Foam	81.64	80.85	78.22	78.00	77.37 °F
1.5-inches of Foam	79.00	78.08	75.18	74.94	74.27
2.0-inches of Foam	75.70	74.71	71.76	71.53	70.89
2.5-inches of Foam	71.10	70.20	67.70	67.51	67.01
<u>Nominal 2 by 6 in. Framing</u>					
2.0-inches of Foam			73.21	72.99	72.36 °F
3.0-inches of Foam			70.72	70.52	69.95
4.0-inches of Foam	70.68	69.79	67.35	67.17	66.68

Table 4. Calculated R-values (ft²·°F/Btu) for Hybrid Insulations

<u>Nominal 2 by 4 in. Framing</u>	R* foam (ft ² ·h·°F/Btu·in.)				
	<u>3.50</u>	<u>4.00</u>	<u>6.00</u>	<u>6.20</u>	<u>6.80</u>
1.0-inch of Foam					
R _{foam}	3.50	4.00	6.00	6.20	6.80
R _{HY-Fi}	8.31	8.36	8.51	8.52	8.56
R _{total}	11.81	12.36	14.51	14.72	15.36
R Rounded	12	12	15	15	15
1.5-inches of Foam					
R _{foam}	5.25	6.00	9.00	9.30	10.20
R _{HY-Fi}	8.47	8.50	8.61	8.62	8.65
R _{total}	13.72	14.50	17.61	17.92	18.85



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(Table 4 –continued)

R Rounded	14	15	18	18	19
2.0-inches of Foam					
R _{foam}	7.00	8.00	12.00	12.40	13.60
R _{HY-FI}	7.32	7.33	7.37	7.37	7.38
R _{total}	14.32	15.33	19.37	19.77	20.98

R Rounded	14	15	19	20	21
2.5-inches of Foam					
R _{foam}	8.75	10.00	15.00	15.50	17.00
R _{HY-FI}	4.91	4.91	4.93	4.94	4.94
R _{total}	13.64	14.91	19.93	20.44	21.94

R Rounded	14	15	20	20	22
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Nominal 2 by 6 in. Framing

2.0-inches of Foam					
R _{foam}			12.00	12.40	13.60
R _{HY-FI}			8.70	8.72	8.77
R _{total}			20.70	21.12	22.37

R Rounded			21	21	22
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3.0-inches of Foam					
R _{foam}			18.00	18.60	20.40
R _{HY-FI}			9.43	9.46	9.53
R _{total}			27.43	28.06	29.63

R Rounded			27	28	30
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4.0-inches of Foam					
R _{foam}	14.00	16.00	24.00	24.80	27.20
R _{HY-FI}	7.51	7.52	7.55	7.55	7.56
R _{total}	21.51	23.52	31.55	32.35	34.76

R Rounded	22	24	32	32	35
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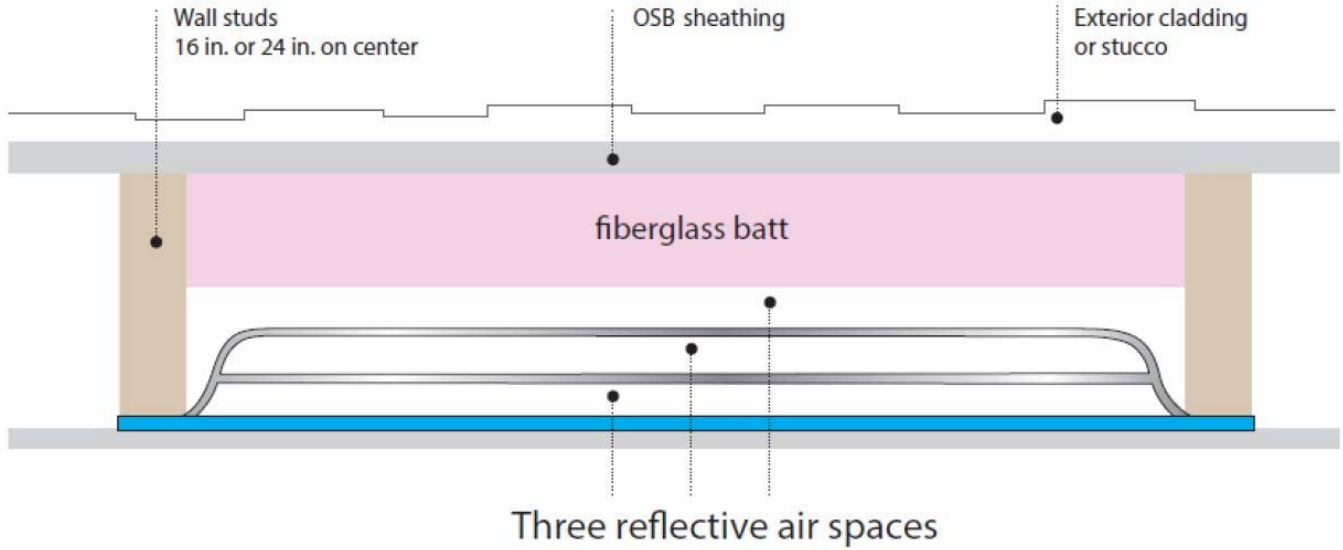


Figure 1 – HY-Fi Hybrid Wall with Fiberglass Batt Illustration

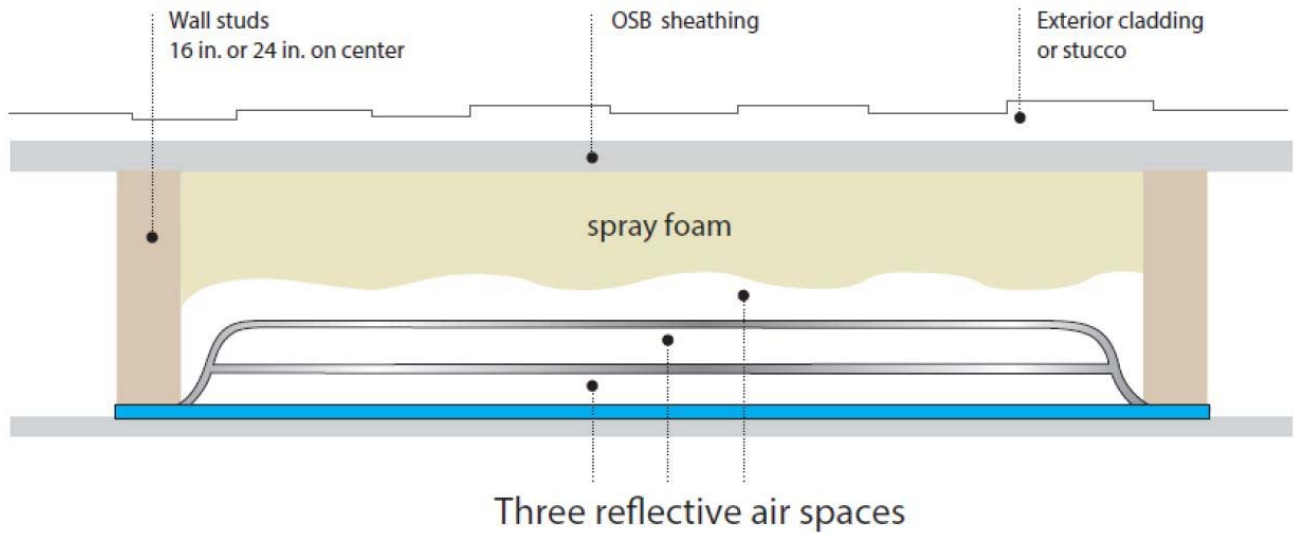


Figure 2 – HY-Fi Hybrid Wall with Spray Foam Illustration



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FLORIDA SUPPLEMENT

**EVALUATION SUBJECT:
HY-FI REFLECTIVE INSULATION**

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1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes & regulations:

- 2014, 2010 and 2007 Florida Building Code, Building[®] (FBC- Building)
- 2014, 2010 and 2007 Florida Building Code, Residential[®] (FBC - Residential)
- 2014, 2010 and 2007 Florida Building Code, Energy Conservation[®] (FECC)

2.0 FINDINGS

HY-FI Reflective Insulation described in IAPMO UES Evaluation Report ER-358 complies with the following: Section 720 of the 2014 FBC-Building, Section 719 of the 2010 and 2007 FBC-Building, Section N1101 of the 2014 and 2010 FBC – Residential and Section N1102 of the 2007 FBC - Residential, and Section 303 of the 2014, 2010 and 2007 FECC.

For products falling under Florida Rule 61G20-2.008, verification that the report holder's quality assurance program is audited by a quality assurance entity, approved by the Florida Building Commission (or the building official when the report holder does not possess an approval by the Commission), to provide oversight and determine that the products are being manufactured as described in this evaluation report to establish continual product performance is required.

For additional information about this evaluation report please visit www.uniform-es.org or email at info@uniform-es.org