



EVALUATION SUBJECT:

AA-2 VAPOR SHIELD, M-SHIELD, SILVER SHIELD RADIANT BARRIER, FSK SHIELD, RBI SHIELD AND VR PLUS SHIELD

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:

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

1.2 Evaluated in accordance with:

- ICC-ES AC 02 – Acceptance Criteria for Reflective Insulation, approved June 2011, editorially revised April 2014
- ICC-ES AC 220 – Acceptance Criteria for Sheet Radiant Barriers, approved September 2010, editorially revised September 2013. *

**Applies only to Silver Shield Radiant Barrier*

1.3 Properties assessed:

- Thermal Resistance
- Surface Burning Characteristics *
- Permeability

**Version of ASTM E84-11 mounted in accordance with ASTM E2599.*

2.0 PRODUCT USE

AA-2 Vapor Shield, M-Shield, Silver Shield Radiant Barrier, FSK Shield, RBI Shield and VR Plus Shield are used as reflective insulation intended for use on furred-out masonry walls, framed walls and roofs, and comply with the following codes:

Section 720 of the 2012 IBC, Section 719 of the 2009 and 2006 IBC, Section N1101 of the 2012, 2009 and 2006 IRC, and Sections C303 and R303 of the 2012, 2009 or 2006 IECC.

3.0 PRODUCT DESCRIPTION

3.1 AA-2 Vapor Shield: AA-2 Vapor Shield is a multi-layer reflective insulation intended for use on furred-out masonry and framed walls. As noted in Section 3.1.1 of this report, AA-2 Vapor Shield shall be installed in substantial contact with the unexposed surface of the wall finish. The insulation 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 inner layer is aluminum foil with a minimum 0.00035 inch (0.00889 mm) thickness and an outer layer is natural kraft paper of 35 pounds (15.9 kg) with internal expanders. The internal expanders separate the paper from the foil creating a 3/8 inch (9.5 mm) reflective air space between the foil layers. The thickness of the second air space is dependent on the thickness of the framing or furring strips.

3.1.1 Installation under the 2012, 2009 and 2006 IBC: AA-2 insulation is permitted to be installed in Type III, IV, and V exterior walls, within 3/4, 7/8 and 1-1/2 inch (19, 22.2 and 38.1 mm) cavities, when placed in such a manner that it is behind and in substantial contact with the unexposed surface of the walls. Figure 1 of this report provides additional details. When installed in this manner, AA-2 Vapor Shield is exempt from surface burning characteristics as set forth in Section 720.2.1 of the 2012 IBC, and Section 719.2.1 of the 2009 and 2006 IBC.

3.1.2 AA-2 Vapor Shield (Standard Non-perforated Version) has a water vapor permeance of 1.0 perm (grains/ft²·h·inch Hg) when tested in accordance with Procedure A of ASTM E96 dry cup method at 73.4 ° F (23°C).

3.1.3 AA-2 Vapor Shield (Hi-Perm Perforated Version) has a water vapor permeance of 5.0 perms (grains/ft²·h·inch Hg) when tested in accordance with Procedure A of ASTM E96 dry cup method at 73.4 ° F (23°C).

3.1.4 AA-2 Vapor Shield has a thermal emittance of less than 0.10 when measured in accordance with ASTM C1371.



3.2 M-Shield: M-Shield is reflective insulation for use on furred-out masonry and framed walls in buildings of Types I, II, III, IV, and V construction. M-Shield incorporates a layer of aluminum foil and synthetic polymers that contain no cellulose. Upon installation the layers separate with internal expanders creating a reflective air space that forms when installed on wood or metal furring strips spaced 16 inches (406 mm) or 24 inches (610 mm) on center. The second reflective air space is dependent upon the thickness of the framing or furring strips.

3.2.1 M-Shield 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 E84-11.

3.2.2 M-Shield has a thermal emittance of less than 0.10 when measured in accordance with ASTM C1371.

3.2.3 M-Shield has a water vapor permeance of 5.0 perm (grains/ft²·h·inch Hg) when tested in accordance with Procedure A of ASTM E96 dry cup method at 73.4°F (23°C).

3.3 Silver Shield Radiant Barrier: Silver Shield Radiant Barrier is a double layer reflective insulation and radiant barrier for use in roof systems or attics in buildings of Types I, II, III, IV, and V construction. It is available as perforated in 16 inches (406 mm) or 24 inches (610 mm) wide rolls each containing 500 square feet (46.5 m²). A 30 inch (762 mm) wide roll containing 250 square feet (23.2 m²) is also available. Silver Shield Radiant Barrier is formed by an inside layer of PVC film metalized PVC. The outside layer is reinforced aluminum foil kraft paper bonded with a fire retardant adhesive. Upon installation the layers expand to form a reflective air space to provide thermal performance and protect the internal or upper low emittance surface, which reduces the potential effect of dust accumulation.

3.3.1 Silver Shield Radiant Barrier 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 E84-11.

3.3.2 Silver Shield Radiant Barrier has a water vapor permeance of 5.0 perms (grains/ft²·h·inch Hg) when tested in accordance with Procedure B of ASTM E96 wet cup method at 73.4°F (23°C). The material is vapor transmitting in accordance with ASTM C1313.

3.3.3 Silver Shield Radiant Barrier has a thermal emittance of less than 0.10 when measured in accordance with ASTM C1371.

3.4 FSK Shield: FSK Shield is a single sheet radiant barrier and insulation facing intended for use in an attic, roof, or wall in buildings of Types I, II, III, IV, and V construction. It is made of 0.0003 inch (0.0076 mm) aluminum foil bonded to 30 pounds (13.6 kg) natural kraft paper with a flame retardant. FSK Facing is available in 54 inch (1,372 mm) wide rolls of 1,000 square feet (92.9 m²).

3.4.1 FSK Shield (on kraft side and foil side exposed) 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 E 84-11.

3.4.2 ASTM E84 test values stated in Section 3.4.2.1 through 3.4.2.3 are applicable only to 2006 Editions of the IBC, IRC, and IECC.

3.4.2.1 FSK Shield Facing & Fiberglass Unfaced Batt (R-11) has a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84-98.

3.4.2.2 FSK Shield Facing & Fiberglass Unfaced Batt (R-19) has a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84-98.

3.4.2.3 FSK Shield Facing & Fiberglass Unfaced Batt (R-30) has a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84-98.

3.4.3 FSK Shield has an emittance of less than 0.10 when measured in accordance with ASTM E408.

3.4.4 FSK Shield 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 dry cup method at 73.4°F (23°C).

3.5 RBI Shield: RBI Shield (Reflective Bubble Insulation) is intended for use in roofs, floors, and walls in buildings of Types I, II, III, IV, and V construction. RBI is available in both single and double bubble versions in rolls of 125 feet (30.1 m) long and 16 inches (406 mm), 24 inches (610 mm), 48 inches (1,219 mm), 54 inches (1,372 mm), 66 inches (1,676 mm), 72 inches (1,829 mm) and 96 inch (2438 mm) widths. It consists of two layers of air filled bubbles and various options for facings: Metalized film both sides or metalized film on one side and white or black polyethylene on the other. The total thickness of the insulation is ³/₁₆ inch (4.76 mm) for the Single Bubble and ⁵/₁₆ inch (7.94 mm) for the Double Bubble.

3.5.1 RBI Shield 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 E84-11.

3.5.2 RBI Shield 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 dry cup method at 70.5°F (21.4°C) and 50.5 percent relative humidity.

3.5.3 RBI Shield has a thermal emittance of less than 0.10 when measured in accordance with ASTM C1371.



3.6 VR Plus Shield: VR Plus Shield is a triple layer reflective insulation for use on furred-out masonry and 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) white kraft paper coated with polyethylene, a layer of 30 pounds (13.6 kg) natural kraft paper laminated to a minimum 0.00025 inch (0.00635 mm) aluminum foil, and a layer of minimum 0.00035 inch (0.00889 mm) aluminum foil. Upon installation, the layers open using internal expanders that form internal airspace ranging between ¼ inch (6.4 mm) and ½ inch (12.7 mm). The thickness of the third airspace is dependent on the thickness of the furring strips or the wall studs.

3.6.1 VR Plus Shield 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.

3.6.2 VR Plus Shield non perforated version has a water vapor permeance of less than 1.0 perm (grains/ft²·h·inch Hg) in accordance with Procedure A of ASTM E96 dry cup method at 73.4° F (23° C).

3.6.3 VR Plus Shield perforated version has a water vapor permeance of 5.0 perms (grains/ft²·h·inch Hg) in accordance with Procedure B of ASTM E96 wet cup method at 73.4°F (23°C).

4.0 DESIGN AND INSTALLATION

4.1.1. AA-2 Vapor Shield at ¾ inch (19.1 mm) thick with nominal 1 inch (25.4 mm) x 2 inch (50.8 mm) furring strips 16 inches (406 mm) on center for the non-perforated type yielded an R-value of 4.2 hr ft² °F/Btu and the perforated type yielded an R-value of 4.1 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.1.2. AA-2 Vapor Shield at 7/8 inch (22.2 mm) x 1.5 inch (38.1 mm) furring strips spaced 16 inches (405 mm) on center for the non-perforated type yielded an R-value of 4.7 hr ft² °F/Btu and the perforated type yielded an R-value of 4.6 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.1.3 AA-2 Vapor Shield at 1.5 inch (38.1 mm) x 1.5 inch (38.1 mm) furring strips spaced 16 inches (406 mm) on center for the non-perforated type yielded an R-value of 5.2 hr ft² °F/Btu and the perforated type yielded an R-value of 5.1 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.2 M-Shield Thermal Resistance

4.2.1. M-Shield at ¾ inch (19.1 mm) thick with a nominal 1 inch (25.4 mm) x 2 inch (50.8 mm) furring strips spaced 16

inches (406 mm) on center yielded an R-value of 4.1 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.2.2. M-Shield at 7/8 inch (22.2 mm) x 1.5 inch (38.1 mm) furring strips spaced 16 inches (406 mm) on center yielded an R-value of 4.6 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.2.3. M-Shield at 1.5 inch (38.1 mm) x 1.5 inch (38.1 mm) furring strips spaced 16 inches (406 mm) on center yielded an R-value of 5.1 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.3 RBI Shield Thermal Resistance

4.3.1 RBI Shield at 1 inch (25.4 mm) x 1 - 7/16 inch (36.5 mm) studs spaced 16 inches (406 mm) on center forming a 1 inch (25.4 mm) air space above the RBI and the bottom open to below. This consists of 1 inch (25.4 mm) of air within the cavity, insulation, and bottom surface air resistance. The RBI Shield shall be oriented with the metalized film facing the 1 inch (25.4 mm) air space and the white plastic facing down. The calculated R-value yielded 6.36 hr ft² °F/Btu. The RBI Shield having two foil sides in which heat flows down yielded an R-value of 9.78 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363 and C1224.

4.3.2 RBI Shield at 8 inch (203 mm) x 1 - ½ inch (38.1 mm) studs forming an 8 inch (203 mm) horizontal air space above the RBI and the bottom open to below. This consists of 8 inch (203 mm) of air within the cavity, insulation, and bottom surface air resistance. The RBI Shield™ shall be oriented with the metalized film facing the 8 inch (203 mm) air space and the white plastic facing down. The calculated R-value yielded 7.63 hr ft² °F/Btu. The RBI Shield having two foil sides in which heat flows down yielded an R-value of 11.16 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363 and derived according to ASTM C1224. The small cavity aspect ratio of 30.5 inch (775 mm)/ 8 inch (203 mm) requires that additional radiant transfer items be considered that are neglected in the strict ASTM C1224 procedure. Specifically there is also radiation heat exchange between the hot plywood cover surfaces and the long intermediate temperature stud surfaces, as well as the hot plywood cover surfaces and the short, intermediate temperature end frame sections. When these are considered the air space above, RBI, and the air space below yielded an R-value of 13.7 hr ft² °F/Btu for the white undercoating and 17.4 hr ft² °F/Btu for the reflective undercoating.



Table -- 4.3.3 Calculated R-values for RBI

Table 4.3.3 Calculated R-Value for RBI ^{1,2} (units of R= hr ft ² °F/Btu) Foil Emissivity = 0.03			
Air space thickness above RBI Insulation	White & Foil ³	Black & Foil ³	Foil & Foil
1" Air space above with R=4.92	7	7	10
2.5" Air space above R=8.01	10	10	13
3.5" Air space above R=9.84	11	11	15
6" to 8" Air space above R is approximately 11.5 ⁴	13 ⁴ Approximate	13 ⁴ Approximate	17 ⁴ Approximate

1. R-values shown include resistance of upper air space, RBI, and lower or room air resistance.
2. In these calculations, the RBI material itself has an R-value of 0.70.
3. Where white/foil RBI material is used, the foil side faces up into the cavity.
4. Calculated values are approximate for this depth of air space.

The calculated R-values in Table 4.3.3 of this report are for the ceiling-roof RBI application at different air space thicknesses and for emissivity of 0.03 for heat flow down. The air space depth shown is the distance from upper surface of insulation to inside of ceiling-roof, and the R-value shown in column is achieved by the air space alone. The insulation is suspended above an open room. The open air space below the insulation has an R-value of 0.92 for the RBI White/Foil and 4.55 for the RBI Foil/Foil.

4.4 Installation shall be in accordance with this report; the manufacturer’s published installation instructions and the applicable code; the manufacturer’s published installation instructions shall be available on the job site. In the event of a conflict between this report and the installation instructions, the more restrictive assumes governance.

4.5 VR Plus Shield Thermal Resistance

4.5.1 VR Plus Shield at 1 inch (24 mm) thick formed by furring strips 16 inches (406 mm) on center for the perforated type yielded an R-value of 5.0 hr ft² °F/Btu at a mean temperature of 75°F (24°C) when tested in accordance with ASTM C1363.

4.5.2 VR Plus Shield at 1.5 inches (38 mm) with two furring strips of 1 inch (24 mm) and ½ inch (13 mm) thick placed 16

inches (406 mm) on center for the non- at a mean temperature of 75°F (24°C) perforated type 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) when tested in accordance with ASTM C1363.

5.0 LIMITATIONS

AA-2 Vapor Shield, M-Shield, Silver Shield Radiant Barrier, FSK Shield, RBI Shield and VR Plus Shield 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 assumes governance.

5.2 AA-2 Vapor Shield shall be installed in concealed spaces in buildings of Type III, IV or V construction, in the flame spread and smoke developed limitations do not apply to the AA-2 Vapor Shield since it is installed behind and in substantial contact with the unexposed surface of the wall finish as per Sections 720.2.1 of the 2012 IBC, and 719.2.1 of the 2009 IBC and 2006 IBC.

5.3 Silver Shield Radiant Barrier shall not be installed on the attic floor.

5.4 AA-2 Vapor Shield, M-Shield, Silver Shield Radiant Barrier, FSK Shield, RBI Shield and VR Plus Shield are manufactured in Auburndale, FL, under a quality control program with inspections by IAPMO.

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 (AC 02), approved June 2011, editorially revised April 2014.

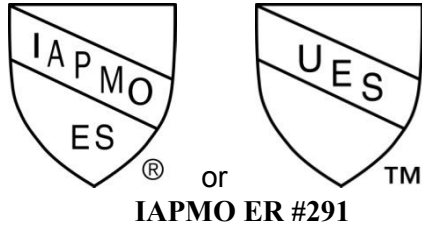
6.2 Data in accordance with the ICC-ES Acceptance Criteria for Sheet Radiant Barriers (AC 220), approved September 2010. editorially revised September 2013.

6.3 Reports of emittance, humidity resistance, adhesive performance, and fungi resistance testing in accordance with, and meeting the thermal resistance parameters in Section 9.7 of ASTM C1224.



7.0 IDENTIFICATION

AA-2 Vapor Shield, M-Shield, Silver Shield Radiant Barrier, FSK Shield, RBI Shield and VR Plus Shield are marked with one of the IAPMO Uniform ES Marks of Conformity and the Evaluation Report Number (ER-291).



Brian Gerber, P.E., S.E.
Vice President, Technical Operations
Uniform Evaluation Service

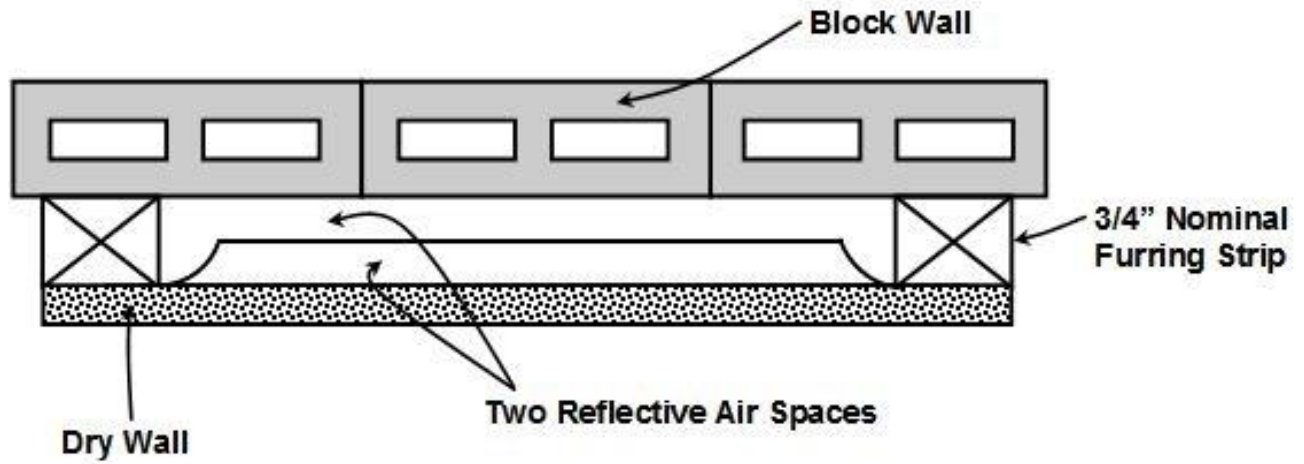
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For additional information about this evaluation report please visit
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FIGURE 1: AA-2 VAPOR SHIELD DETAIL





FLORIDA SUPPLEMENT

EVALUATION SUBJECT:

AA-2 VAPOR SHIELD, M-SHIELD, SILVER SHIELD RADIANT BARRIER, FSK SHIELD, RBI SHIELD AND VR PLUS SHIELD



CSI Division: 07 00 00 – THERMAL AND MOISTURE PROTECTION

CSI Section: 07 21 00 – Thermal Insulation

1.0 SCOPE OF EVALUATION

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

1.1 Evaluated in accordance with:

- ICC-ES AC 02 – Acceptance Criteria for Reflective Insulation, approved June 2011, editorially revised April 2014
- ICC-ES AC 220 – Acceptance Criteria for Sheet Radiant Barriers, approved September 2010, editorially revised September 2013 *

**Applies only to Silver Shield Radiant Shield*

1.2 Properties assessed:

- Thermal Resistance
- Surface Burning Characteristics
- Permeability

2.0 APPLICABILITY

2.1 FBC: All provisions of ER0291 referencing the 2012, 2009 and 2006 IBC shall apply to use under the 2014, 2010 and 2007 FBC, respectively. Along with Section 720 of the FBC, Building, or Section R302 of the FBC, Residential, and C303 or R303 of the FBC, Energy Conservation, as applicable.

2.2 FRC: All provisions of ER0291 referencing the 2012, 2009 and 2006 IRC shall apply to use under the 2014, 2010 and 2007 FRC respectively, along with Section 720 of the FBC, Building, or Section R302 of the FBC, Residential, and C303 or R303 of the FBC, Energy Conservation, as applicable.

2.3 FECC: All provisions of ER0291 referencing the 2012, 2009 and 2006 IECC shall apply to use under the 2014, 2010 and 2007 FECC respectively, and Section 720 of the FBC, Building, or Section R302 of the FBC, Residential, and C303 or R303 of the FBC, Energy Conservation, as applicable.

3.0 ADDITIONAL REQUIREMENTS

Evaluation to the high-velocity hurricane zone provisions in Section 1409 of the FBC, Building and Chapter 44 of the FBC, Residential is outside the scope of this report.

Verification shall be provided that a quality assurance agency audits the manufacturers quality assurance program and audits the production quality of products, in accordance with Section (5)(d) of Florida Rule 61G20-3.008. The quality assurance agency shall be approved by the Commission (or the building official when the report holder does not possess an approval by the Commission).

4.0 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:

4.1 Data in accordance with the ICC-ES Acceptance Criteria for Reflective Insulation (AC 02), approved June 2011, editorially revised April 2014.

4.2 Data on Radiant Shield only in accordance with the ICC-ES Acceptance Criteria for Sheet Radiant Barriers (AC 220), approved September 2010, editorially revised September 2013.