

## ***DRAFT PDS-02.3***

### ***Proposed Addendum BSR/RESNET/ICC 301-2014 Addendum F-201x, Normative Appendix A***

#### **3.2–Definitions**

~~***Approved Tester***—An individual who, by virtue of training and examination, has demonstrated competence in the performance of on-site testing in accordance with requirements equivalent to Sections 802 and 803 of the *Mortgage Industry National Home Energy Rating Systems Standards ANSI/RESNET/ICC 380-2016* and who has been approved by an Approved Rating Provider to conduct such tests.~~

#### **Table 4.2.2(1) Notes**

~~(e) Tested envelope leakage shall be determined and documented using the on-site inspection protocol as specified by requirements equivalent to Section 802 of the *Mortgage Industry National Home Energy Rating Systems Standards ANSI/RESNET/ICC 380-2016* by an Approved Tester.~~

~~(e) Tested duct leakage shall be determined and documented by an Approved Tester using the protocols equivalent to those specified in Section 803 of the *Mortgage Industry National Home Energy Rating Systems Standards ANSI/RESNET/ICC 380-2016*.~~

**4.2.2.2.** Insulation Inspections: All enclosure elements for the Rated Home shall have their insulation assessed in accordance with this Standard. Installed cavity insulation shall be rated as Grade I, II, or III in accordance with the on-site inspection procedures equivalent to Normative Appendix A.

**4.2.2.2.1.** The insulation of the Energy Rating Reference Home enclosure elements shall be modeled as Grade I. The insulation of the Rated Home shall either be inspected according to procedures equivalent to Normative Appendix A or, if not inspected, shall be modeled as Grade III and shall be recorded as “not inspected” in the rating.

~~**5.1.4.1.3.** Confirmed Ratings shall be subjected to Quality Assurance requirements equivalent to Section 900 of the *Mortgage Industry National Home Energy Rating Systems Standard adopted by an Approved Rating Provider*.~~

~~**5.1.4.2.1.** For the set of Rated Homes, all Minimum Rated Features shall be field-verified through inspection and testing of a single home in the set, or distributed across multiple homes in the set, in accordance with requirements equivalent to Section 600 of the *Mortgage Industry National Home Energy Rating Systems Standard*.~~

~~**5.1.4.2.3.** Sampled Ratings shall be subjected to Quality Assurance requirements equivalent to Section 900 of the *Mortgage Industry National Home Energy Rating Systems Standard adopted by an Approved Rating Provider*.~~

## Normative Appendix A

### A-1. Insulation

In order to meet the requirements of a Grade I or Grade II insulation rating, the insulation material shall be installed in accordance with the minimum installation requirements of this Appendix and the requirements specified by ASTM standards C727, C1015, C1743, C1320, ~~and C1321, and ASTM WK41440~~ as described below in the Insulation Grading section.

Installations not complying with the minimum installation requirements of this Appendix, ~~and the relevant ASTM standard for the type insulation, and or not complying with~~ the Grade I or Grade II coverage requirements shall be considered Grade III installations. Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

#### A-1.1 Minimum General Installation Requirements:

1. Insulation shall be installed to manufacturers' recommendations ~~and industry standards~~.
2. Insulation shall be integral to or on the interior to or exterior side and in substantial and permanent contact with the primary air barrier.
3. No air spaces shall be allowed between different insulation types or systems.

Exception: When claiming the R-value of an enclosed reflective air space in accordance with ~~the ASHRAE Handbook of Fundamentals~~ 90.1-2016 Section A9-4 (or addendum ac to the 2013 edition) or ASTM C 1224.

4. Insulation shall be installed to the required density and thickness necessary to achieve the labeled R-value.
5. Insulation shall fill around obstructions including, but not limited to, framing, blocking, wiring, pipes, etc. without substantial gaps or voids.

#### A-1.2 Minimum Specific Application Requirements:

1. Insulation installed in framed floor assemblies shall be in substantial and permanent contact with the subfloor.

Exception: The floor framing-cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum wood frame wall R-value in Table 402.1.2 of the 2015 International Energy Conservation Code (IECC) and that extends from the bottom to the top of all perimeter floor framing members.

The cavity insulation between floor joists, beams or other horizontal floor supports that create cavities under the subfloor shall be permitted to be in direct contact with any additional continuous insulation attached to the underside of the horizontal supports. The combination of both cavity and continuous insulation shall meet or exceed the minimum

required floor R value in table 402.1.2 of the 2015 International Energy Conservation Code, (IECC). Instances of reflective insulation system installed beneath hydronic floors are not required to meet this standard.

2. For rim or band joist applications, insulation shall be in substantial and permanent contact with rim or band joist framing and tightly fitted to intersecting solid floor joists or extend continuously through open web floor trusses; interior sheathing or air barrier is not required provided there is an air barrier on the exterior side or the insulation material is installed as an air barrier material.
3. Air permeable insulation installed in ventilated attics and vented sloped roofs shall have an effective air barrier (wind block, air chute, or eave baffle) securely fastened and installed at the eave or soffit edge vent of every cavity. The effective air barrier shall extend up and beyond the surface of the insulation or to the ridge vent that extends up and beyond the surface of the insulation or to the ridge vent to prevent air movement through the insulation.

### **A-1.3 Minimum Specific Material Requirements:**

#### **A-1.3.1 Insulated Sheathing:**

1. If used as an air barrier, Eedges and joints shall be ~~durably~~ taped or otherwise air sealed in accordance with the manufacturer's recommendations.
2. Edges not supported directly on sheathing or framing shall be tightly fitted to one another without substantial gaps.
3. Sheathing shall be carefully fitted and ~~durably~~ taped or otherwise air sealed around obstructions in accordance with the manufacturer's recommendations.
4. When two or more layers of insulation are installed the joints shall be staggered. Only the joints of one of the exterior layers shall be required to be ~~durably~~ taped or otherwise air sealed where that layer is designated to be an air-barrier.
5. Where used as an approved water-resistive barrier (WRB), Sheathing joints, fenestration, and service penetrations shall be ~~durably~~ taped or otherwise air sealed in accordance with the manufacturer's installation instructions and have the proper approvals if used as a Weather Resistive Barrier (WRB).

#### **A-1.3.2 Fibrous Batt Insulation:**

1. Insulation shall fill the cavity being insulated side to side, top to bottom.
2. Insulation shall be enclosed on all six sides.

Exceptions:

- a. Insulation installed in attics above ceilings shall not require an air barrier on the exterior side.
- b. Insulation installed under floors directly above an unvented crawl space shall not require an air barrier on the exterior side.
- c. Insulation installed in rim or band joists located in conditioned space shall not require an air barrier on the interior side.

- d. Insulation installed on conditioned basement and crawlspace walls where an air barrier material meeting code requirements for exposed applications and tested in accordance with ASTM E2178 is installed on the interior side.
3. Faced batts shall be stapled to the face of the studs or side stapled to the studs with no buckling of the stapling tabs or the tabs shall be permitted to be left unstapled. Inset or side stapling of batt insulation shall not be permitted for Grade I installations. Faced batt products without tabs and friction fit products shall not be required to be stapled when installed in vertical walls
4. When side stapled, compression is permitted only along edges to the depth of the stapling tab.
5. Insulation shall be closely fitted around obstructions including, but not limited to, framing, blocking, wiring, pipes, etc. to avoid substantial gaps, voids or compression.

#### **A-1.3.3 Blown or Sprayed Fibrous Loose Fill Insulation:**

1. Insulation containment fabric or system that is side stapled shall not be stapled more than ½ inch back from the face of the stud.
2. Insulation shall be rolled or trimmed flat to allow installation and contact with interior sheathing or finish material.
3. Insulation shall fill the cavity being insulated, side to side, and top to bottom.
4. Blown insulation shall meet the manufacturer's stated recommendations for density and coverage in order to meet the required R value and to minimize or prevent settling. ~~Insulation shall be installed at a density sufficient to prevent settling over time.~~
5. Insulation shall be enclosed on all six sides.

##### Exceptions:

- a. Air permeable insulation installed on the top side of the ceiling in unconditioned attics shall not require an air barrier on the exterior. ~~Insulation installed in attics and ceilings shall not require an air barrier on the exterior or interior side.~~
- b. Insulation installed under floors that are directly above an unvented crawl space shall not require an air barrier on the exterior side.
- c. Insulation installed in rim or band joists located in conditioned space shall not require an air barrier on the interior side.
6. Insulation shall be installed around obstructions including, but not limited to, framing, blocking, wiring, pipes, etc. as to avoid substantial gaps, voids or compression.

#### **A-1.3.4 Open cell spray polyurethane foam (SPF) insulation:**

1. Installers shall meet the manufacturer's recommended training requirements and shall complete the online health and safety training for SPF provided by the Center for Polyurethanes Industry.
2. Spray foam shall be well-bonded to the substrate, including framing and sheathing.

3. Insulation, installed at a minimum thickness to be air impermeable per E2178 (air permeance less than 0.04 cfm/ft<sup>2</sup>) and in-contact with the substrate shall be permitted to serve as the air barrier.
4. When insulation extends beyond the wall cavity it shall be trimmed to allow installation and contact with interior sheathing or finish material.
5. Insulation shall fill the cavity to within no more than ½ inch from the face of the studs.

Exception: When the required R-value is met using a thickness that is less than the cavity depth.

#### **A-1.3.6 Closed-cell spray polyurethane foam (SPF) insulation:**

1. Installers shall meet the manufacturer's recommended training requirements and shall complete the online health and safety training for SPF provided by the Center for Polyurethanes Industry.
2. Spray foam shall be well-bonded to the substrate, including framing and sheathing.
3. Closed-cell Insulation, installed at thicknesses of 1.5 inches thick or more shall be permitted to be an air-impermeable insulation when in-contact with the substrate.

Exception: Thicknesses less than 1.5 inches considered air-impermeable with appropriate ASTM E2178 data (air permeance less than 0.04 cfm/ft<sup>2</sup>) from manufacturer data sheet or [code evaluation report by an authority having jurisdiction or approved source](#)~~ICC-ES Report.~~

#### **A-2.0 Insulation Grading**

##### **A-2.1 Grading Criteria for Batt, Loose-fill, Open and Closed Cell Polyurethane Spray Foam Insulation and Insulated Sheathing**

###### **A-2.1.1 Grade I (Minor Defects)**

Shall meet ASTM-specified installation requirements in [the applicable](#) standards C1015, [and](#) C1320, ~~and ASTM WK41440~~ and shall also meet the following cavity fill requirements:

###### **A-2.1.1.1 Batt or Loose-fill Insulation**

When installing batt, or loose-fill insulation, no more than 2% of the total insulated area (cavity) shall be compressed below the thickness required to attain the labeled R-value or contain gaps or voids in the insulation. These areas shall not be missing or compressed more than ~~½~~[3/4](#) inch of the specified insulation thickness in any given location. Voids extending from the interior to exterior of the intended insulation areas shall not be permitted.

###### **A-2.1.1.2 Open-Cell Polyurethane Spray Foam Insulation (cavity not filled and not trimmed)**

When installing open-cell polyurethane spray foam the average of all thickness measurements shall be greater than the specified thickness required to obtain the

specified R-value. No more than 2% of the insulated area shall contain voids or be more than  $\frac{3}{4}$  inch below the specified thickness. The minimum installed thickness shall not be less than 1 inch below the specified thickness at any point. Voids extending from the interior to the exterior of the intended insulation areas shall not be permitted.

#### **A-2.1.1.3 Closed-Cell Polyurethane Spray Foam**

When installing closed-cell polyurethane spray foam the average of all thickness measurements shall be greater than the specified thickness required to obtain the specified R-value. No more than 2% of the insulated area shall contain voids or be greater than  $\frac{1}{2}$  inch less than the specified thickness. The minimum installed thickness shall not be less than  $\frac{3}{4}$  inch below the specified thickness at any point. Voids extending from the interior to exterior of the intended insulation areas shall not be permitted.

#### **A-2.1.1.4 Insulated Sheathing**

Insulated sheathing insulation installations meeting the minimum installation, application, and material requirements above. Voids exceeding 1/8" through interior to exterior of the intended insulation areas shall not be permitted. Joints and other gaps or separations in sheathing used as an air barrier, vapor retarder or drainage plane shall be taped or sealed.

#### **A-2.1.2 Grade II (Moderate Defects)**

Shall meet ASTM-specified installation requirements in ASTM standards C1015, and C1320, and ASTM WK41440 and shall also meet the following cavity fill requirements:

##### **A-2.1.2.1 Batt or Loose-fill Insulation**

When installing batt, or loose-fill insulation, no more than 15% of the total insulated area (cavity) shall be compressed or contain gaps or voids in the insulation. These areas shall not be missing or compressed more than  $\frac{3}{4}$  inch of the specified insulation thickness in any given location. Inset staples are allowed for batt insulation. Voids through interior to exterior of the intended insulation areas shall not be permitted.

##### **A-2.1.2.2 Open-Cell Polyurethane Spray Foam Insulation (cavity not filled and not trimmed)**

When installing open-cell polyurethane spray foam the average of all thickness measurements shall be greater than the specified thickness required to obtain the specified R-value. No more than 15% of the insulated area shall contain voids ~~or be more than 1 inch below the specified thickness~~. The minimum thickness shall not be less than ~~1.5~~3/4 inches below the specified thickness at any point. Voids extending from the interior to the exterior of the intended insulation areas shall not be permitted.

##### **A-2.1.2.3 Closed-Cell Polyurethane Spray Foam**

When installing closed-cell polyurethane spray foam the average of all thickness measurements shall be greater than the specified thickness required to obtain the specified R-value. No more than 15% of the insulated area shall contain voids ~~or be greater than 1/2 inch below the specified thickness~~. The minimum ~~installed~~ thickness shall not be less than ~~1~~3/4 inch below the specified thickness at any point. Voids extending from the interior to exterior of the intended insulation areas shall not be permitted.

### **A-2.1.3 Grade III (Substantial Defects)**

Installations not complying with the minimum installation requirements in ASTM standards C1015, ~~and C1320, and ASTM WK41440~~ and Grade I or Grade II cavity fill requirements shall be considered a Grade III installation.

Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

### **A-2.2 Structural Insulated Panels (SIPs) Grading Criteria**

1. Sealing of panel joints shall meet the manufacturer's recommended requirements regarding the use of mastics and/or expanding foam. If the manufacturer does not have specific joint sealing details use SIPA's typical joint sealing details. SIPA details are available at [www.sips.org](http://www.sips.org).
2. Use spray foam to seal penetrations through the SIP panels.
3. Any damaged area shall be repaired.
4. All gaps and penetrations through SIPs including windows, doors, and foundation or roof connections shall be air-sealed with expanding foam compatible with the SIP materials.

### **Grade I (Minor Defects)**

Shall meet the minimum installation requirements for SIP products above and the following requirements:

1. SIP panels shall be properly aligned and unsealed penetrations extending from the interior to exterior of the panels shall not be permitted.
2. 2% or less of the total area of the SIPS panels have damage which is unrepaired, including but not limited to cutouts for electrical boxes, pipes and other penetrations.

### **Grade II (Moderate to Frequent Defects)**

Shall meet the minimum installation requirements for SIPS products above and the following:

1. Greater than 2% and less than 5% of the total area of the SIP panels have damage which is unrepaired, including but not limited to cutouts for electrical boxes, pipes and other penetrations.
2. SIP panels shall be properly aligned and unsealed penetrations extending from the interior to exterior of the panels shall not be permitted.

### **Grade III (Major Defects)**

SIP panel installations not complying with the minimum installation requirements and Grade I or Grade II requirements above shall be considered a Grade III installation.

Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

### **A-2.3 Reflective/Radiant Grading Criteria**

Regarding thermal performance claims or R-values:

1. R-value claims for the air space adjacent to a reflective insulation product shall be based on average cavity depth (where not less than 1/2"), heat flow direction which represents the application (wall, ceiling or floor), temperature of the airspace surfaces relative to the specific wall assembly, location of the airspace in the assembly, and design climate conditions.
2. When utilizing R-values claims for the air space adjacent to a reflective insulation product from the ASHRAE Handbook of Fundamentals, the enclosed airspaces shall be sealed cavities which do not to allow air flow in or out of the cavity.
3. Where utilizing R-values based on testing in accordance with ASTM C1224, the air-space shall be enclosed on all 6 sides by building components installed in the field in a manner consistent with the materials and methods used in the tested assembly, including sealing of joints between the enclosing building components if used. All other R-value claims by the manufacturer for the assembly including the airspace shall be based on ASTM C1224, the Standard Specification of Reflective Insulation. The assembly that is tested for thermal resistance shall be representative of the field assembly.
4. Reflective airspaces behind cladding or otherwise located to the exterior side of the air barrier layer for the assembly shall not claim R-values based on having an airspace.

#### **A-2.3.1 Reflective Insulation in Ceilings, Walls and Floors**

Reflective insulation products include types with multiple layers, reflective bubble, and reflective foam – refer to the manufacturer's instructions for the product's installation details.

1. The products shall be permitted to be either face or side (inset) stapled and shall be permanently attached to the framing member;
2. When side or inset stapled, reflective insulation shall be installed at the depth in the cavity to attain the required airspace(s). Refer to manufacturer's installation details for the specific application, including required airspace dimensions. Where the cavity is partitioned to provide two or more airspaces that are each claimed for R-value contribution, the attachment of the reflective material separating the spaces shall be sealed to the framing to prevent air-exchange between the two or more airspaces;
3. When face-stapled, the material width shall match the framing width (e.g. 16" wide material is used for 16" on-center framing).
  - a. Exception: Nonstandard cavity widths.
4. When face-stapled, the staple tabs shall be aligned with the direction of the framing;
5. When reflective insulation is to serve as a vapor retarder, the tabs are over-lapped or taped when face-stapled. When inset stapled, the edges shall be attached to the sides, top and bottom of the framing.
6. Reflective insulation and radiant barriers (sheet type) materials shall not be laid directly on top of the attic floor or insulation materials installed above the ceiling.
7. Reflective insulation and radiant barriers installed under slabs shall not claim R-values based on having an airspace.
8. Reflective airspaces behind cladding or otherwise located to the exterior side of the air barrier layer for the assembly shall not claim R-values based on having an air-space.



#### **A-2.3.1.1 Grade I (Minor Defects)**

Shall meet the minimum installation requirements in ASTM standard C727 and shall also the following area coverage requirements:

2% or less of the area is not insulated such that the building envelope exterior sheathing (wall) is visible from the building's interior and that air leakage is not evident between the sheathing and radiant barrier.

#### **A-2.3.1.2 Grade II (Moderate to Frequent Defects)**

Shall meet the minimum installation requirements in ASTM standard C727 and shall also the following area coverage requirements:

Greater than 2% and less than 10% of the area which is available for insulation is not insulated such that the building envelope exterior sheathing (wall) is visible from the building's interior and that air leakage is not evident between the sheathing and radiant barrier.

#### **A-2.3.1.3 Grade III (Substantial Defects)**

Installations not complying with the minimum installation requirements in ASTM standard C727 and Grade I or Grade II area coverage requirements above shall be considered a Grade III installation.

Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

#### **A-2.3.2 Attic Radiant Barriers**

Minimum Requirements:

1. Attic radiant barriers shall be installed with an airspace adjacent to the low emittance (metallic) surface(s);
2. When the radiant barrier only has one low emittance surface, it shall be on the bottom side (in the direction of the ceiling );
3. Attic and/or roof ventilation shall be maintained. Roof, gable and soffit vents shall not be covered.
4. The radiant barrier shall be installed on gable ends.
5. The radiant barrier shall be firmly secured.

Attic radiant barriers shall be permitted to be installed using one of the following three methods

RB Method 1: Deck applied – aluminum faced oriented strand board or plywood; radiant barriers applied in this manner shall be perforated.

RB Method 2: Draped – radiant barrier draped over the trusses or rafters;

RB Method 3; Truss applied – radiant barrier stapled to the bottom of the top cord of the roof truss or rafter.

#### **A-2.3.2.1 Grade I (Minor Defects)**

Shall meet the minimum installation requirements in ASTM C1743 and shall also meet the following area coverage requirements:

1. 2% or less of the roof is bare wood or does not include low-emittance.
2. 2% or less of the surface has contaminates, particles or ink on the surface (e.g. dirt, printing of product identification, etc.) reduces effectiveness.
3. Radiant barrier is installed to cover the face of the rafter (Method 3 only).

#### **A-2.3.2.2 Grade II (Moderate to Frequent Defects)**

Shall meet the minimum installation requirements in ASTM C1743 and shall also meet the following area coverage requirements:

1. 3% or greater and 10% or less of the roof is bare or does not include the radiant surface.
2. 3% or greater and 10% or less of the surface has contaminates, particles or printed information on the .
3. Radiant barrier is inset stapled (Method 3 only).

#### **A-2.3.2.3 Grade III (Substantial Defects)**

Installations not complying with the minimum installation requirements in ASTM C1743 and Grade I or Grade II area coverage requirements above shall be considered a Grade III installation.

Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

Additionally, radiant barrier installations which have the following issues shall be deemed to be Grade III:

1. Radiant barrier is not permanently attached;
2. Radiant barrier is not perforated (RB Method 1 only).

#### **A-2.3.3 Interior Attic Radiation Control Coatings (IRCCs)**

IRCC materials are a liquid applied with an emittance of 0.25 or less.

Application Requirements:

1. The IRCCS shall be in permanent contact with the underside of the roof deck and should cover the underside of all roof deck and gable surfaces.
2. The coating shall render the application surface to an overall metallic finish that in some cases retains the texture characteristics of the wood surface.
3. The coating surface shall be dry to the touch.

#### **A-2.3.3.1 Grade I (Minor Defects)**

Shall meet the minimum installation requirements in ASTM C1321 and shall also meet the following area coverage requirements:

Less than 2% of the surface is bare wood or discolored.

#### **A-2.3.3.2 Grade II (Moderate to Frequent Defects)**

Shall meet the minimum installation requirements in ASTM C1321 and shall also meet the following area coverage requirements:

Greater than 2% and equal to or less than 10% of the surface is bare wood or discolored.

#### **A-2.3.3.3 Grade III (Substantial Defects)**

Installations not complying with the minimum installation requirements in ASTM C1321 and Grade I or Grade II area coverage requirements above shall be considered a Grade III installation.

Grade III installations shall be recorded and shall be modeled as specified by Section 4.2.2.2.2 of this Standard.

#### **A-3.0 Normative References:**

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ASTM Installation Standards for Building Insulation Products

ASTM C727: Standard Practice for Installation and Use of Reflective Insulation in Building Constructions

ASTM C1015 - 06(2011)e1: Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation

ASTM C1743 – 12: Standard Practice for Installation and Use of Radiant Barrier Systems (RBS) in Residential Building Construction

ASTM C1320 - 10(2016): Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction

ASTM C1321: 15 Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction

~~ASTM WK41440: New Guide for Installation of Spray Polyurethane Foam Insulation in the Building Envelope~~