**DRAFT PDS-01**

**BSR/RESNET/ICC 301-2019 Addendum E-202x**

**Insulation Installation Grading Update**

***Modify Section 4.2.2.2.2. as follows:***

**4.2.2.2.2. Insulation Assessment**: Properly Installed insulation as defined in Appendix A, (Inspection procedures for Insulation Type and Proper Insulation installation (PII)), ~~Insulated surfaces categorized as “Grade I~~” shall be modeled such that the insulation R-Value is considered at its measured (for loose fill, spray foam, etc.), ~~or~~ labeled (when an R‐value mark is provided by the manufacturer), or installer certified value, including other adjustments~~,[[1]](#footnote-2)~~ as described in Appendix A.~~for the insulated surface area (not including framing or other structural materials which shall be accounted for separately). Insulated surfaces categorized as “Grade II” shall be modeled such that there is no insulation R-Value for 2 percent of the insulated surface area and its measured or labeled value, including other adjustments,[[2]](#footnote-3) for the remainder of the insulated surface area (not including framing or other structural materials).~~ Installed insulation that is deemed to not be properly installed (NPI) in accordance with Appendix A ~~Insulated surfaces categorized as “Grade III”~~ shall be modeled such that there is no insulation R-Value for 10~~5~~ percent of the insulated surface area and its measured or labeled value, including other adjustments as described in Appendix A. ~~,[[3]](#footnote-4) for the remainder of the insulated surface area (not including framing or other structural materials).~~ Other building materials, including framing, sheathing and air films, shall be assigned aged or settled values according to ASHRAE *Handbook of Fundamentals*. In addition, the following accepted conventions shall be used in modeling Rated Home insulation enclosures:

1. Insulation that does not cover framing members shall not be modeled as if it covers the framing. Insulated surfaces that have continuous insulation, including rigid foam, fibrous batt, loose fill, sprayed insulation or insulated siding, covering the framing members shall be assessed and modeled according to Section 4.2.2.2 and combined with the cavity insulation, framing and other materials to determine the overall assembly R-Value.

The base R-Value of fibrous batt insulation that is compressed to less than its full rated thickness in a completely enclosed cavity shall be assessed as described in Appendix A.~~according to the manufacturer’s documentation. In the absence of such documentation, use R-Value correction factor (CF) for Compressed Batt or Blanket from ACCA Manual J, 8th edition, Appendix 4.~~

Areas of an assembly having different insulation types or R-Values (including uninsulated areas in excess of 5 percent of any otherwise insulated building component) shall be modeled separately with the applicable R-Values and assembly areas associated with each different insulation situation.

The overall thermal properties of steel-framed walls, ceilings and floors shall be calculated in accordance with the modified zone method specified by Chapter 27, ASHRAE *Handbook of Fundamentals* or tested in accordance with ASTM Standard C1363. Modification of test results to add or subtract R-Values to the tested assembly that reflect differences between the tested assembly and proposed assemblies is authorized when such differences are continuous and occur outside of the cavity.

***Strike ALL of ANSI/RESNET/ICC 301-2019 Appendix A and replace with the following:***

# Normative Appendix A – Inspection Procedures for Insulation Type and Proper Insulation Installation (PII)

#  Insulation Installation Assessment

To meet the requirements of proper insulation installation, the insulation material shall be installed in accordance with the requirements outlined in this Appendix for the applicable insulation type. Installations not complying with the requirements of this Appendix shall be considered not properly installed and shall be assessed an insulation grade of Not Properly Installed per Section 4.2.2.2.2 of this Standard.

## Batt and Blanket Insulation

### Insulation R-value Assessment

Insulation shall be installed to the density and thickness required to attain the required R-Value. The base R-Value of fibrous batt insulation that is compressed to less than its full rated thickness in a completely enclosed cavity shall be assessed according to the manufacturer’s documentation. In the absence of such documentation, use “Estimated R-values for Compressed Fiber Glass Batt Insulation” (NAIMA BI506) for assessing the compressed R-value.

### Air Barrier Requirements

#### Insulation shall be enclosed with an air barrier on all six sides with permanent materials except for the following:

#### Insulation installed in vented attics above ceilings shall not require an air barrier on the exterior side.

#### Insulation installed under floors directly above an unvented crawl space or basement shall not require an air barrier on the side facing the crawl space or basement.

#### Insulation installed in rim or band joists located in conditioned space shall not require an air barrier on the interior side.

#### Insulation installed in knee walls shall not require an air barrier on the exterior side.

### Exterior Wall Insulation

#### Batt and blanket insulation shall be correctly sized or cut to fit properly on all sides without voids or gaps.

#### Batt and blanket insulation shall be fitted around wiring and plumbing, or other obstructions in the cavity, or be split into equal layers so that one layer can fit behind the obstruction, and one layer fit in front, to avoid voids and gaps.

#### Insulation shall be placed between the sheathing and the rear of electrical boxes and other obstructions that are not as deep as the cavity.

#### Wall stud cavity penetrations shall be caulked, foamed or otherwise sealed to provide a substantially air-tight envelope to between conditioned and unconditioned space. Electrical, fan or other utility boxes that penetrate the drywall or sheathing separating conditioned space from unconditioned space shall be sealed, and sealed to the surface the penetrate. All gaps in the air barrier shall be caulked, taped, or sealed..

#### Batt and blanket insulation shall be installed to fill the cavity and be in contact with the sheathing on the back, the wallboard on the front and the framing members on each side and the top and bottom plates without gaps or voids.

#### Exception: The portion of batt insulation with flanges that are inset stapled to the wallboard side of the stud and held no more than one inch from the wallboard with the remainder of the batt in contact with the wallboard. When batt and blanket insulation are cut to fit a non-standard cavity, they shall be snugly fitted to fill the cavity without gaps or voids.

#### Bottom plates of framed assemblies shall be sealed or gasketed to the subfloor or slab beneath the bottom plate.

#### Special Situations—Narrow-framed Cavities

##### Narrow spaces less than 1 inch in width at windows and door jambs, shall be filled with appropriate foam, caulk, or other air sealing product. In cases where the manufacturer's warranty would be void if minimally expansive foam is used to seal the gap between the window frame or door jamb, batt insulation cut to width and snugly fitted in the space.

##### Narrow spaces 1 inch to less than 2 inches in width, including between studs at building corners, and at the intersection of interior partition walls to exterior walls, shall be filled with insulation snugly fitted in the space.

#### Special Situations--Kneewalls and Skylight Shafts

##### Insulation for all kneewall and skylight shafts shall be completely enclosed by vertical and horizontal framing, including horizontal plates at top and bottom of the insulation.

## Ceiling Insulation

#### Blocking/air barrier shall be placed over all drop ceiling areas and interior wall cavities to keep insulation in place. If the area is framed and has a proper air barrier in place, the entire drop area may be insulated to the required R-value.

#### An effective air barrier (wind blocks, air chutes or eave baffles) shall be securely fastened at eaves or soffit vents of vented attics to keep insulation from blocking eave ventilation and to prevent air movement from bypassing the air barrier and entering under the insulation. The effective air barrier shall extend up and beyond the surface of the insulation or to the ridge vent.

#### Facings and insulation shall be kept away from combustion appliance flues and recessed lights in accordance with manufacturer's installation instructions or product labels.

#### Special Situations--Enclosed Rafter Ceilings

##### In vented rafter ceilings, an air space shall be maintained between the insulation and roof sheathing as specified by IRC Section R806.3 or as specified by the local building code.

##### Where insulation is installed in unvented rafter ceilings or to the underside of unvented roofs, the air barrier shall be uniform across the transition of roof to wall. The insulation shall be in contact with the air barrier.

#### Special Situations--HVAC Platform

##### Batt and blanket insulation shall be installed under HVAC platforms to the required R-value without gaps or voids. If necessary, HVAC platforms shall be raised to accommodate the required ceiling insulation.

#### Special Situations--Attic Access

##### Permanently attach rigid board insulation or batt or blanket insulation with the required R-value to the access door using adhesive or mechanical fastener. The bottom of the attic access shall be gasketed to prevent air leakage of conditioned air to the unconditioned attic.

#### Special Situations--Below Roof Deck Insulation (Unvented Attics)

##### If installed in an unvented attic, insulation shall be installed as specified by IRC Section R806.5.

##### Below roof deck insulation consisting of batts that nominally fill the cavity space between roof framing members shall be stapled, or supported with cabling, tension rods, or other approved support measures which maintain the batt uniformly against the roof deck.

##### Batts with facing directed to the attic space shall be face stapled. Inset stapling of underside batts is not allowed in this application.

##### Batts supported with cabling, tensions rods, or other methods supporting the batt from below shall be supported at intervals less than or equal to 16", and no further than 8" from the end of the batt. Batts that are directly stapled through the insulation material to the roof deck shall maintain the batt uniformly in full contact against the roof deck.

##### When the batt thickness nominally exceeds the depth of the roof framing members, full-width batts must be used.

##### In unvented attics, where insulation is applied directly to the underside of the roof deck, framing for gable ends that separate the unvented attic from the exterior or unconditioned space shall be insulated to meet or exceed the required wall R-value.

#### Special Situations--Below Roof Deck Insulation (Vented Attics)

##### For vented attics, below deck batt or blanket insulation shall be installed in a manner that does not obstruct eave, ridge, or other vents to allow for adequate attic ventilation. The required net free ventilation area of all eave and roof vents shall be maintained. Eave vent baffles shall be installed per A-2.1.4.2.

## Floor Insulation

#### Batt and blanket insulation shall be in full contact with the air barrier.

#### Faced batts or blankets shall be placed toward the living space and be in contact with the underside of the floor sheathing. Continuous support shall be provided to keep the facing in contact with the floor sheathing. The insulation shall be properly supported by stapling of flanges, netting, or other method approved by the manufacturer and required codes for the product.

#### Batt and blanket insulation shall be properly supported to avoid gaps or voids.

#### Special Situations--Rim and Band Joists

##### All rim and band joists shall be insulated to the same R-value as the exterior walls.

##### Insulation shall be in permanent contact with rim or band joist framing and tightly fitted to intersecting solid floor joists, I-joists or extend through open web floor trusses.

#### Special Situations— Garages or Other Unconditioned Spaces

##### On floors that are over unconditioned spaces, or where there is an air space between the insulation and the subfloor, the rim or band joist shall be insulated to the same R-value as exterior walls.

##### For dwelling units with conditioned space over other unconditioned spaces, the separation between conditioned space and the unconditioned space shall be insulated to create a continuous thermal boundary. All rim and band joists adjoining conditioned space shall be airtight and insulated to the same R-value as exterior walls.

##### For dwelling units with unconditioned space over unconditioned spaces, the band joist where the other unconditioned space transitions shall have an air barrier installed in full contact with the thermal boundary.

## Blown or Sprayed Fibrous Loose Fill Insulation

### Insulation R-value Assessment

#### Insulation shall be installed to the density and thickness required to attain the required R-Value.

#### Walls. The rater shall verify the manufacturer specified density for the required R-value through verification of the installer’s insulation installation certificate.

#### Ceilings. The rater shall verify the insulation depth indicated as independently measured against manufacturer specified depth for R-value as indicated by properly installed attic rulers.

### Air Barrier Requirements

#### Insulation shall be enclosed with an air barrier on all six sides with permanent materials except for the following:

#### Insulation installed in ventilated attics above ceilings shall not require an air barrier on the exterior side.

#### Insulation installed under floors directly above an unvented crawl space or basement shall not require an air barrier on the side facing the crawl space or basement.

#### Insulation installed in rim or band joists located in conditioned space shall not require an air barrier on the interior side.

#### Insulation installed in knee walls shall not require an air barrier on the exterior side.

### Exterior Wall Insulation

#### Insulation shall fill the cavity side-to-side, top-to-bottom, and front-to-back without gaps or voids.

#### Insulation shall be installed so that it will be in full contact with the air barrier.

#### Insulation shall be installed to completely fill around wiring, plumbing, and other obstructions.

#### Insulation shall fill between the exterior sheathing and the rear of electrical boxes and junction boxes.

#### Bottom plates of framed assemblies shall be sealed or gasketed to the subfloor or slab beneath the bottom plate.

#### Special Situations—Narrow-framed Cavities

##### Narrow spaces less than 1 inch in width at windows and door jambs, shall be filled with the appropriate foam, caulk, or other air sealing product. In cases where the manufacturer's warranty would be void if minimally expansive foam is used to seal the gap between the window frame or door jamb, batt insulation cut to width and snugly fitted in the space.

#### Narrow spaces 1 inch to less than 2 inches in width, including between studs at building corners, and at the intersection of interior partition walls to exterior walls, shall be completely filled with insulation snugly fitted in the space.

#### Special Situations--Kneewalls and Skylight Shafts

##### Insulation for all kneewall and skylight shafts shall be completely enclosed by vertical and horizontal framing, including horizontal plates at top and bottom of the insulation.

## Ceiling Insulation

#### Insulation shall be installed so that it will be in contact with the air barrier.

#### An air barrier or blocking shall be placed over all drop ceiling areas and interior wall cavities to keep insulation in place. If blocking is missing or incomplete, it shall be completed before insulation is installed. If the area is framed and has a proper air barrier in place, the entire drop area may be insulated to the required R-value.

#### An effective air barrier (wind blocks, air chutes, or eave baffles) shall be securely placed at eaves or soffit vents of vented attics to keep insulation from blocking eave ventilation and to prevent air movement from bypassing the air barrier and entering under the insulation. The effective air barrier shall extend above the insulation.

#### Insulation shall be kept away from combustion appliance flues and recessed lights in accordance with manufacturer's installation instructions or product labels.

#### Insulation shall surround obstructions such as cross-bracing and wiring.

#### Insulation shall be installed to cover the exterior wall top plate.

#### Special Situations--Enclosed Rafter Ceilings

##### In vented rafter ceilings, an air space shall be maintained between the insulation and roof sheathing as specified by IRC Section R806.3, or as specified by the local building code.

##### Where insulation is installed in unvented rafter ceilings or to the underside of roof sheathing the air barrier shall be uniform across the transition of roof to wall. The insulation shall be in contact with the air barrier.

#### Special Situations--HVAC Platform

##### Loose-fill insulation shall be installed under HVAC platforms to the full depth and required R-value, without gaps. If necessary, HVAC platforms shall be raised to accommodate ceiling insulation.

##### Permanently attach insulation with the required R-value to the access door using adhesive or mechanical fastener. The bottom of the attic access shall be gasketed to prevent air leakage of conditioned air to the unconditioned attic.

#### Special Situations--Below Roof Deck Insulation (Vented and Unvented Attics)

##### For vented attics, below deck loose-fill insulation shall be installed in a manner that does not obstruct soffit, eave, ridge or other vents to allow for adequate attic ventilation. Baffles shall be used to provide ventilation space from soffit to ridge. At the soffit, baffles shall be installed per A-2.1.4.2.

##### Where installed, netting shall be secureded around conduit, plumbing, roof penetrations and all other obstructions that penetrate the netting.

##### Loose-fill insulation shall be installed uniformly in the netted cavity side-to-side, top-to-bottom, and front-to-back and be in continuous contact with the roof sheathing or continuous baffle material.

#### Loose-fill insulation shall be installed to fit around wiring, conduit, plumbing, and other obstructions.

### Floor Insulation

#### Insulation shall be in full contact with the air barrier.

#### Insulation shall completely fill around wiring, plumbing, and other obstructions.

#### Insulation shall be properly supported where necessary to avoid sagging, gaps, and voids.

#### Special Situations— Garages

##### On floors that are over unconditioned spaces, or where there is an air space between the insulation and the subfloor, the rim or band joist shall be air sealed and insulated to the same R-value as exterior walls.

##### For dwelling units with conditioned space over unconditioned spaces, the separation between conditioned space (house) and unconditioned space shall be insulated to create a continuous thermal barrier. All rim and band joists adjoining conditioned space shall be airtight and insulated to the same R-value as exterior walls.

##### For dwelling units with no conditioned space over unconditioned spaces, the band joist where the unconditioned space transitions to an attic above conditioned space shall have an air barrier installed in full contact with the edge of the attic insulation.

## Medium Density Spray Polyurethane Foam Insulation

### Insulation R-value Assessment

#### Substantiating data must be provided on a technical data sheet (TDS) provided by the manufacturer or a code compliance report (CCR) prepared by an approved product certification organization per ISO-17065 or other authority having jurisdiction.

#### Minor variations in thickness are common with spray applied insulation. The object of the field assessment is to verify applications are code compliant and to obtain the average thickness of the installation. A pin and disc depth gauge, such as described in ASTM C167, shall be used to measure the average thickness of installed SPF. Alternatively, where structural elements extend through the foam, the average thickness can be determined by measuring the space between the surface of framing members and the surface of the foam.

#### Average thickness shall be measured once every 100 square feet evenly distributed (e.g. at the top, middle, and bottom of the assembly.) These measurements shall be averaged to get the reference thickness for each assembly.

* 1. In cases where a specification requires a minimum thickness or R-value, the average reference thicknesses shall not be below the minimum thickness minus 10%.
	2. No individual measurement shall fall below 25% variance per inch for a total installed thickness of up to and including 4 inches.
	3. No individual measurement shall fall below 1” of the specified thickness for total installed thicknesses of over 4 inches.

#### Medium density SPF shall be well-bonded to the substrate, including framing and sheathing.

1. Visible cracks less than 1mm in width shall be sealed with one-component polyurethane foam or similar.
2. Cracks or gaps may not exceed 1mm in width.
3. No cracks may extend from the substrate to the surface of the SPF.
4. The SPF shall have no signs of shrinkage, including pulling away from the substrate or framing.
5. SPF shall be well-adhered to the substrate. At least one check should be performed by the installer with results provided to the reviewer. The adhesion check may be performed using a coring tool. The removed foam square shall be replaced and sealed with one-component polyurethane foam or using a method recommended by the SPF manufacturer.

#### The exterior of the medium density SPF shall have a uniform and consistent appearance and texture, including color, and surface characteristics. The cured SPF should be solid and depress no more than ¼” when finger pressure is applied.

### Exterior Wall (Continuous) Insulation

#### Medium density SPF shall be permitted to be used as continuous insulation, air barrier, and water resistive barrier when installed at sufficient thickness (as referenced on the product’s TDS or CCR) on the exterior surface of a building with compatible transitions to windows, doors, flashings, etc. and without cracks, gaps, or voids that may prevent the building envelope from being sufficiently air and vapor-tight.

1. When installed on the exterior of a building, medium density SPF must meet the minimum thickness required for it to be considered an air barrier, or a separate air barrier must be installed.
2. Medium density SPF may be considered a water-resistive barrier (WRB). Refer to the TDS or CCR for the specific product. If WRB approvals are not listed, a separate WRB must be installed, either over or behind the medium density SPF.

### Exterior Wall (Interior Cavity Insulation)

#### Medium density SPF shall be permitted to be used as a component of the air barrier and vapor retarder when installed at sufficient thickness (as referenced on the product’s TDS or CCR) in interior cavities of exterior walls and without cracks, gaps, or voids that may prevent the building envelope from being sufficiently air- and vapor-tight.

#### In hybrid walls, consisting of a layer of medium density SPF along with air permeable cavity insulation, a supplemental vapor retarder shall not be required, provided the thickness of medium density SPF conforms to the requirements of IRC Table R702.7.1.

### Basement or Crawl Space

#### Medium density SPF on basement or crawl space walls shall be permitted to serve as a component of a continuous air barrier when it is in continuous and substantial contact with the substrate and all framing members and meets the minimum thickness for an air barrier as referenced on the product’s TDS or CCR.

#### If “stand off wall” framing is being used, a percentage of the installed thickness of spray foam qualifies as “continuous” insulation and the remainder as cavity insulation. Consult installation details for information on framing dimensions and stand-off distance.

#### Medium density SPF installed continuously on the exterior side of foundation walls shall meet the following requirements:

1. Permanent, rigid, and opaque protection from ultraviolet light (sunlight) is provided. The protective covering must cover the exposed, above-grade portion of the insulation and extend at least 6 inches below grade per IECC Section R303.2.1.
2. 6 inches of ground clearance shall be maintained between below grade SPF and untreated wood framed assemblies.

### Under Slab

#### Medium density SPF under slab on grade foundations and non-structural slabs shall be permitted to serve as a component of a continuous air barrier when it is in continuous and substantial contact with the grade and where it meets the minimum thickness for an air barrier as referenced on the product’s TDS or CCR.

### Vented Attics

#### Air-permeable (i.e. medium density SPF installed below the minimum specified thickness for an air barrier) insulation installed in ventilated attics and vented sloped roofs shall have an air barrier properly installed at the eave or soffit edge vent of each cavity.

#### Medium density SPF installed on the floor of a vented attic must be installed to at least the minimum thickness to qualify as an air-impermeable material as referenced on the product’s TDS or CCR. Supplemental air permeable insulation may be added to achieve desired R-value.

### Unvented Attics

#### Medium density SPF used as a component of an unvented attic assembly shall be installed at or above the minimum thickness required for an air barrier and vapor retarder (where required), as referenced on the product’s TDS or CCR. When this application is utilized, an additional air barrier shall not be required.

#### Hybrid assemblies (i.e. combining medium density SPF and air permeable insulation) should contain sufficient medium density SPF to meet the requirements of IRC Table R806.5 for condensation control.

### Framed Floor Assemblies

#### Medium density SPF installed in framed floor assemblies shall be in substantial contact with either the subfloor above or sheathing or continuous insulation installed on the bottom of the floor framing. In both cases, medium density SPF shall be installed to at least the minimum thickness to qualify as an air-impermeable material as referenced on the product’s TDS or CCR and cover the entirety of all exposed surfaces of floor framing members adjacent to the exterior, including rim or band joists.

### Rim or Band Joists

#### Medium density SPF installed in rim or band joist applications shall be in continuous and permanent contact with all framing members. SPF may extend to intersecting floor joists or trusses and I-joists. Medium density SPF installed in rim or band joist applications shall be installed at a thickness to qualify as an air barrier as referenced on the product’s TDS or CCR.

## Low Density Spray Polyurethane Foam Insulation

### Insulation R-value Assessment

#### Substantiating data must be provided on a technical data sheet (TDS) provided by the manufacturer and/or a code compliance report (CCR) prepared by an approved product certification organization per ISO-17065 or other authority having jurisdiction.

#### Low density SPF shall be well-bonded to the substrate, including framing and sheathing, without cracks or gaps between the SPF and any substrate it is in contact with.

* 1. When application extends the full thickness of the cavity, low density SPF shall be trimmed to facilitate installation of interior sheathing or finish material.
	2. No more than 10% area shall be filled below the required thickness in the cavity.
	3. No more than 20% of the trimmed foam shall contain visible gaps or voids, and no voids may extend from the interior sheathing to the exterior of the cavity.
	4. The foam shall have no signs of shrinkage, such as pulling away from the substrate or framing.
	5. At least one adhesion check shall be performed by installing contractor (either witnessed by or with results provided to reviewer) to determine whether there is a gap between the SPF and the substrate in at least one location per job site. A 5-inch square shall be cut out of the center of a cavity and removed. If there is significant resistance when removing the square, or if the foam breaks before it lifts off the substrate, the adhesion shall be recorded as proper. If there is no resistance when removing the square, a gap behind the SPF shall be measured. Gaps may not exceed ½”. The removed foam square shall be replaced and sealed with one-component polyurethane foam or product recommended by the manufacturer.

#### Low density SPF may also be sprayed to less than the full thickness of the cavity when specified. Low density SPF rarely has a completely flat surface profile. A pin and disc depth gauge, such as described in ASTM C167, shall be used to measure the thickness of installed SPF. Alternatively, where structural elements extend through the foam, the average thickness can be determined by measuring the space between the surface of framing members and the surface of the foam.

1. A pin and disc depth gauge, as described in ASTM C167, shall be used to measure the average thickness of installed SPF.
	* 1. Average thickness shall be measured once every 100 square feet evenly distributed (e.g. at the top, middle, and bottom of the assembly.) These measurements shall be averaged to get the reference thickness for each assembly.
2. In cases where a specification requires a minimum thickness or R-value, the average reference thicknesses shall not be below the minimum thickness minus 10%.
3. No individual measurement shall fall below 25% variance per inch for a total installed thickness up to and including 4 inches.
4. No individual measurement shall fall below 1” of the specified thickness for total installed thicknesses of over 4 inches.

#### The exterior of the SPF shall have a uniform and consistent appearance and texture, including color, and surface characteristics.

#### Low density SPF shall be permitted to serve as a component of a continuous air barrier when it is in continuous and substantial contact with the substrate and all framing members and meets the minimum thickness for an air barrier as referenced on the product’s TDS or CCR.

#### Low density SPF is vapor permeable. A supplemental vapor retarder (e.g. polyethylene sheeting or vapor retarder paint) may be required in assemblies requiring vapor retarder protection in certain climate zones (e.g. Climate zones Marine 4-8).

### Exterior Wall (Interior Cavity Insulation)

#### Low density SPF shall be permitted to be used as cavity insulation and a component of the air barrier when installed at sufficient thickness (as referenced on the product’s TDS or CCR) in interior cavities of exterior walls and without cracks, gaps, or voids that may prevent the building envelope from being sufficiently air-tight.

#### Low density SPF shall be permitted to be used as its own Class III vapor retarder when installed at sufficient thickness (as referenced on the product’s TDS or CCR) in interior cavities of exterior walls conforming to IRCC Table R702.7.1. A supplemental Class I or II vapor retarder may not be required in these cases.

### Basement or Crawl Space

#### Low density SPF on basement or crawlspace walls shall be permitted to serve as a cavity insulation component of a continuous air barrier when it is in continuous and substantial contact with the substrate and all framing members and meets the minimum thickness for an air barrier as referenced on the product’s TDS or CCR.

#### Low density SPF on the interior can be permitted with non-structural framing and installed directly against the structural wall (providing cavity insulation only) or at a “stand-off” distance from exterior walls so as to provide room for SPF to flow behind framing and thermally isolate the interior from the exterior wall (providing cavity and continuous insulation).

### Vented Attics

#### Air-permeable (i.e. low density SPF installed below the minimum specified thickness for an air barrier) insulation installed in ventilated attics and vented sloped roofs shall have an air barrier properly installed at the eave or soffit edge vent of each cavity.

#### Low density SPF may be installed as an air-sealing material on the floor of a vented attic (e.g. at eaves and along wall top plates) and then covered with additional air-permeable insulation. Low density SPF must be installed at least to the minimum thickness to qualify as an air-impermeable material.

### Unvented Attics

#### Low density SPF may be used as a component of an unvented attic assembly when installed at or above the minimum thickness required for an air barrier (as referenced on the product’s TDS or CCR). When this application is utilized, an additional air barrier is not required and should be avoided.

#### A supplemental vapor retarder may be required in Climate Zones Marine 4 through 8 per IRC Section R806.5.

### Framed Floor Assemblies

#### Low density SPF installed in framed floor assemblies shall be in substantial contact with either the subfloor above or sheathing or continuous insulation installed on the bottom of the floor framing. In both cases, low density SPF at a thickness to qualify as an air barrier must cover the entirety of all exposed surfaces of floor framing members adjacent to the exterior (e.g. rim or band joists).

#### Subfloors and floor finishes typically provided needed vapor retarder protection.

### Rim or Band Joists

#### Low density SPF installed in rim or band joist applications shall be in continuous and permanent contact with all framing members. SPF may extend to intersecting floor joists or trusses and I-joists. Low density SPF installed in rim or band joist applications shall be installed at a thickness to qualify as an air barrier (as referenced on the product’s TDS or CCR.

#### Low density SPF shall be permitted to be used as its own Class III vapor retarder when installed at sufficient thickness (as referenced on the product’s TDS or CCR in interior cavities of exterior walls conforming to IRCC Table R702.7.1. A supplemental Class I or II vapor retarder may not be required in these cases.

## Interior Radiation Control Coating (IRCC)

### Interior Radiation Control Coating Thermal Performance Assessment

#### The emittance of the IRCC shall be no more than 0.25.

### Roof Assembly Application

#### The IRCC shall be sprayed, roller applied, or brushed to the underside of a roof assembly.

#### The IRCC shall be applied to the exposed gable end wall and other vertical surfaces within the roof assembly.

#### The installed IRCC shall face an air space.

#### The installed IRCC shall be dry to the touch when cured.

## Radiant Barrier

### Radiant Barrier Thermal Performance Assessment

#### The emittance of radiant barriers shall be less than or equal to 0.10.

### General Requirements

####  The low emittance, metallic surface(s) of the radiant barrier shall be adjacent to a ventilated air space and face the interior of the attic.

#### The radiant barrier shall be laminated to a substrate or securely fastened to the roof assembly.

#### Radiant barriers shall not be installed on the attic floor or attic floor insulation.

#### The downward facing surface of the radiant barrier shall be free from contamination which includes but not limited to; dirt, pollen, fly ash, or scarring from storage or installation.

### Roof Assembly Application

#### Radiant barriers in roof assemblies shall be installed in one of the following methods:

#### Radiant barrier roof decking with the low emittance material laminated or fasten to OSB or plywood. The low emittance material shall be perforated.

#### Radiant barrier draped over the truss or rafter prior to the installation of decking.

#### Radiant barrier shall be attached to the side or bottom of the truss top chord or rafter.

#### The radiant barrier shall be installed in gable end walls and other vertical surfaces in the attic.

#### The installation of a radiant barrier shall not interfere with attic/roof ventilation.

## Reflective Insulation

### General Installation Requirements

#### Reflective insulation assemblies shall be installed in enclosed cavities that are unventilated.

#### Where necessary, reflective insulation shall be cut to fit as required to provide coverage without gaps or openings.

#### Any penetrations or cuts from damage shall be repaired with an acrylic adhesive foil tape.

### Exterior Wall Insulation

#### Cavities shall be in code compliance with air barrier requirements prior to the installation of the reflective insulation.

#### Reflective insulation shall be firmly attached to the cavity framing member.

#### The reflective insulation shall match the width of the framing and be installed at the depth in the cavity as specified by the manufacturer to attain the required airspace(s).

#### For multi-airspace cavity designs, reflective insulation shall be installed without any gaps where attached to the framing to minimize air exchange between the enclosed air spaces.

#### Reflective insulation installed as a vapor retarder shall be securely attached to the sides, top and bottom of the framing.

#### Special Situations—Non-standard Cavities

#### Reflective insulation shall be cut to the dimensions of non-standard width cavities and installed in accordance with manufacturer’s installation instructions.

#### Spaces less than one inch in width at windows and door jambs that are not airtight shall be filled with appropriate foam, caulk or other air sealing product.

#### Spaces one inch to less than two inches in width, such as between studs at the building corners, or at the intersection of interior partition wall to exterior walls, shall have reflective insulation appropriately installed or be filled with appropriate foam, caulk or other air sealing product.

### Floor Insulation

#### Reflective insulation shall be installed either face or side (inset) stapled to the cavity framing.

#### Reflective insulation shall match the width of the framing and be installed at the depth in the cavity specified by the manufacturer.

#### For multi-airspace cavity designs, reflective insulation shall be installed without any gaps where attached to the framing to minimize air exchange between the enclosed air spaces.

#### Reflective insulation installed as a vapor retarder shall be securely attached to all the sides on the bottom of the framing.

#### Special Situations—Non-standard Cavities

#### The reflective insulation shall be cut to the dimensions of non-standard width cavities and installed in accordance with the standard cavity installation instructions. An acrylic adhesive foil tape shall be used to repair penetrations or cuts.

## Foam Plastic Insulating Sheathing (FPIS)

### General Installation Requirements

#### FPIS shall be installed on the interior or exterior of the building envelope, or integral to any opaque surface of the building envelope as indicated by approved construction plans.

#### FPIS shall be installed to meet or exceed the minimum R-value or maximum U-factor required by approved construction plans complying with the applicable code.

#### FPIS shall be installed substantially free of gaps, voids or misalignments at the joint edges and at penetrations or other obstructions.

#### FPIS shall be installed in substantial contact with, and securely to, any substrate or the framing surface.

#### Damage to FPIS during installation in the form of breakage, substantial puncture or other damage that results in the material’s inability to achieve the specified performance shall be repaired or replaced.

### Continuous Insulation Application Requirements

#### FPIS shall be installed continuously across all structural members with no thermal bridges other than fasteners and service openings.

#### When required by the applicable code, FPIS shall be installed in two or more layers with the edge joints between each layer staggered.

### Specific Insulation Requirements

#### Above-Grade Exterior Walls

#### When FPIS is specified as an air barrier and/or water-resistive barrier, the joint edges and joints around penetrations or obstructions shall be sealed in accordance with the manufacturer’s installation instructions.

#### Above-Deck Roofs

#### FPIS shall be installed in accordance with the roof covering or shingle manufacturer’s installation instructions, including instructions for venting.

#### Holes, gaps and penetrations in the roof deck shall be sealed to prevent air leakage.

#### Floors Over Unconditioned Space

#### FPIS shall be installed on the underside of the floor framing in direct contact with the specified cavity insulation to meet or exceed the specified R-value or U-factor.

#### Basement Walls

#### For exterior applications, the foundation wall shall be damp proofed or water proofed in accordance with the applicable code, prior to installing FPIS.

#### Crawlspace Walls

#### FPIS shall be installed in accordance with applicable code requirements in areas of very heavy termite infestation probability to allow for required termite or other pest inspections.

#### Below-Slab

#### When installed as a vapor retarder, the joint edges of FPIS shall be sealed in accordance with the manufacturer’s installation instructions.

#### When a separate vapor retarding material is installed, the joint edges of FPIS are not required to be sealed.

#### Slab Edge

#### FPIS shall be installed vertically from the top of the slab down to the depth specified in accordance with the applicable code or horizontally inward from the edge of the slab to the length specified in accordance with applicable code.

#### When the slab is poured separately from the exterior foundation wall and slab edge insulation is installed between the floor slab and the foundation wall, FPIS may be installed by cutting the top of the material at a 45-degree angle away from the exterior wall to protect the upper edge with concrete.

#### Kneewall and Skylight Shaft

#### When FPIS is installed as an air barrier to cover the backside of air permeable insulation that is otherwise exposed to the unconditioned space, the joint edges of FPIS shall be sealed.

#### Cavity Wall or Space

#### FPIS shall be installed against adjoining framing members or other substrate with no substantial gaps and secured to remain in place.

#### Insulated Header

#### FPIS may be installed between the framing members or to one side of the framing members.

#### Attic Hatch and Door

#### FPIS shall be installed to meet or exceed the required R-value or U-factor of the surrounding area unless an alternative value or factor is allowed by the applicable code.

#### FPIS shall be installed securely to remain in place and allow for the intended operation of the attic hatch or door.

## Structural Insulated Panel

### General Requirements

#### Sealing of panel joints shall meet the manufacturer's requirements. Where the manufacturer does not have specific joint sealing details, the Structural Insulated Panel Association’s (SIPA) typical joint sealing details shall be used.

#### SIP panels shall be properly aligned and unsealed penetrations extending from the interior to exterior of the panels shall not be permitted.

#### 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.

1. ~~(Informative Note) Such as compression and cavity fill versus continuous.~~ [↑](#footnote-ref-2)
2. ~~(Informative Note) Such as compression and cavity fill versus continuous.~~ [↑](#footnote-ref-3)
3. ~~(Informative Note) Such as compression and cavity fill versus continuous.~~ [↑](#footnote-ref-4)