RESNET
INSULATION GRADING CRITERIA
DRAFT




Presented by:

Charles Cottrell

Vice President Technical Services, NAIMA

Chairman, RESNET Insulation Council

NAIMA NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

Requirements Affecting Insulation

DRAFT

RESNET Insulation Grading Criteria

- Purpose of the Council
- RESNET Insulation Council Members
- Insulation Requirements
- Grading Criteria

ICC Energy Code Requirements Affecting Insulation

RESNET
Residential Energy Service Network
Setting the Standards for Quality

Insulation Grading Criteria

DRAFT

NAIMA
NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

Insulation Grading Criteria

Purpose of the Council

- Clarify and Update Current Grading Criteria in Appendix A of RESNET's 2006 *Mortgage Industry National Home Energy Rating Systems Standards*
- Add Criteria for Insulation Materials Not Currently in the RESNET Appendix
- Develop Commentary

Insulation Grading Criteria

RESNET Insulation Council Members

- BIBCA
- CIMA
- ICAA
- Insulate America
- NAIMA
- NICE
- SPFA
- RIMA

DRAFT

Insulation Grading Criteria

Minimum General Requirements

1. Installed to manufacturers' recommendations and industry standards.
2. Integral to or interior to and in substantial and permanent contact with the primary air barrier
3. No air spaces between different insulation types or systems.
   Exception: *Reflective air space in accordance with ASHRAE Handbook or ASTM C1224*
4. Installed to the required density and thickness necessary to achieve the required R-value
5. Fill around obstructions including framing, blocking, wiring, pipes, etc. without substantial gaps or voids.

DRAFT

Insulation Grading Criteria

Minimum Specific Material Requirements

1. Framed floor assemblies – Insulation must be in substantial and permanent contact with the subfloor.

   Exception: *Reflective air space in accordance with ASHRAE Handbook-Fundamentals or ASTM C1224*

2. Rim or band joist applications – Insulation must be in substantial and permanent contact with exterior framing; interior sheathing or air barrier. Not required provided there is an air barrier on the exterior side.
3. Ventilated attics and sloped roofs - Air permeable insulation must have an effective air barrier (wind block, air chute, or eave baffle) installed at the eave or soffit edge to prevent air movement through the insulation.

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Insulated Sheathing* ◆

1. Edges and joints durably taped/air sealed.
2. Edges tightly fitted against one another without substantial gaps.
3. Carefully fitted and durably taped/air sealed around obstructions.
4. With two or more layers - the joints must be staggered. Only the joints of the exterior layer need to be durably taped/air sealed.
5. Tape or air seal joints and have the proper approvals if used as a Weather Resistive Barrier (WRB)

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Batt Insulation*◆

NAIMA NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Batt Insulation* ◆

1. Insulation must fit the cavity being insulated side to side, top to bottom.
2. Enclosed on all six sides.

Exceptions:

a. *Attics above ceilings don't require an air barrier on the exterior side.*
b. *Under floors directly above an unvented crawl space don't require an air barrier on the exterior side.*
c. *Rim or band joists located in conditioned space don't require an air barrier on the interior side a - verify vapor and air barriers meet local code requirements.*
d. *Conditioned basement/crawlspace walls when an air barrier material meeting combustibility requirements and tested for air permeability is installed on the interior side.*

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Batt Insulation* ◆

3. Faced batts must be stapled to the face of the studs or side stapled to the studs with no buckling. The tabs can be left unstapled. Faced batt products without tabs and friction fit products don't need to be stapled in vertical walls.
4. When side stapled, compression is permitted along edges to the depth of the stapling tab.
5. Closely fit insulation around obstructions like framing, blocking, wiring, pipes, etc. to avoid substantial gaps, voids or compression.

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Blown or Sprayed Loose Fill Insulation* ◆

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Blown or Sprayed Loose Fill Insulation* ◆

1. Containment fabric or system that is side stapled - can't be stapled more than ½ inch from the face of the stud.
2. Insulation must be rolled or trimmed to allow installation of the interior finish material. (cellulose and MF blown with adhesive)
3. Attic rulers installed IAW with the codes.
4. Fill the cavity side to side, and top to bottom.
5. Density sufficient to prevent settling.

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Blown or Sprayed Loose Fill Insulation* ◆

6. Enclosed on all six sides.

   Exceptions:

   a. *In attics and ceilings - air barrier on the exterior or interior side.*
   b. *Under floors directly above an unvented crawlspace don't require an air barrier on the exterior side.*
   c. *Rim or band joists located in conditioned space don't require an air barrier on the interior side*

7. Installed around all obstructions including framing, blocking, wiring, pipes, etc. to avoid substantial gaps, voids or compression.

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Hybrid Insulation Systems* ◆

1. Hybrid systems, composed of 2 or more insulation types - The individual components must meet the minimum requirements for each material type.
2. Individual components are graded using the grading criteria for the material types. The Grade of the system will be the worst of any individual grade of the components.
3. Combined R-value of the insulation materials must meet the minimum R-value specified. Confirm the system components comply with manufacturer's installation instructions.

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Open Cell Spray Polyurethane Foam (SPF) Insulation* ◆

NAIMA NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Open Cell Spray Polyurethane Foam (SPF) Insulation* ◆

1. Installers must meet training requirements and complete the online H&S training by the Center for Polyurethanes Industry.
2. Well-bonded to the substrate, including framing and sheathing.
3. Permitted as the air barrier - When installed at the minimum thickness to be air impermeable and in-contact with the substrate.
4. Trim excess to allow installation and contact with interior finish.
5. Fill the cavity to within 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.*

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Closed-Cell Spray Polyurethane Foam Insulation* ◆

NAIMA NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

DRAFT

Insulation Grading Criteria

Minimum Specific Application Requirements

◆ *Closed-Cell Spray Polyurethane Foam Insulation* ◆

1. Installers must meet training requirements and complete the online H&S training by the Center for Polyurethanes Industry.
2. Well-bonded to the substrate, including framing and sheathing.
3. Can be the air barrier when installed at thickness of 1.5 inches or more and can be an air-impermeable insulation when in-contact with the substrate.

Exception: *Thicknesses less than 1.5 inches considered air-impermeable with appropriate test data from or ES Report.*

NAIMA NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Batt, Loose-fill, Open Cell SPF – *Cavity filled & trimmed*

Batt, loose-fill, or open cell polyurethane spray foam can't have more than 2% of the total insulated area compressed. Or contain gaps or voids in the insulation.

These areas can't be missing or compressed more than ½ inch of the nominal thickness in any given location.

Voids cannot extend from the interior to exterior of the intended insulation area.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Open-Cell SPF - *cavity not filled and trimmed*

The average of all thickness measurements ≥ the specified thickness for the R-value.

No more than 2% of the insulated area can contain voids or be more than ½ inch below the specified thickness.

The minimum installed thickness at any point can't be more than 1 inch below the specified thickness.

No voids extending from the interior to the exterior.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Closed-Cell SPF

The average of all thickness measurements must be ≥ to the thickness to get the specified R-value.

No more than 2% of the insulated area can contain voids or be greater than ½ inch less than the specified thickness.

The minimum installed thickness can't be less than ¾ inch below the specified thickness at any point.

No voids extending from the interior to exterior.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Insulated Sheathing

Insulated sheathing meeting the minimum installation, application and material requirements above. (i.e. butted, air sealed etc.

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate Defects

Batt, Loose-fill, Open Cell SPF – *cavity filled & trimmed*

No more than 15% of the total insulated area (cavity) can be compressed or contain gaps or voids in the insulation.

These areas shall not be missing or compressed more than ¾ inch of the nominal insulation thickness in any given location.

Voids can't extend from the interior to the exterior.

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate Defects

Open-Cell SPF - *cavity not filled and trimmed*

Average of all thickness measurements must be greater than or equal to the specified thickness required for the R-value.

No more than 15% of the insulated area can contain voids or be more than ¾ inch below the specified thickness.

The minimum thickness shall not be less than 1 inch below the specified thickness at any point.

Voids can't extend from the interior to the exterior.

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate Defects

Closed-Cell SPF

Average of all thickness measurements must be greater than the specified thickness required to obtain the R-value.

No more than 15% of the insulated area can contain voids or be more than ¾ inch below the specified thickness.

The minimum installed thickness can't be less than 1 inch below the specified thickness at any point.

Voids can't extend from the interior to exterior.

DRAFT

Insulation Grading Criteria

Grade 3 – Substantial Defects

Batt, Loose-fill, OC CC SPF

Insulated Sheathing

Installations not complying with the minimum installation requirements and Grade 1 or Grade 2 requirements above are a Grade 3 installation.

Grade 3 installations must be recorded and modeled as uninsulated.

.

DRAFT

Insulation Grading Criteria

Structural Insulated Panels (SIPs)

DRAFT

Insulation Grading Criteria

Structural Insulated Panels (SIPs)

1. Seal joints to the manufacturer's recommended requirements with the correct mastics and/or expanding foam. When the manufacturer does not have specific joint sealing details use SIPA's typical joint sealing details. Use spray foam to seal penetrations through the SIP panels.

2. Repair damaged areas.

3. Gaps and penetrations through SIPs including windows, doors, and foundation or roof connections must be air-sealed with expanding foam compatible with the SIP materials.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Structural Insulated Panels (SIPS)

1. Panels must be properly aligned and unsealed penetrations from the interior to exterior of the panels aren't 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.

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate to Frequent Defects

Structural Insulated Panels (SIPS)

1. Greater than 2% and less than 5% of the total area of the SIP panels have damage which is unrepaired, including cutouts for electrical boxes, pipes and other penetrations.

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

DRAFT

Insulation Grading Criteria

Grade 3 – Major Defects

Structural Insulated Panels (SIPS)

SIP panel installations not complying with the minimum installation requirements and Grade 1 or Grade 2 requirements are considered a Grade 3 installation.

Grade 3 installations must be recorded and modeled as uninsulated.

DRAFT

Insulation Grading Criteria

Reflective/Radiant Grading Criteria

DRAFT

Insulation Grading Criteria

Reflective/Radiant Grading Criteria

Thermal performance and R-Value claims:

R-value for the air space adjacent to a reflective insulation is based on average cavity depth, heat flow direction which represent the application (wall, ceiling or floor), temperature of the surfaces of the wall assembly, location of the airspace, and design climate conditions.

When the ASHRAE Handbook of Fundamentals R-values, the enclosed airspaces shall be sufficiently sealed cavities to prevent air flow in or out of the cavity and shall be moderately smooth.

R-value claims by the manufacturer for the assembly - including the airspace - must be based on ASTM C1224 *Standard Specification of Reflective Insulation*. The assembly that is tested for thermal resistance must be representative of the field assembly.

DRAFT

Insulation Grading Criteria

Reflective Insulation (*Ceilings, Walls and Floors)*

Reflective insulation materials – refer to the manufacturer's instructions for the product's installation details.

1. Products can be either face or side (inset) stapled and must be permanently attached to the framing member.
2. When side or inset stapled, reflective insulation must be installed at the depth in the cavity to attain the required airspace(s). Refer to manufacturer's installation details.
3. When face-stapled, the material width shall match the framing width (e.g. 16" wide material is used for 16" on-center framing).

   Exception: *Nonstandard cavity widths.*

DRAFT

Insulation Grading Criteria

Reflective Insulation (*Ceilings, Walls and Floors)*

4. Face-stapled - staple tabs must be aligned with the direction of the framing.
5. To be a vapor retarder, the tabs must be over-lapped or taped when face-stapled.
6. When inset stapled, the edges shall be attached to the sides, top and bottom of the framing.
7. 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.
8. When installed under slabs can't claim R-values based on having an airspace.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Reflective Insulation

2% or less of the area is not insulated such that the building envelope exterior sheathing (wall) is visible from the building's interior.

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate to Frequent Defects

Reflective Insulation

Greater than 2% and less than 10% of the area available for insulation is not insulated.

DRAFT

Insulation Grading Criteria

Grade 3 – Substantial Defects

Reflective Insulation

Installations not complying with the minimum installation requirements and Grade 1 or Grade 2 requirements above shall be considered a Grade 3 installation.

Grade 3 installations shall be recorded and modeled as uninsulated.

DRAFT

Insulation Grading Criteria

Attic Radiant Barriers (*Minimum Requirements)*

1. Attic radiant barriers must 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 must be on the bottom side (in the direction of the ceiling).
3. Maintain attic and/or roof ventilation Roof, gable and soffit vents shall not be covered.
4. The radiant barrier must be installed on gable ends.
5. The radiant barrier must be firmly secured.

DRAFT

Insulation Grading Criteria

Attic Radiant Barriers (*Minimum Requirements)*

Attic radiant barriers can be installed using the following 3 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.

DRAFT

Insulation Grading Criteria

Grade 1 – Minor Defects

Attic Radiant Barriers

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).

DRAFT

Insulation Grading Criteria

Grade 2 – Moderate to Frequent Defects

Attic Radiant Barriers

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 surface.
3. Radiant barrier inset stapled (Method 3 only).

DRAFT

Insulation Grading Criteria

Grade 3 – Substantial Defects

Attic Radiant Barriers

Installations not complying with the minimum installation requirements and Grade 1 or Grade 2 requirements above shall be considered a Grade 3 installation.

Grade 3 installations shall be recorded and modeled as uninsulated.

Additionally, radiant barrier installations which have the following issues shall be deemed to be grade 3:

- Radiant barrier is not permanently attached
- Radiant barrier is not perforated (Method 1 only).

DRAFT

Insulation Grading Criteria

Interior Radiation Control Coatings (IRCCs)

IRCC liquid applied materials with emittance of 0.25 or less.

Application Requirements:

1. IRCCS in permanent contact with the underside of the roof deck and 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.

DRAFT

Insulation Grading Criteria

Interior Radiation Control Coatings (IRCCs)

Grade 1 (Minor Defects)
Less than 2% of the surface is bare wood or discolored.

Grade 2 (Moderate to Frequent Defects)
Greater than 2% and equal to or less than 10% of the surface is bare wood or discolored.

Grade 3 (Substantial Defects)
Greater than 10% of the surface is bare wood or discolored.

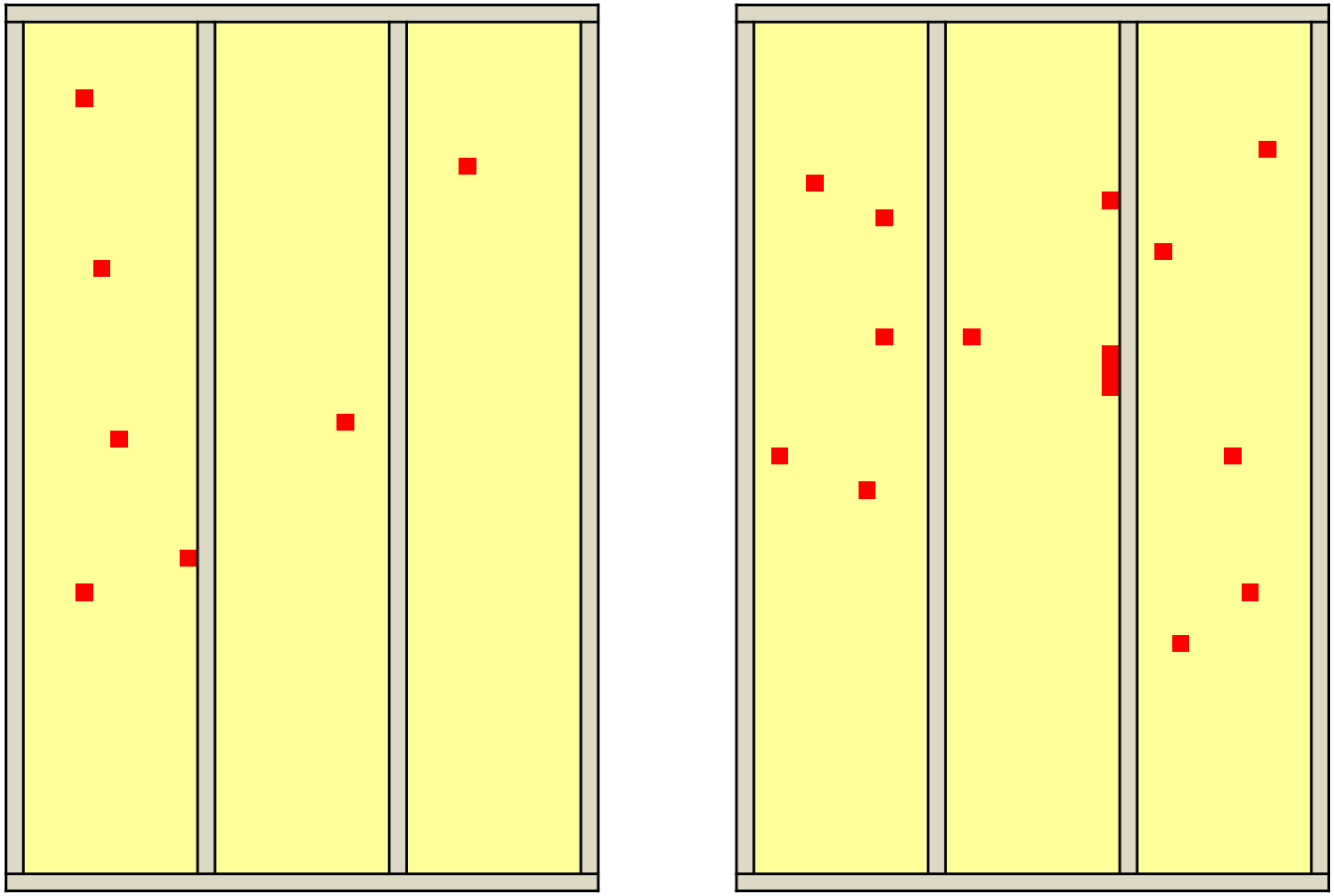
DRAFT

Insulation Grading Criteria

Application of Grading Criteria

What does 2% look like?

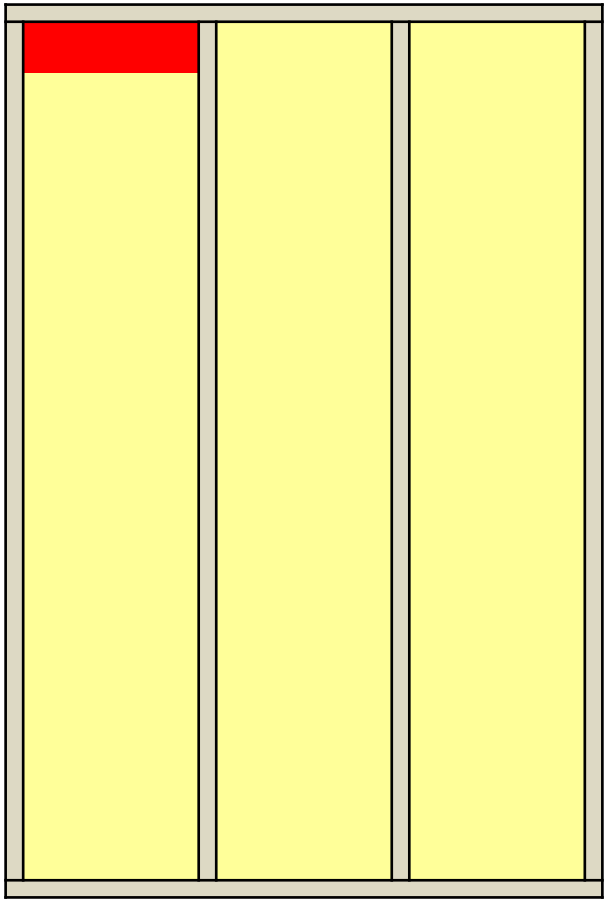
Insulation Grading Criteria



NAIMA

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

Insulation Grading Criteria



NAIMA

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

Insulation Grading Criteria

Next Steps

Review and approval by the RESNET Training and Education Committee

Public review

Commentary on application of the grading criteria will be developed after the grading criteria are finalized.

Insulation Grading Criteria

QUESTIONS?