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Ensuring the Quality of Insulation: RESNET's New Insulation Inspection Procedures

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Bruce Harley, Technical Director
Conservation Services Group

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Insulation Inspection Procedures

- RESNET standards
- Practical Applications
- Sample Inspection Checklist

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Insulation Inspection Procedures

- Assess insulation quality
 - Three installation Grades: I, II, and III
 - “Grade I” based on industry published standards
- Provide specific modeling guidance
 - Based on results of field assessment
 - Primarily for software developers, not raters
- Other details
 - Installation practices, framing, compression

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Inspection Requirement ?

- Yes—to take full credit for thermal performance of properly installed product
- No—not required for a rating
 - Accept defaults if you don't inspect
 - Equivalent to Grade III
 - Parallel to other HERS requirements
 - Envelope, duct testing
- Applies to all types of insulation

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Assessment: Grade I

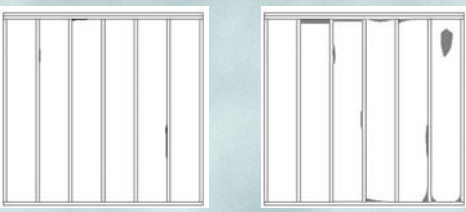
- Installed according to manufacturers instructions
 - Fills each cavity side-to-side and top-to-bottom
 - No substantial gaps or voids around obstructions (i.e. blocking or bridging)
 - Split and/or fitted tightly around wiring and other services
- No exterior sheathing is visible through gaps in the material, minimal compression
- Incomplete fill or compression of up to 30% of intended thickness, to up to 2% of the area

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Boundary condition for “Grade I”



- Gaps clear through insulation— minimal
- Compression or incomplete fill: <2% of area, compressed by <30% of intended thickness

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NOTE

- “Grade I” is **REQUIRED** to use the EPA 2006 National Builder Option Package

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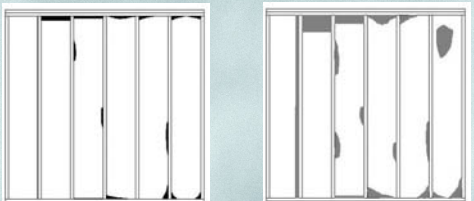
Assessment: Grade II

- Moderate to frequent defects:
 - Gaps around wiring, electrical outlets, plumbing, other intrusions
 - Rounded edges or “shoulders”
- Gaps/spaces clear through the insulation amounting to more up to 2% of total surface area covered by the insulation; or
- Incomplete fill or compression of up to **30%** of intended thickness, to up to 10% of the area

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Boundary condition for “Grade II”



- Gaps clear through insulation: <2%
- Compression or incomplete fill: <10% of area, compressed by <30% of intended thickness

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Assessment: Grade III

- Gaps and voids amounting to greater than 2% percent of the surface area it is intended to occupy
 - But less than 5%
- Compression greater than 10% of the area compressed (70% or less of rated thickness)

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Boundary condition for “Grade III”



- In cases that are worse than “Grade III”, the requirement is to measure missing areas.
- If the entire surface is compressed, insulation R-value according to manufacturer (or defaults) for whole assembly
- Gaps – no more than 5% missing

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Conditions for *Wall* Insulation

- To attain a rating of “Grade I” or “Grade II”:
- Must be enclosed on all six sides
 - Sheathing wrap is acceptable
- Must be in substantial contact with the sheathing material on at least one side of the cavity
 - Interior or exterior

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Wall insulation that is:

- Not in substantial contact with the sheathing on at least one side of the cavity
- OR, wall that is open (unsheathed) on one side and exposed to the exterior conditions or a vented attic or crawlspace;
- Shall be rated "Grade III"

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Additional for Ceilings

- For "Grade I" rating
 - Must be in complete contact with the surface it is intended to insulate
 - Must have eave baffles
 - Need *not* be enclosed on the top
- Inspectors need to note whether the framing is covered, and by how much
 - Model cavity insulation separately from continuous insulation

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Additional for Floors:

- Must be in complete contact with the surface it is intended to insulate, for "Grade I" rating
- Need not be enclosed on 6 sides, **IF** in enclosed, unconditioned basement
 - Vented, or outdoors does need enclosure

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Missing insulation

- Treat as SEPARATE areas
 - Insulation R-values may **not** be averaged over areas
 - Example: If 50 square feet of wall has no insulation, must be counted as separate wall area with no insulation
 - Example: if 100 s.f. of an attic has ½ the R-value of loose fill that exists everywhere else, must be input as 100 s.f. with ½ the R-value

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Practical Issues

- Inspections of Modular/Manufactured
 - Can use in-plant inspection (IAPA) *provided* they follow the RESNET inspection guidelines
 - Use judgment (!) about what you'll accept
- Building techniques or materials with inherent insulation qualities
 - SIP's, ICF's, log construction, etc.
 - Be *careful* about manufacturers' claims of "equivalent" R-values (!)
- Steel framing: use specified method in standards
 - NOT parallel path UxA calculations! (Software)

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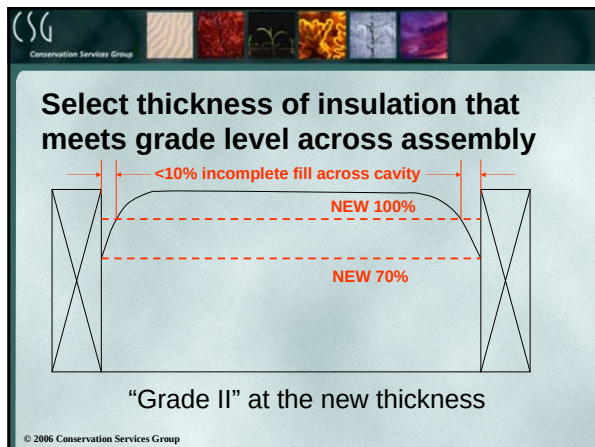
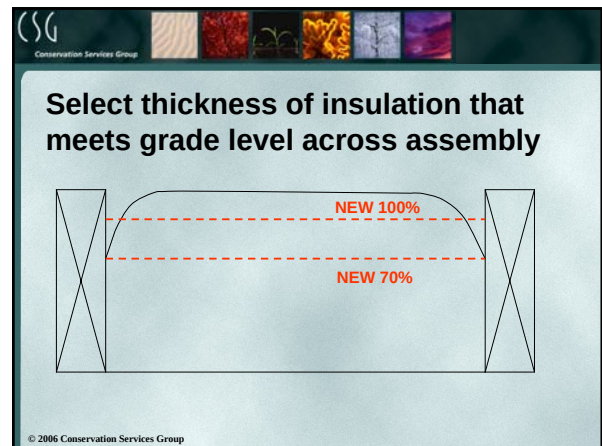
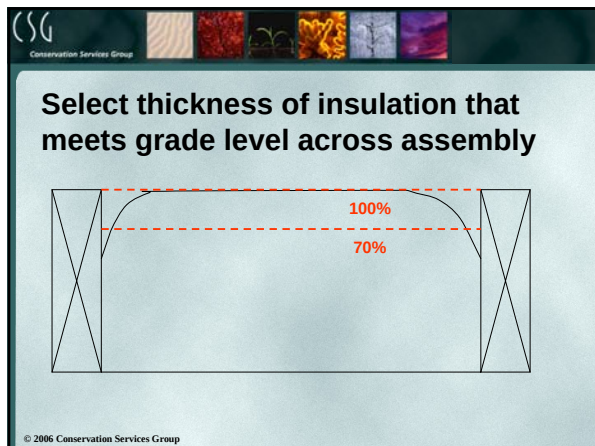


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Incomplete Fill / Compression

- Two choices
 - Select thickness of insulation that meets grade level across assembly
 - Select lower grade

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Individual Cavities

- For example, exterior wall cavities containing duct risers
- Measure area separately
 - Give credit as due for any rigid foam, fiberglass, or whatever is in bays
 - According to guidelines, but at that R-value
- Or, the walls ALL have to be Grade III

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Comments

- Grade I
 - Essentially “practically” perfect installation
 - Does *not* exclude kraft-faced batt installation—provided it meets criteria
 - Can be assessed for less than “full” thickness
- Grade II
 - Can NOT be met using batts, if batts are stuffed in over wiring
 - Splitting batts around wiring necessary (but not sufficient)

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Checklist Example

Insulation Inspection Grading Checklist			
ALL items in a category must be checked to assign that category for an insulation rating			
WALLS			
Grade I	Grade II	Grade III	
☐ Negligible void area	☐ Void area <= 2%	☐ Void area <= 5%*	
☐ Compression or incomplete fill <= 2%	☐ Compression or incomplete fill <= 10%		
☐ Fitted neatly around all obstructions	☐ Insulation in substantial contact with sheathing		
☐ Insulation enclosed on all 6 sides	☐ Insulation in substantial contact with sheathing		
☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)	☐ Insulation enclosed on all 6 sides		
☐ Tightly fitted joints (rigid foam only)			
☐ Insulation springs back when compressed (blown- or sprayed-in materials only)			

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CEILINGS		
Grade I	Grade II	Grade III
☐ Negligible void area	☐ Void area <= 2%	☐ Void area <= 5%*
☐ Compression or incomplete fill <= 2%	☐ Compression or incomplete fill <= 10%	
☐ Fitted neatly around all obstructions	☐ Insulation in substantial contact with sheathing	
☐ Installed in complete contact with the drywall or plywood surfaces it is intended to insulate		
☐ Eave baffles or equivalent construction to prevent wind washing		
☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)		
☐ Tightly fitted joints (rigid foam only)		
FLOORS		
Grade I	Grade II	Grade III
☐ Negligible void area	☐ Void area <= 2%	☐ Void area <= 5%*
☐ Compression or incomplete fill <= 2%	☐ Compression or incomplete fill <= 10%	
☐ Fitted neatly around all obstructions	☐ Installed in complete contact with the subfloor	
☐ Installed in complete contact with the subfloor		
☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)		
☐ Tightly fitted joints (rigid foam only)		
Additional for floors over outdoor air or vented crawlspace:		
☐ Insulation enclosed on all 6 sides	☐ Insulation enclosed on all 6 sides	

* NOTE: If void area is more than 5%, uninsulated areas must be measured and input as separate, uninsulated

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Using REM/Rate Libraries

- R-19 Wall examples
 - Account for compression, grading
- R-30 Ceiling examples
 - Account for exposed, covered framing

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☒ R19,FG1,6-24 0.061
☐ R19,FG2,6-24 0.067
☐ R19,FG3,6-24 0.074

Input Mode: ☒ Quick Fill Site-Built ☐ Path Layer

Wall Type Name:

Wall Construction:

Continuous Insulation R-Value: Stud Spacing (in oc):

Frame Cavity Insulation R-Value: Stud Width (in):

Cavity Insulation Thickness (in): Stud Depth (in):

Cavity Insulation Grade: Framing Factor:

Block Cavity Insulation R-Value: Use Default ☒

Gypsum Thickness (in):

☒ R19,FG1,6-24 0.061
☒ R19,FG2,6-24 0.067
☐ R19,FG3,6-24 0.074

Input Mode: ☒ Quick Fill Site-Built ☐ Path Layer

Wall Type Name:

Wall Construction:

Continuous Insulation R-Value: Stud Spacing (in oc):

Frame Cavity Insulation R-Value: Stud Width (in):

Cavity Insulation Thickness (in): Stud Depth (in):

Cavity Insulation Grade: Framing Factor:

Block Cavity Insulation R-Value: Use Default ☒

Gypsum Thickness (in):

☐ R30,FG3,X-24 0.075
☒ R30,FG1,X-16 0.040 Attic
☐ R30,FG2,X-16 0.055 Attic
☐ R30,FG3,X-16 0.072 Attic

Input Mode: ☒ Quick Fill Site-Built ☐ Path Layer ☐ Quick Fill Mobile Home

Ceiling Type Name:

Ceiling Type:

Continuous Insulation R-Value: Gypsum Thickness (in):

Cavity Insulation R-Value: Framing Factor:

Cavity Insulation Thickness (in): Use Default ☒

Cavity Insulation Grade:

Bottom Chord/Rafter Spacing (in oc):

Bottom Chord/Rafter Size (w x h, in): x

☐ R19+19,FGX,6-16 0.027 Attic
☒ R19+11,FGX,6-16 0.034 Attic
☐ R19+7,FGX,6-16 0.020 Attic

Input Mode: ☒ Quick Fill Site-Built ☐ Path Layer ☐ Quick Fill Mobile Home

Ceiling Type Name:

Ceiling Type:

Continuous Insulation R-Value: Gypsum Thickness (in):

Cavity Insulation R-Value: Framing Factor:

Cavity Insulation Thickness (in): Use Default ☒

Cavity Insulation Grade:

Bottom Chord/Rafter Spacing (in oc):

Bottom Chord/Rafter Size (w x h, in): x

☒ R30,CE8",4-24 0.033 Attic
☐ R30,CE8",8-16 0.038 Attic
☐ R30,CE7",4-24 0.028 Attic

Input Mode: ☒ Quick Fill Site-Built ☐ Path Layer ☐ Quick Fill Mobile Home

Ceiling Type Name:

Ceiling Type:

Continuous Insulation R-Value: Gypsum Thickness (in):

Cavity Insulation R-Value: Framing Factor:

Cavity Insulation Thickness (in): Use Default ☒

Cavity Insulation Grade:

Bottom Chord/Rafter Spacing (in oc):

Bottom Chord/Rafter Size (w x h, in): x




CSG REM/Rate libraries

- Hundreds of pre-loaded wall, ceiling, floor assemblies and mechanicals
- For more information about the library set, please contact
- Adam Gifford at 207-368-5355
adam.gifford@csggrp.com
- To order the library set, please contact
- Cara Russell at 508-836-9500, ext. 3214
cara.russell@csggrp.com

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Insulation Inspection Grading Checklist

ALL items in a category must be checked to assign that category for an insulation rating

WALLS

Grade I

- ☐ Negligible void area
- ☐ Compression or incomplete fill $\leq 2\%$
- ☐ Fitted neatly around all obstructions
- ☐ Insulation in substantial contact with sheathing
- ☐ Insulation enclosed on all 6 sides
- ☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)
- ☐ Tightly fitted joints (rigid foam only)
- ☐ Insulation springs back when compressed (blown- or sprayed-in materials only)

Grade II

- ☐ Void area $\leq 2\%$
- ☐ Compression or incomplete fill $\leq 10\%$
- ☐ Insulation in substantial contact with sheathing
- ☐ Insulation enclosed on all 6 sides

Grade III

- ☐ Void area $\leq 5\%^*$

CEILINGS

Grade I

- ☐ Negligible void area
- ☐ Compression or incomplete fill $\leq 2\%$
- ☐ Fitted neatly around all obstructions
- ☐ Installed in complete contact with the drywall or plywood surfaces it is intended to insulate
- ☐ Eave baffles or equivalent construction to prevent wind washing
- ☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)
- ☐ Tightly fitted joints (rigid foam only)

Grade II

- ☐ Void area $\leq 2\%$
- ☐ Compression or incomplete fill $\leq 10\%$
- ☐ Insulation in substantial contact with sheathing

Grade III

- ☐ Void area $\leq 5\%^*$

FLOORS

Grade I

- ☐ Negligible void area
- ☐ Compression or incomplete fill $\leq 2\%$
- ☐ Fitted neatly around all obstructions
- ☐ Installed in complete contact with the subfloor
- ☐ Face- or neatly side-stapled tabs (no buckling) (Faced batt only)
- ☐ Tightly fitted joints (rigid foam only)

Grade II

- ☐ Void area $\leq 2\%$
- ☐ Compression or incomplete fill $\leq 10\%$
- ☐ Installed in complete contact with the subfloor

Grade III

- ☐ Void area $\leq 5\%^*$

Additional for floors over outdoor air or vented crawlspace:

- | | |
|---|---|
| ☐ Insulation enclosed on all 6 sides | ☐ Insulation enclosed on all 6 sides |
|---|---|

* NOTE: If void area is more than 5%, uninsulated areas must be measured and input as separate, uninsulated assemblies