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NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

INSULATION DEFECTS – HOW THEY EFFECT THERMAL PERFORMANCE

Charles Cottrell, Vice-President of Technical Services

OUTLINE

- Introduction
- RESNET insulation grading criteria
- New grading criteria?
- Possible defects
- Review recent insulation test results

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RESNET INSULATION GRADING CRITERIA

MORTGAGE INDUSTRY NATIONAL HOME ENERGY RATING SYSTEMS STANDARDS

GRADE 1

All Insulation Types

- Generally installed according to manufacturers instructions
- Uniformly fills each cavity side-to-side top-to-bottom
- No substantial gaps or voids around obstructions
- Split, and/or fitted tightly around wiring and other services in the cavity
- Not a “Grade I” installation if exterior sheathing visible through gaps
- Enclosed on all six sides, and in substantial contact with the sheathing material on at least one side (interior or exterior) of the cavity
  - Exception: interior sheathing/enclosure material optional in CZ 1-3, provided insulation is adequately supported and meets all other requirements

- Rim or band joist insulation - use the inspection guidelines under “walls—insulation value” to assess “Grade I”, “Grade II”, or “Grade III” installation
  - Exception: interior sheathing/enclosure material optional in CZ 1-3, provided insulation is adequately supported and meets all other requirements

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RESNET INSULATION GRADING CRITERIA

MORTGAGE INDUSTRY NATIONAL HOME ENERGY RATING SYSTEMS STANDARDS

GRADE 1

Faced Batt Insulation

- Grade I can be designated for side-stapled tabs, when the tabs are stapled neatly (no buckling), and the batt is only compressed at the edges of each cavity, to the depth of the tab itself, and provided it meets the other requirements of Grade I

Sprayed Or Blown-In Products

- Density sufficient that the material springs back when compressed slightly and provided it meets the other requirements of Grade I

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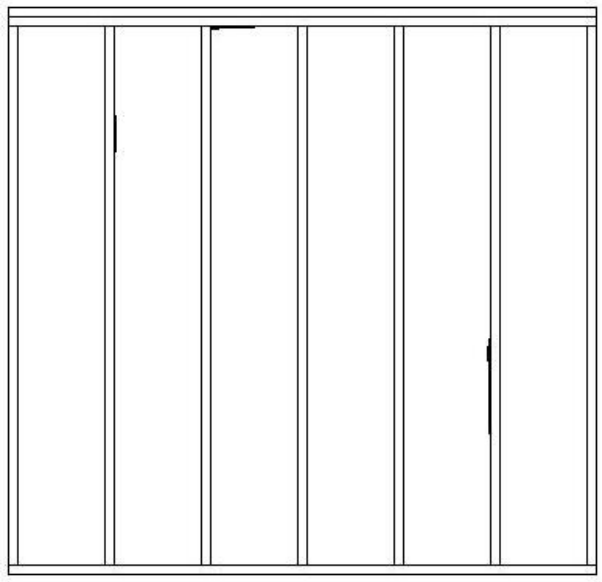
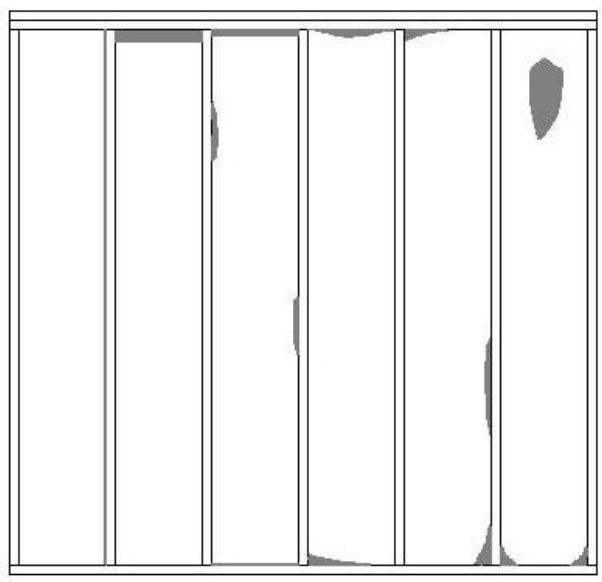
GRADE 1

- The installation shall be at least this good to be labeled as “Grade I”
- Occasional very small gaps are acceptable for “Grade I”
- Compression or incomplete fill ≤ 2% - if empty spaces are less than 30% of the intended fill thickness, are acceptable for “Grade I”





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GRADE 2

All Insulation Types

- An installation with moderate to frequent installation defects: gaps around wiring, electrical outlets, plumbing and other intrusions; rounded edges or “shoulders”
- Or incomplete fill amounting to less than 10% of the area with 70% or more of the intended thickness (i.e. 30% compressed)
- Or gaps and spaces running clear through the insulation amounting to no more than 2% of the total surface area covered by the insulation
- Wall insulation shall be enclosed on all six sides, and shall be in substantial contact with the sheathing material on at least one side (interior or exterior) of the cavity

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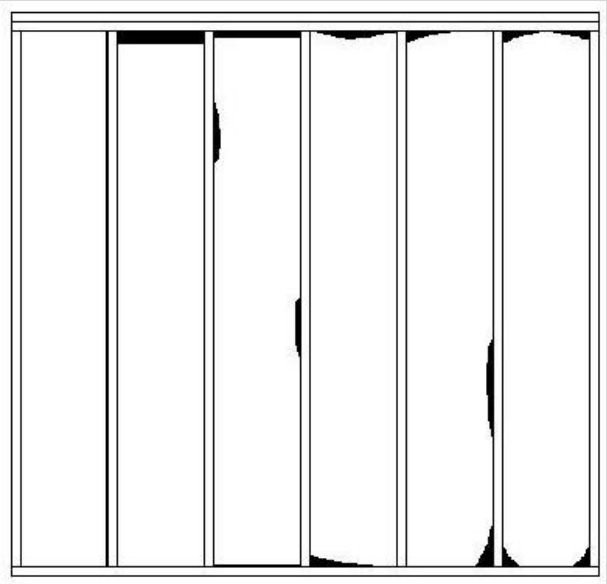
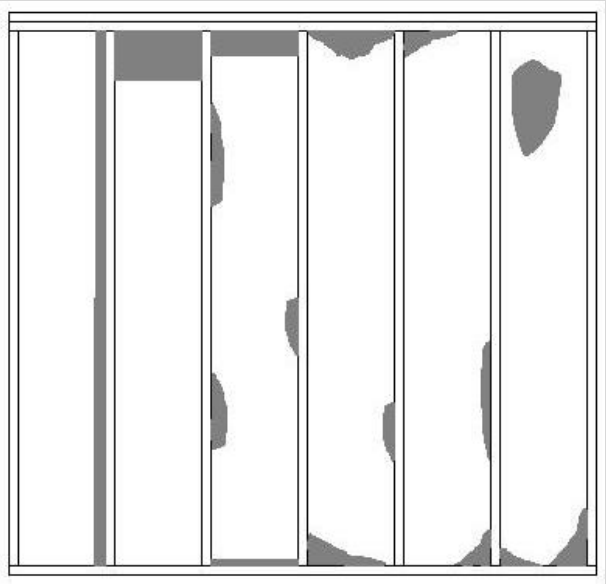
GRADE 2

- Installation shall be at least this good to be labeled as “Grade II” with no more than 2% of surface area of insulation missing is acceptable for “Grade II”
- No more than 10% of surface area may be compressed or incomplete fill, by up to 30% (70% or more of intended thickness) for “Grade II”





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GRADE 3

- Installation with substantial gaps and voids
- Missing insulation greater than 2% of the area, but less than 5% of the surface area it is intended to occupy
- Wall insulation that is not in substantial contact with the sheathing on at least one side of the cavity
- OR wall insulation that is open (unsheathed) on one side and exposed to the exterior, ambient conditions or a vented attic or crawlspace
  - The presence of an air-impermeable barrier such as housewrap will be considered to enclose the building cavities

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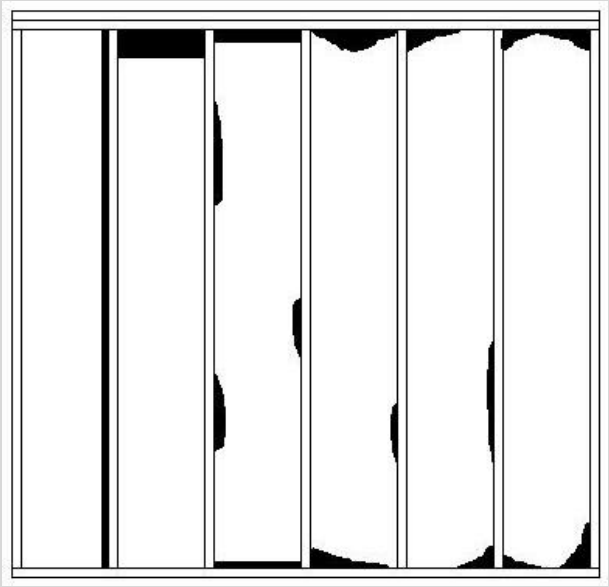
GRADE 3

- Installation must be this good to be labeled as Grade III



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NEW GRADING CRITERIA

- Insulated sheathing (XPS, EPS, cellotex, etc.)
- Batts (fiber glass, mineral wool, cotton, etc.)
- Blown or Sprayed loose-fill (cellulose, fiber glass, mineral wool etc.)
- Spray foam (OCSPF and CCSPF)
- Reflective and Radiant barrier
- Hybrid systems (e.g. flash & batt)

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DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

- AIR INFILTRATION/EXFILTRATION
- STILL AIR IS A GOOD INSULATOR
- COMPRESSION and DENSITY
- CONVECTIVE LOOPING
- FACTORS WHICH MAKE GAPS/VOIDS MORE PROBLEMATIC
  - TEMPERATURE DIFFERENCE
  - ORIENTATION
  - DIMENSIONS

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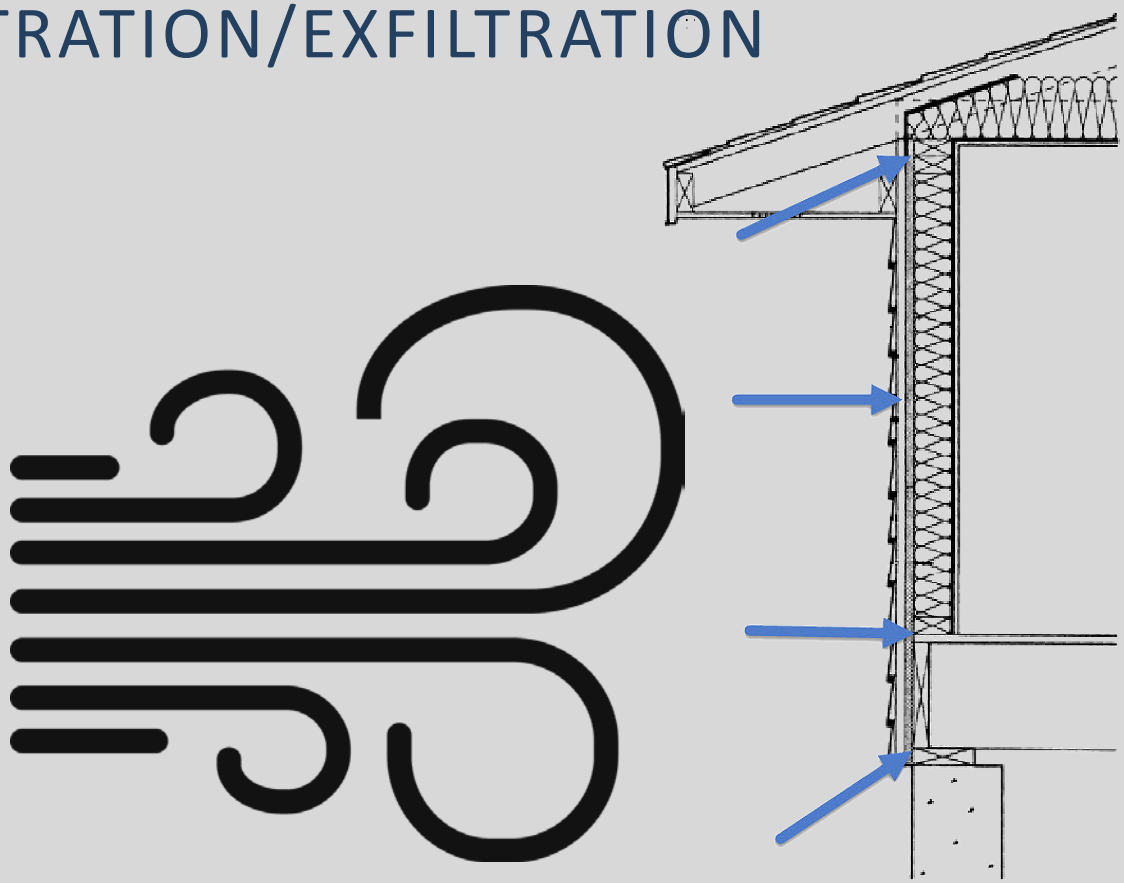
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

AIR INFILTRATION/EXFILTRATION



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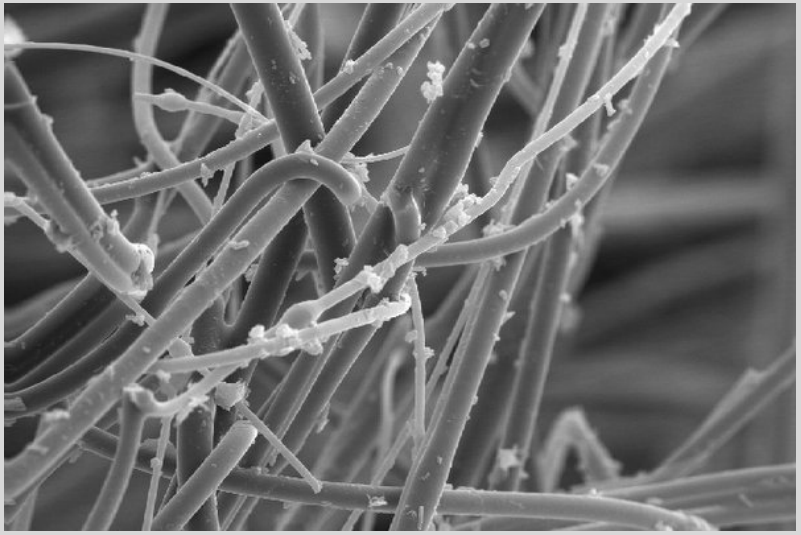
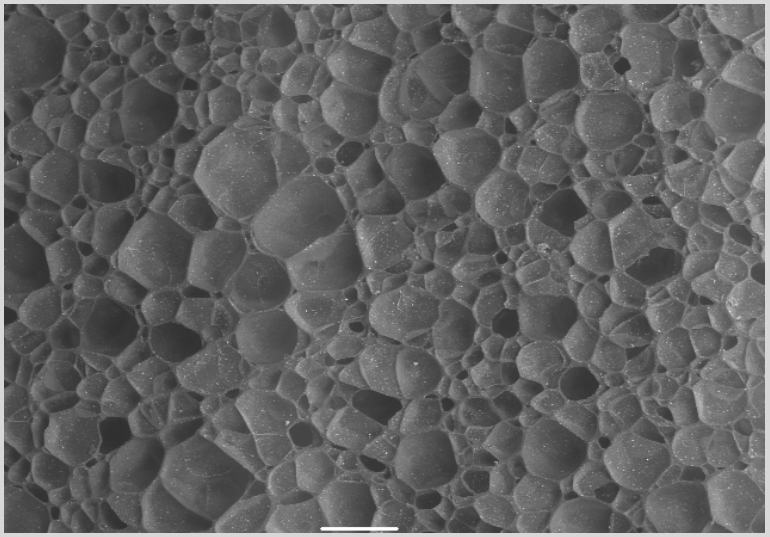
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

STILL AIR IS A GOOD INSULATOR





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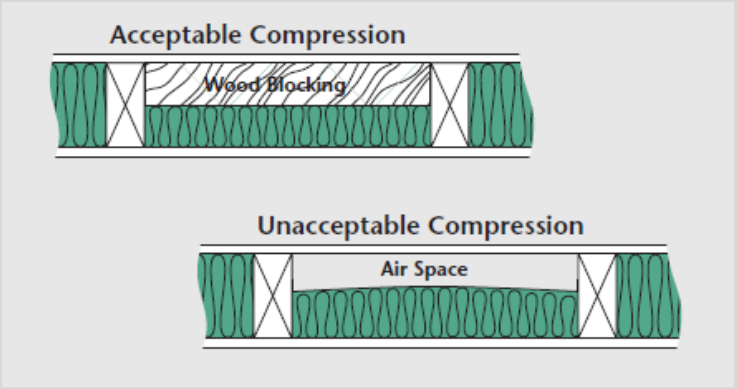
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

COMPRESSION – Good or bad? Depends



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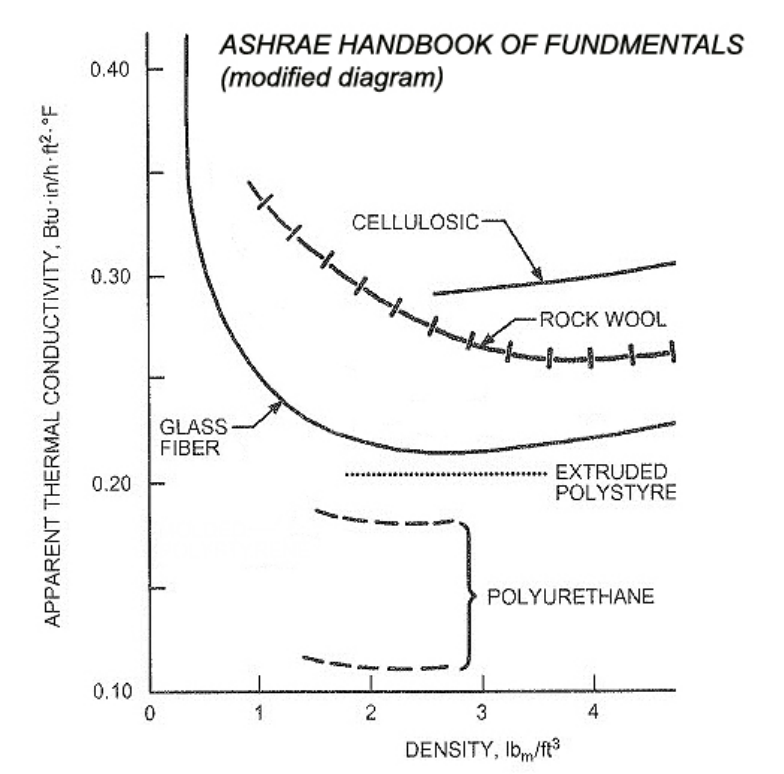
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

COMPRESSION – R-Value is Density and Thickness



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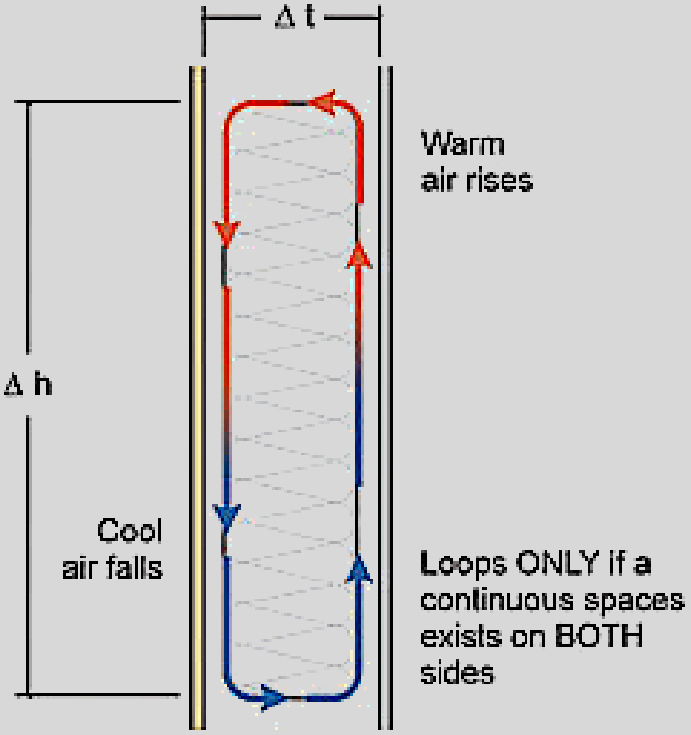
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

CONVECTIVE LOOPING

Δ T

Void or Gap

H x W x D



Air loops around insulation

Diagram courtesy of Building Science Corp.

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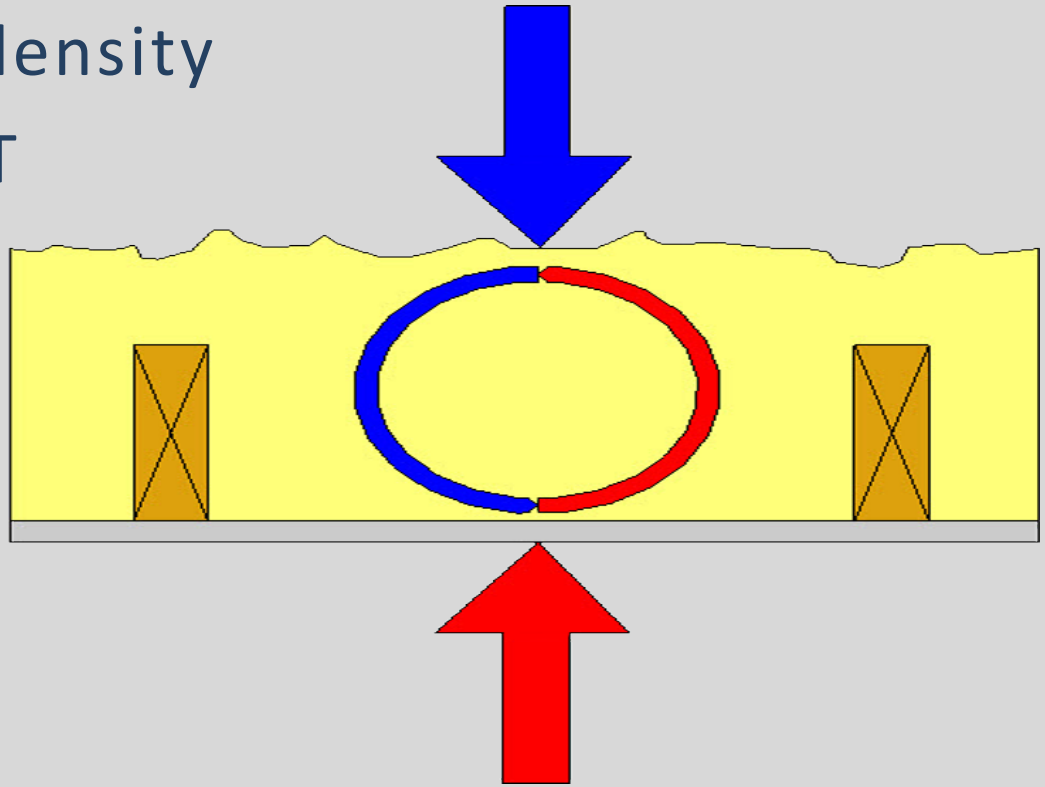
DEFECTS – WHAT FACTORS MAKE SOME WORSE THAN OTHER?

DENSITY of LOOSE-FILL

With very light density

And very high ΔT



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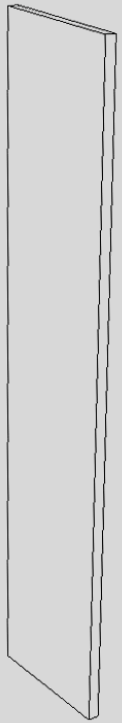

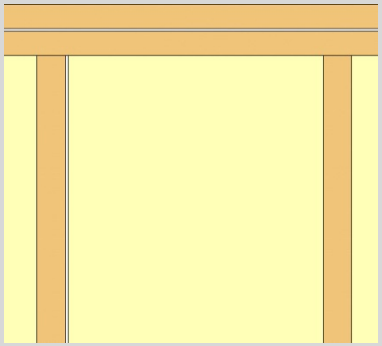

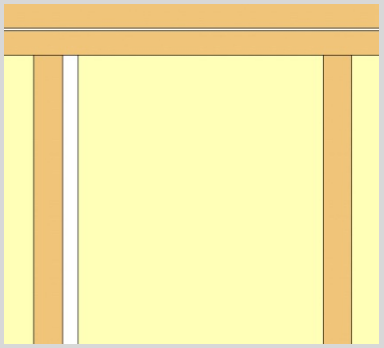

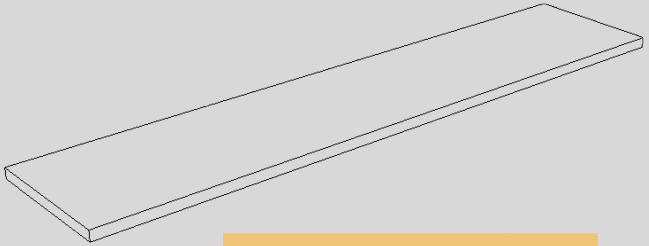

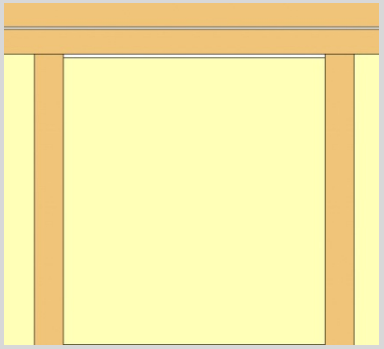

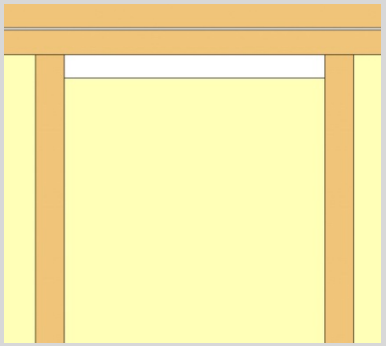

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POSSIBLE DEFECTS

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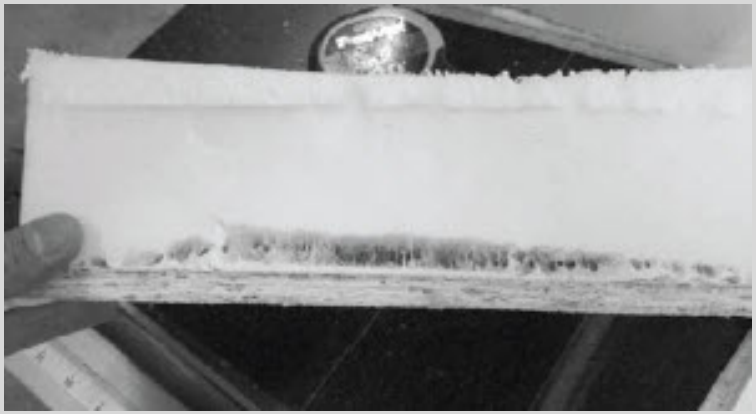
POSSIBLE DEFECTS



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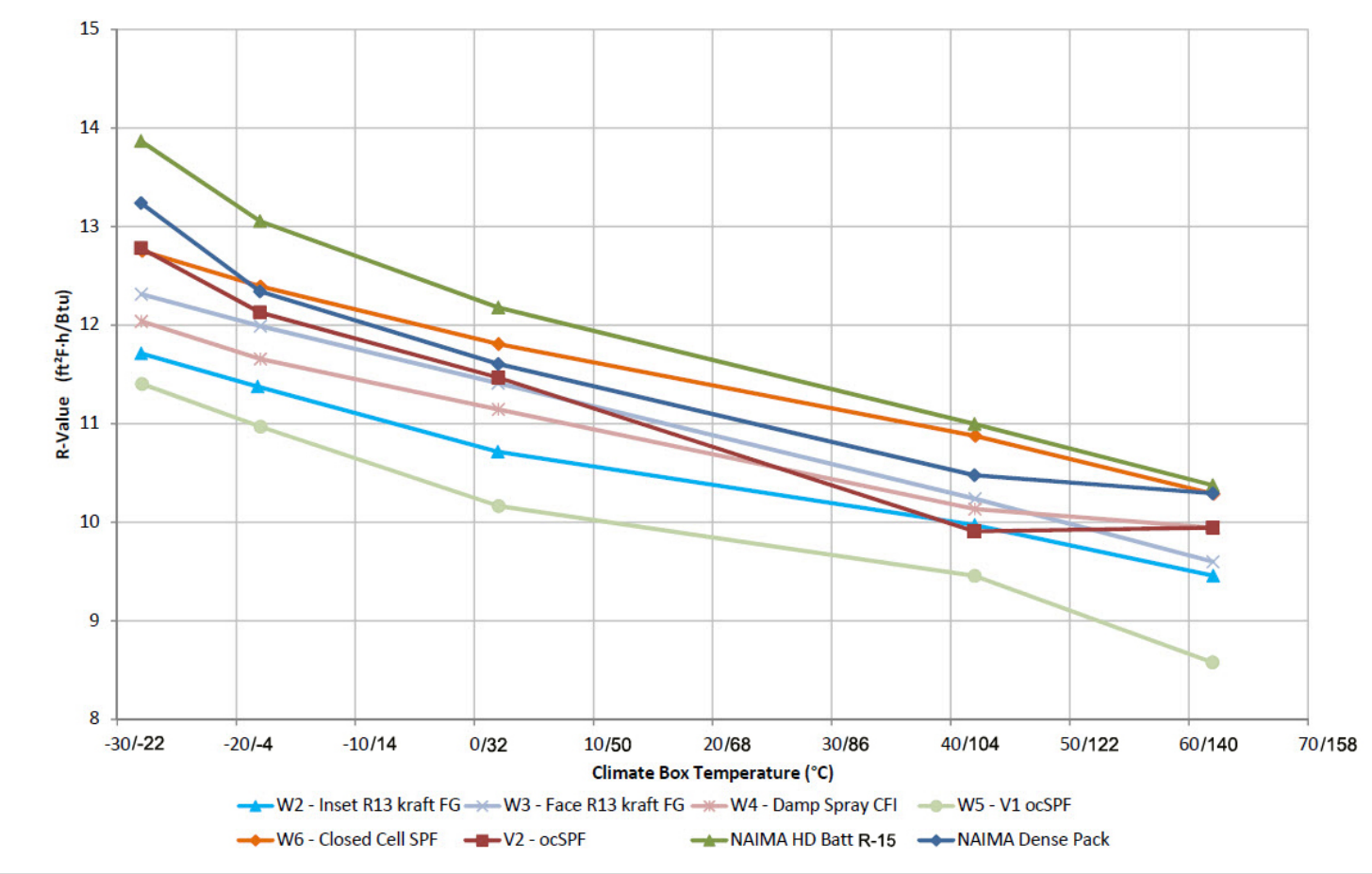
INSULATION TESTING



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INSULATION TESTING
THERMAL METRIC REPORT

- R-value is R-value. When walls are constructed to the same R-value and properly air sealed, all insulation types perform essentially the same.
- Air sealing is required for all insulation types to provide the optimal performance. No insulation product alone provides a sufficient whole-home air sealant.
- Energy losses due to thermal bridging occur with all insulation types and has the same effect on all insulation types.
- NAIMA - The R-15 fiber glass batt wall was among the better-performing assemblies tested and all of the fiber glass walls with air-sealing were among the top performers.
- NAIMA - During decommissioning of the open cell spray foam wall, the researchers confirmed there were areas where the foam did not adhere to the OSB sheathing, resulting in large voids. These gaps can affect performance.

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CONCLUSIONS

- AIR SEALING IS CRITICAL TO THERMAL PERFORMANCE
- INSULATION DEFECTS (HIDDEN AND VISIBLE) CAN EFFECT THERMAL PERFORMANCE
  - TEMPERATURE DIFFERENCE
  - DIMENSIONS/ORIENTATION
- DENSITY IS IMPORTANT – INSULATION MADE IN THE FIELD CAN VARY
- ALL TYPES OF INSULATION ARE SUBJECT TO POSSIBLE INSTALLATION DEFECTS

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INFORMATION SOURCES

WWW.INSULATIONINSTITUTE.ORG

Link to Building Science Corp. Thermal Metric Report

http://insulationinstitute.org/wp-content/uploads/2016/03/20150618-Thermal-Metric-Summary-Report-June-2015-Update-1.pdf

WWW.SPRAYFOAM.ORG

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QUESTIONS?

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