5.3 Air Barriers & Thermal Bridging

Module 5: Envelope & insulation fundamentals
Part 3

Objective: Understand ways energy moves in systems and its impact on thermal envelope design and code compliance.

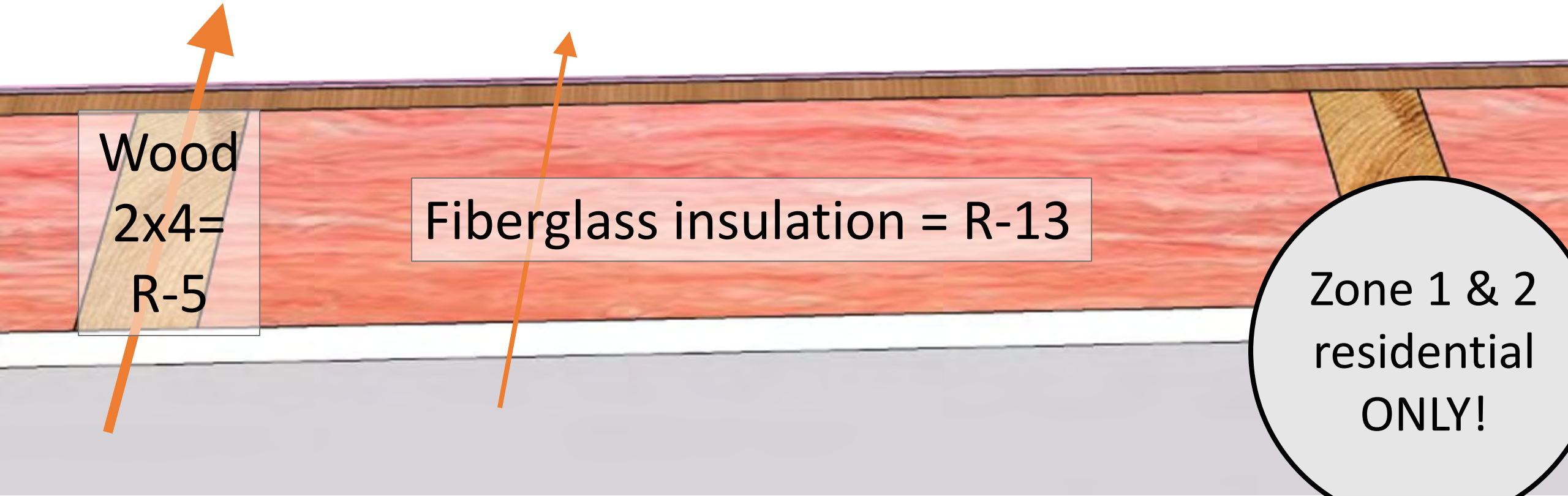
5.3 Air barriers & thermal bridging: outline

A. Thermal bridging
B. Air barriers

A. Thermal bridging

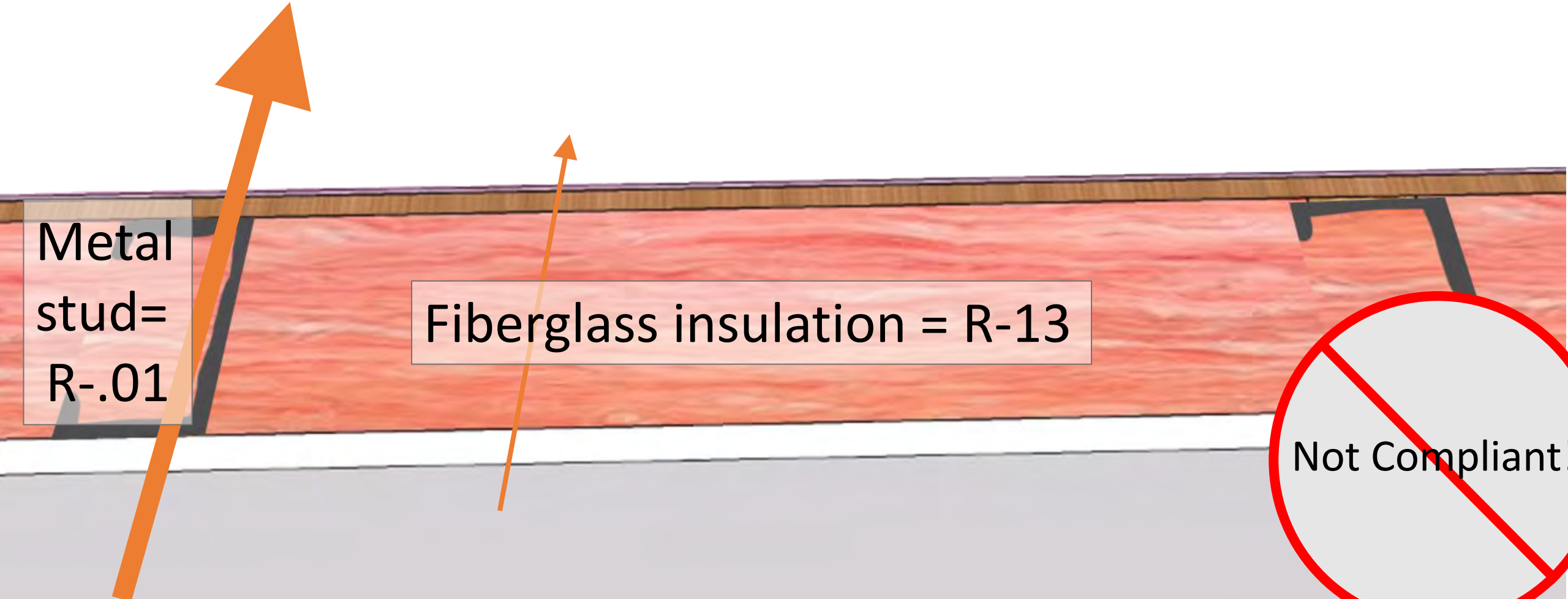
Thermal bridging

Thermal bridging occurs when materials with lower R-value interrupt insulation materials. For example, wood studs in a wall transmit more energy. Therefore, more insulation is required where a thermal bridge exists to limit total energy loss.



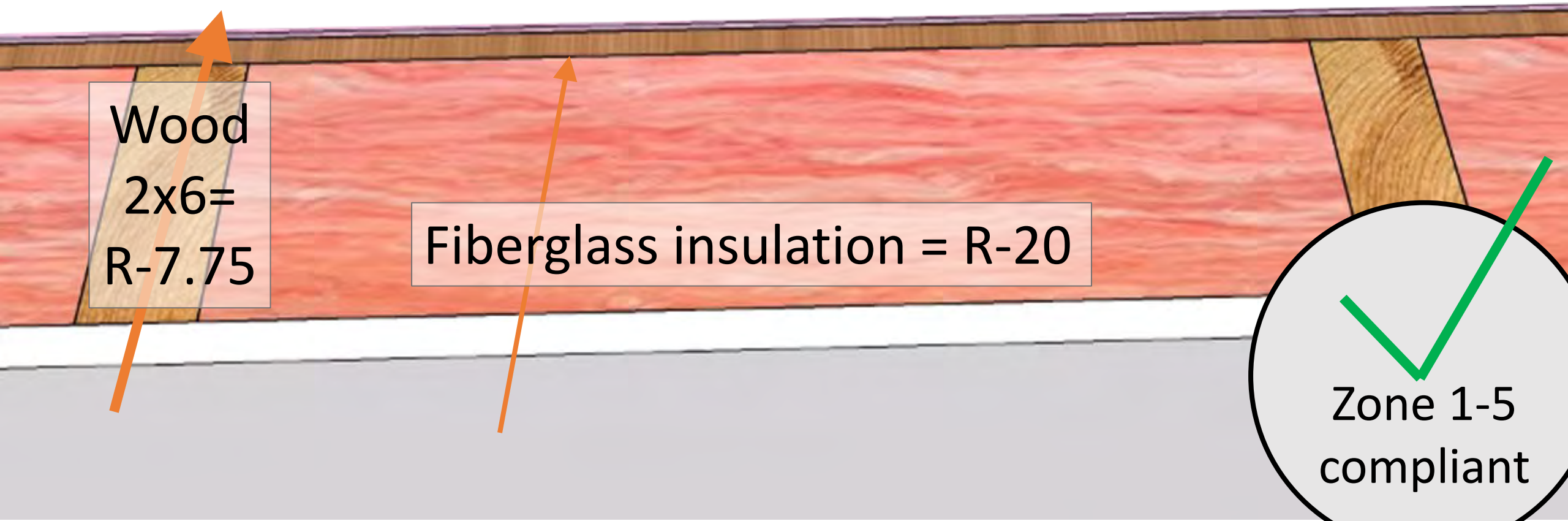
Why continuous insulation?

Metal studs conduct more heat. ASHRAE studies indicate that metal studs 16” on center reduce the effective R-value by 63%!



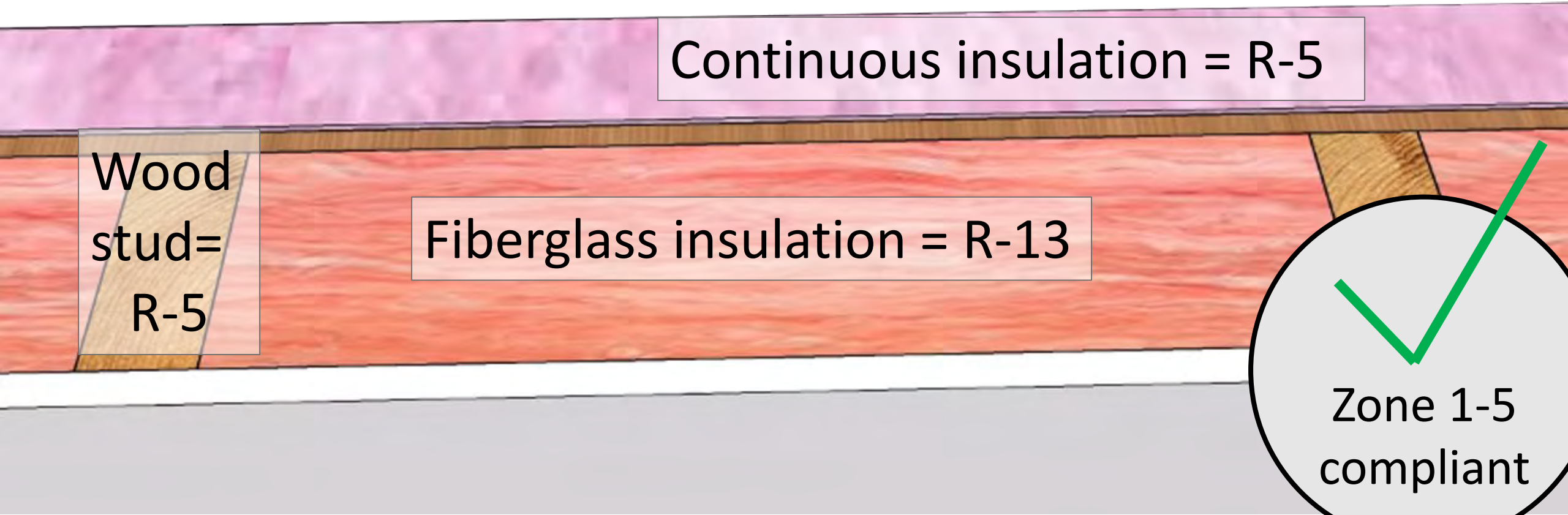
Solution 1 – Add thickness

Increasing the thickness and insulation value can create a code compliant wall without exterior insulation.



Why continuous insulation?

Continuous Insulation blocks the thermal bridge and increases performance. Therefore, the Energy Code allows lower overall R-value if continuous insulation is used. R-13+R-5 < R-20 but performs equally well because the thermal bridge is blocked. The U-values of each assembly is equivalent.



B. Air barriers

Air movement

But what about air leakage?

- Heat Movement
- Air movement
- Solar Heat Gain

✓Thermal
(R-value & U-value)

✓Air barrier
(Air changes per hour or ACH)

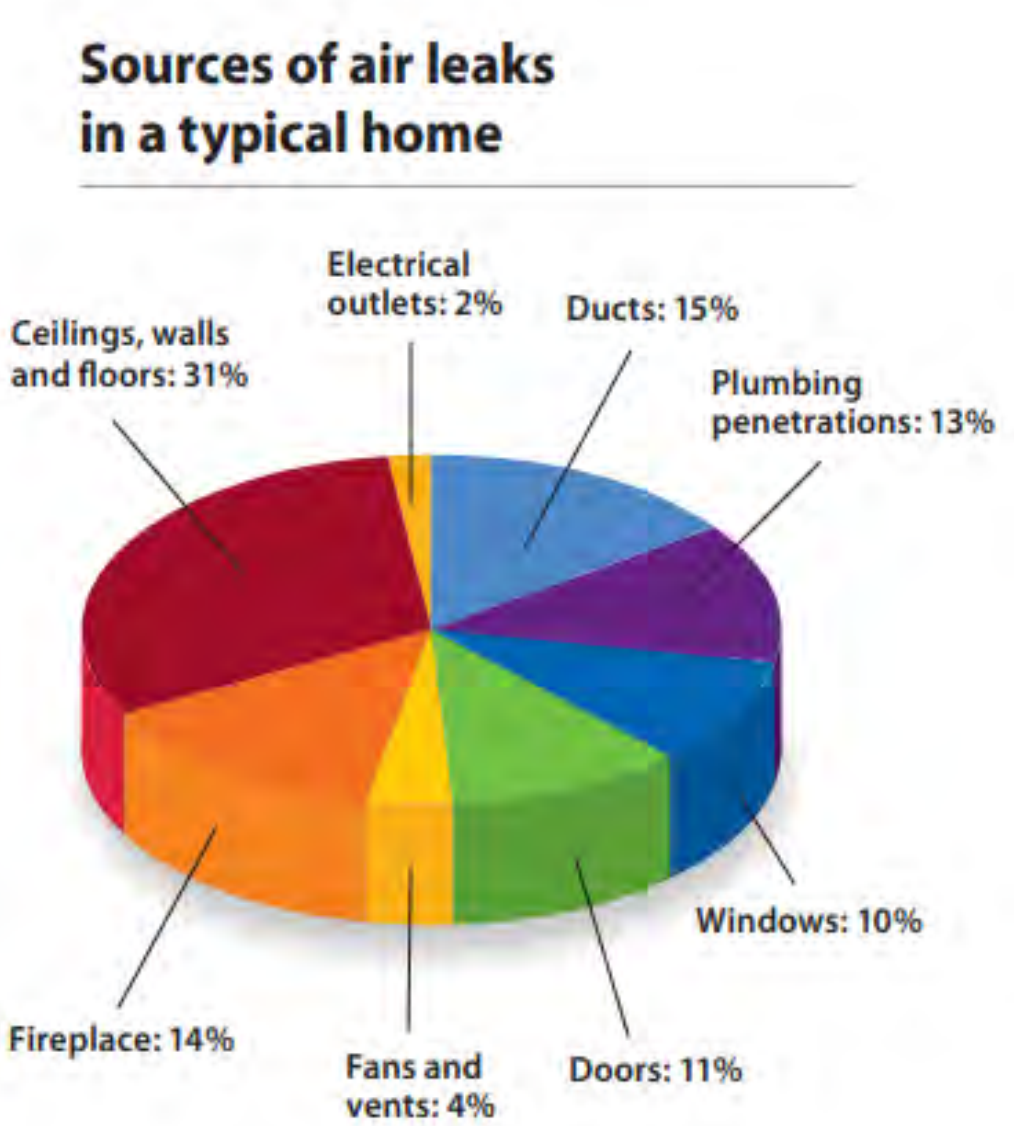
✓Window Transmissibility
(Solar Heat Gain Coefficient)

R402.4 and C402.5

Prevent air leakage

Air infiltration: The unintentional introduction of outside air into a building.

Air exfiltration: The unintentional passage of interior air out of a building.

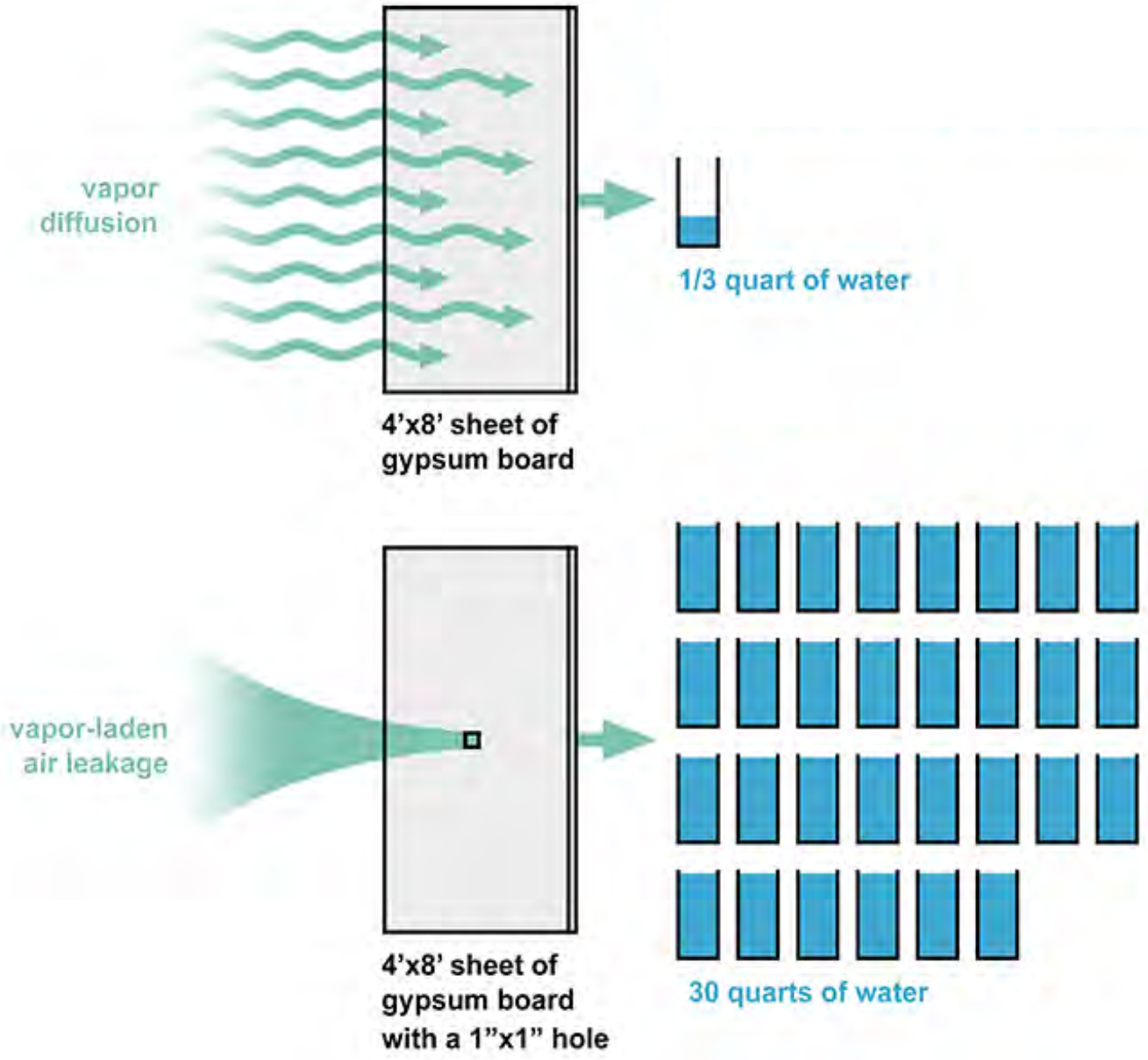


https://www.iowaeda.com/userdocs/programs/HomeSeries1.pdf

Prevent air leakage

Air leaks:

- ✓Cost money and reduce comfort.
- ✓Interfere with mechanical system operations.
- ✓Let moisture in the air into walls where it may condense.

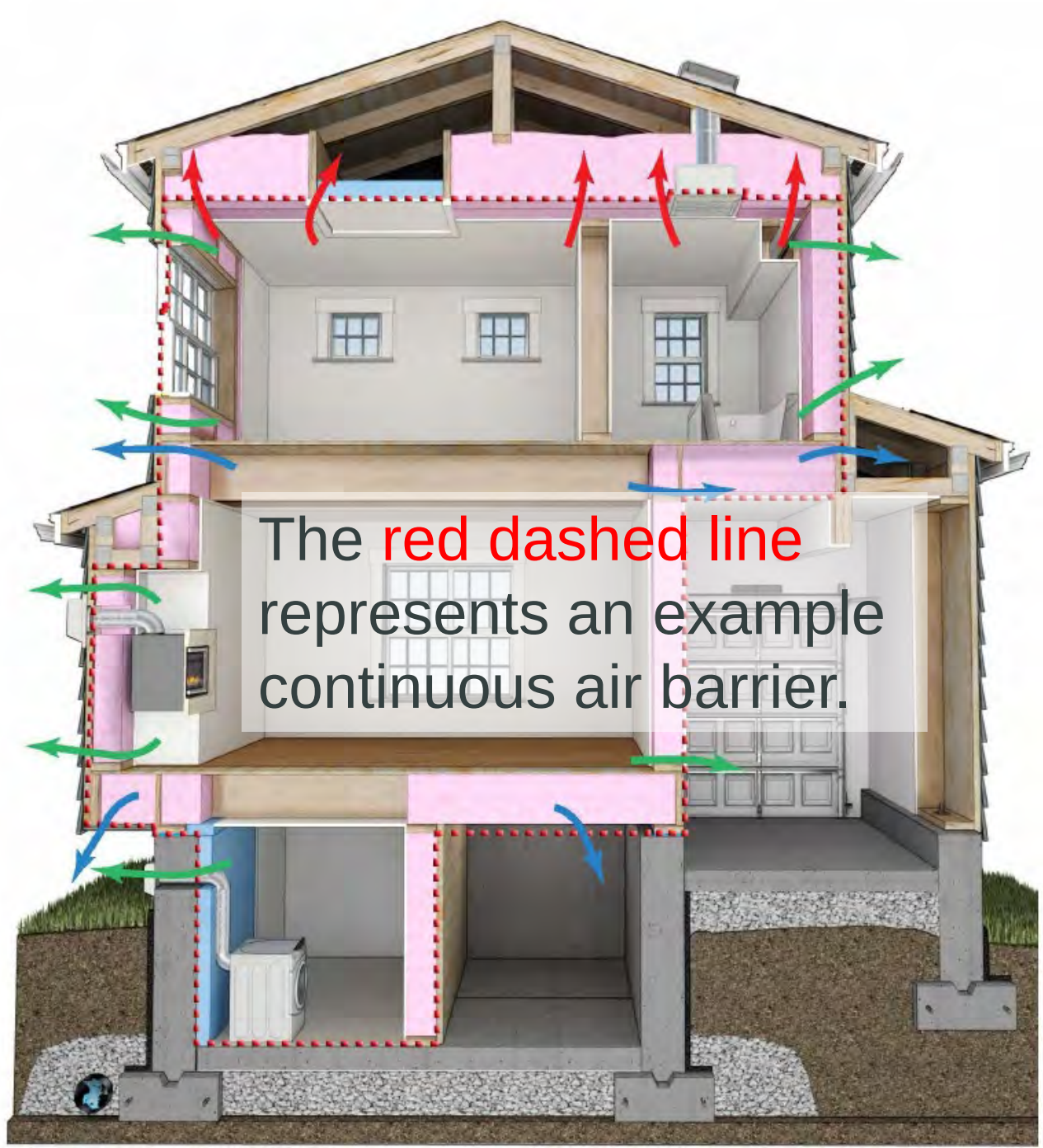


https://sbcmag.info/news/2019/may/analyzing-significant-impacts-water-infiltration

Where are air leaks?

Air leaks often occur where dissimilar materials meet. All penetrations in the building thermal envelope and air barrier should be sealed with care.

Residential buildings must be **tested** for air tightness.



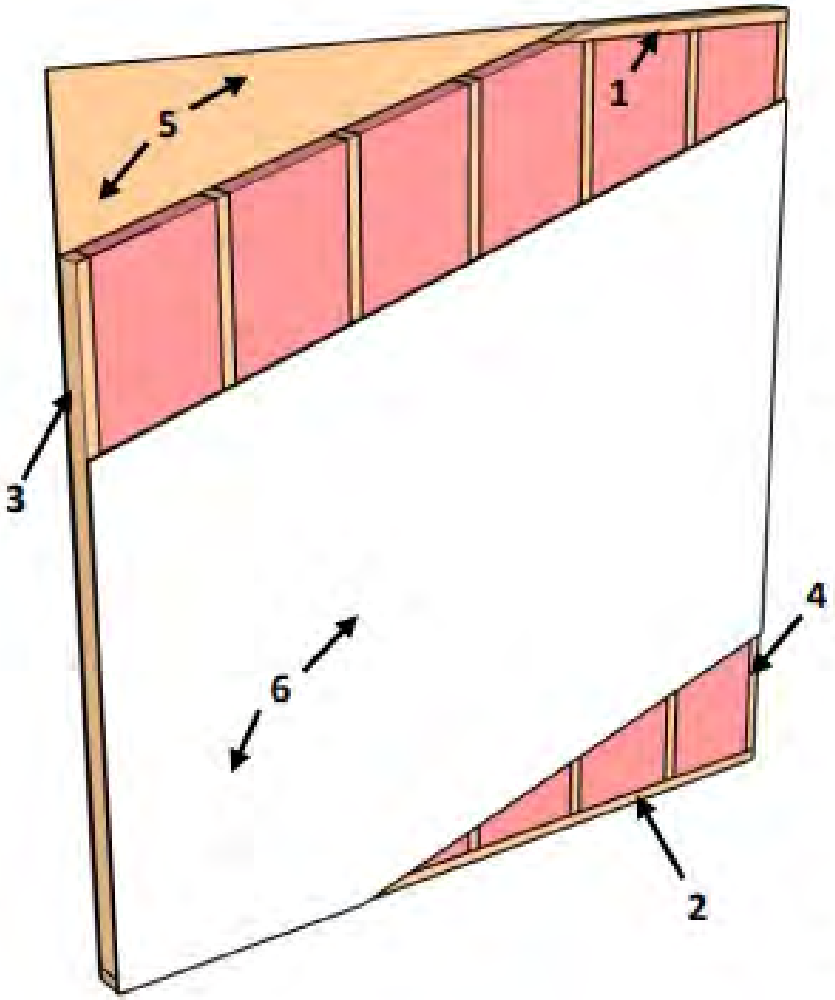
https://www.homeinnovation.com/~/media/Files/Reports/TechNotes-Building-Air-Tightness-January-2014.pdf

The six-sided wall

1. **Top Plate**
Sometimes a double top plate. Important to seal especially if there is attic space above.

2. Bottom (Sill) Plate
Caulking and sill seal is often used to seal this to the subfloor to prevent air from getting under the wall.

3. Left Stud
If stud goes to a corner, it is best to seal the gap where the adjoining wall connects.



4. Right Stud
Same as left stud. Look for penetrations such as electrical outlets or light switches.

5. Exterior Sheathing
Typically OSB (plywood). It serves as the first air barrier separating exterior & interior space.

6. Interior Barrier
Typically, drywall or other rigid material like thermo-ply that serves as another air and thermal barrier. Its best to seal the top plate to the drywall.

https://static1.squarespace.com/static/57475479d210b8552e8ce6e5/t/5ce2f9056d457000018f29f9/1558378757436/2019+-+05+-+The+six+sided+wall.pdf

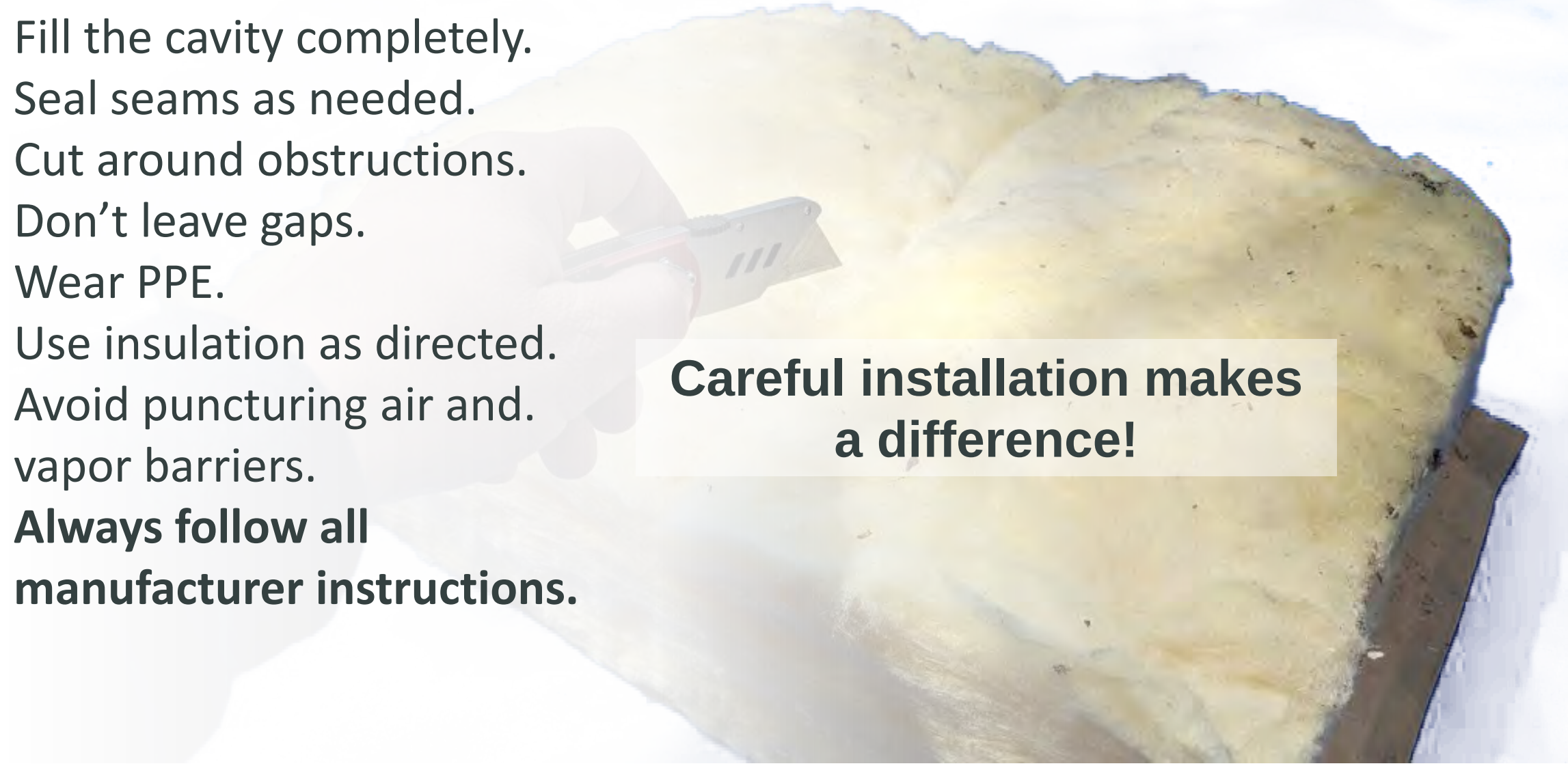
R402.4.1.2
Blower door testing

- Mandatory for residential construction
- Residential air leakage rate not to exceed:
    - 5 ACH in Zones 1-2
    - 3 ACH in Zones 3-8

      @ 50 pascals

Installation quality matters

- ✓ Fill the cavity completely.
- ✓ Seal seams as needed.
- ✓ Cut around obstructions.
- ✓ Don’t leave gaps.
- ✓ Wear PPE.
- ✓ Use insulation as directed.
- ✓ Avoid puncturing air and. vapor barriers.
- ✓ **Always follow all manufacturer instructions.**



Careful installation makes a difference!

This material was developed by the Smart Energy Design Assistance Center at the University of Illinois at Urbana-Champaign.

This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Building Technology Office (BTO) and Advanced Building Construction with Energy Efficient Technologies & Practices (ABC), Award Number DE-EE0009092.

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