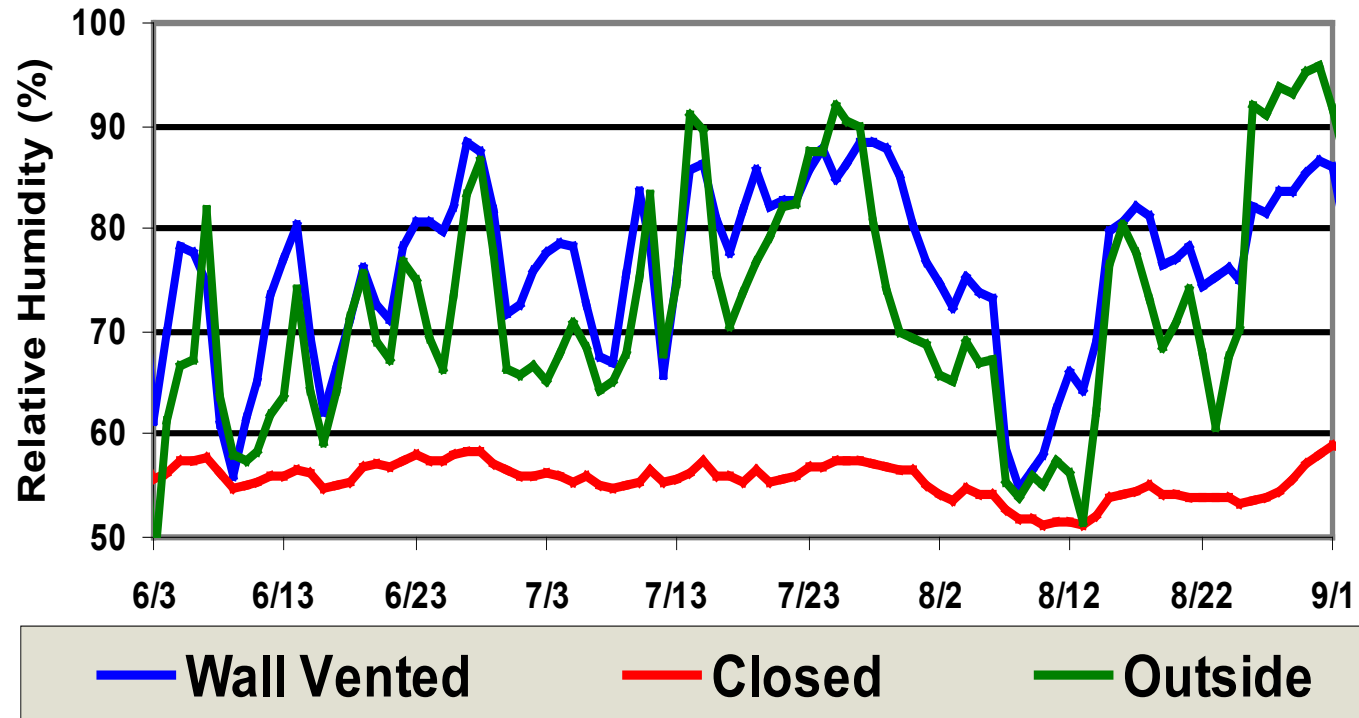


Closed Crawlspace Case Study

Crawlspace Moisture Levels Summer 2002



- If crawlspace is vented, the humidity levels will often be at least as high as the ambient air

R402.2.11 Crawlspace Walls

- Air seal & insulate band area
- Insulation must be permanently fastened and extend at least to the finished interior grade
- Pest control inspection strips required in some areas
- Complete plastic sealed to walls at least 6 inches up the stem wall
- Overlap seams by 6 inches



Insulation techniques – Crawl Walls



SF suggestion: taped, hinged "plug" of rigid insulation board in gap



Gap for pest inspection

Insulation techniques – Band area



Open/
Closed
Cell
Foam

- Pest Control industry struggles with band area fully filled with SPF
- SPF that fills band blocks inspection for pest control
- Air seal and then insulate with movable insulation product (batts, pillows, rigid board, etc.)

Caulk and
Fiberglass
Batt



- Must air seal and insulate rim/band area in basements & crawlspaces



Blown
Bag /
Pillow

The band joist area can be a challenge to insulate correctly. For installers working with blown fiberglass or cellulose, a fire-rated bag can be filled with blown insulation on site, then friction fit between joists.

Crawlspace Walls

- Seal ground with minimum 6 mil plastic (6" up walls, 6" overlaps)
- Eliminate all vents and leaks (access doors sealed and insulated)
- Insulate all walls to R-10 continuous
- Use a sealed combustion/direct vent furnace or install a heat pump
- Condition crawlspace
 - Supply air
 - Dedicated dehumidifier (Best!)
- Install moisture sensor and alarm



Atmospherically Vented Appliances

- Do **not** use atmospherically vented appliances in closed crawlspaces or attics



Systems Approach to Basements



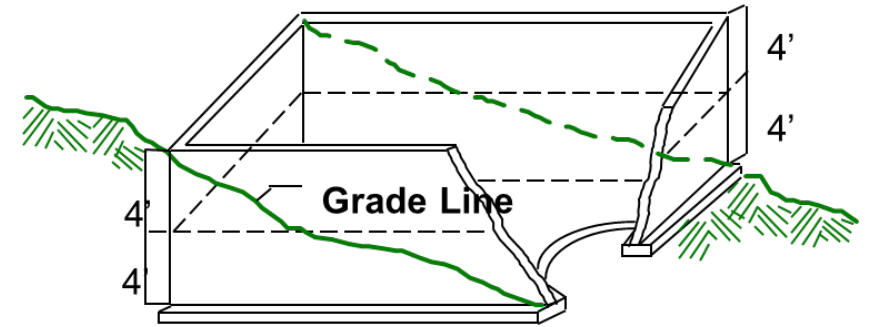
Advantages to insulating all basement walls:

- Wall insulation lasts longer and stays in place better (R-10 wall in CZ4 vs. R-19 floor)
- Ducts and AHU are brought inside thermal envelope
- Main floor level is more comfortable
- Basement may be finished or unfinished

Basement Walls

- Basement Wall – Average gross wall must be $> 50\%$ below grade and enclosed conditioned space
- CZ4: R-10 continuous or R-13 cavity
- CZ5: R-15 continuous or R-19 cavity

*Try to avoid cavity insulation;
continuous insulation performs better*



Basement Insulation Strategies

Cellulose batt



Fiberglass batts with vinyl backing



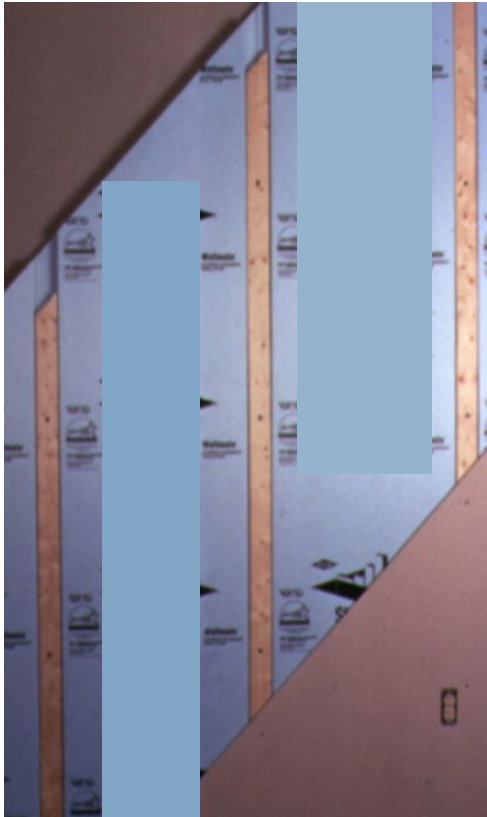
Foil-faced rigid foam board



<https://www.youtube.com/watch?v=la0ihgfgRDw>

Basement Insulation Strategies

Rigid foam board



Foam board on concrete



Spray Polyurethane foam



Interior Insulation Strategies



Blanket Basement Insulation Options



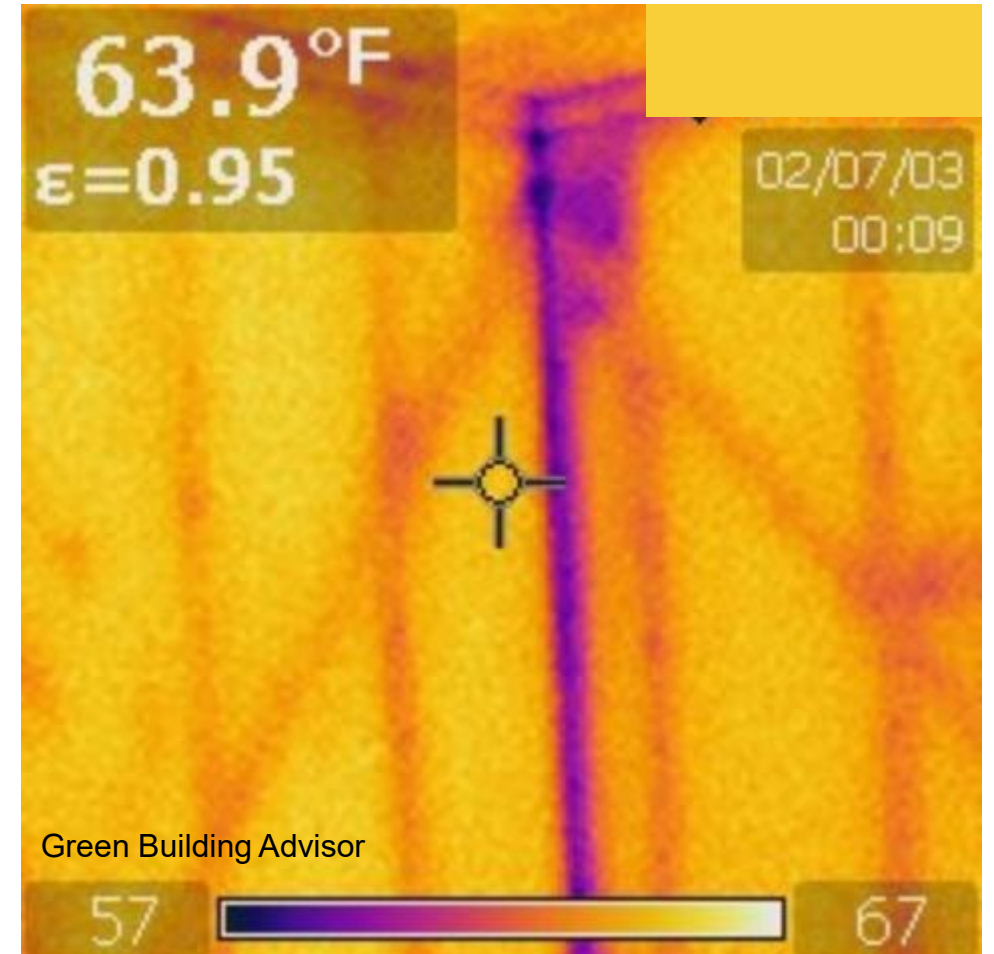
Exterior Wall Insulation

- Insulation must be applied to wood-frame, steel-frame, and mass walls that are above grade and associated with the building thermal envelope
- R20 or R13+5 c.i. is current IECC
- Continuous insulation is desirable because it prevents thermal bridging and is more effective overall

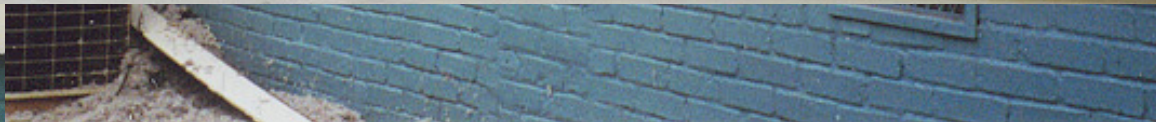


Thermal Bridging

- Studs conduct heat better than insulation, so each stud acts as a thermal bridge
- Continuous insulation creates a thermal break, which slows down conduction considerably
- Consider continuous insulation when renovating exterior walls. It can be installed on the interior or exterior (preferred) depending on the scope of the remodel



Insulating Exterior Walls



Insulating Exterior Walls



Insulating Exterior Walls: from inside – drill holes and patch



Siding Remains: Drainage Plane Retrofit – Interior Stripped to Studs



- Install vertical spacer strips (sill gasket or foam strips) into sides of cavity
- Install ½" foam board piece (~14.25" width) against strips
- Seal edges with caulk or foam
- Slightly compress batt into cavity against foam board

Siding Remains: Drainage Plane Retrofit – Interior Stripped to Studs



Wall and Ceiling Vapor Retarders

Not required in CZ 1-4

Class 1 or 2 vapor retarder is required on the interior side of frame walls per IRC in zone 5. Except for:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials

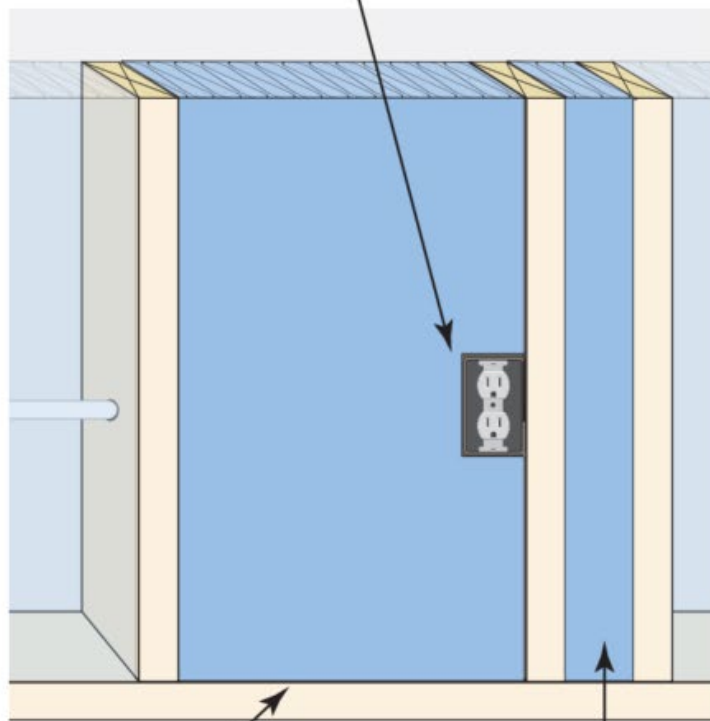


Wall Insulation Details

Voids / Gaps


Passing Grade 

Insulation is notched and completely surrounds electrical box

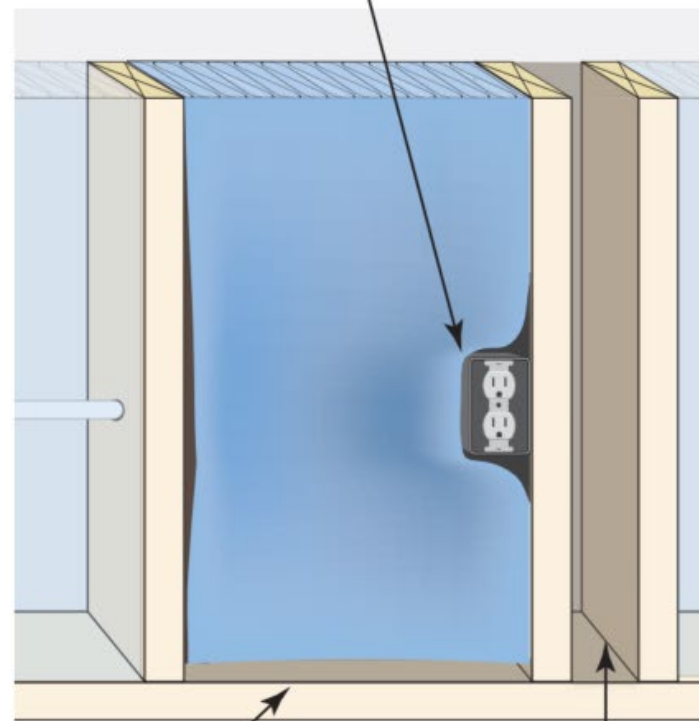


Insulation fully fills cavity at top and bottom

Narrow cavity fully insulated

Unacceptable Installation 

Incomplete insulation coverage around electrical box



Insulation does not extend to bottom of cavity

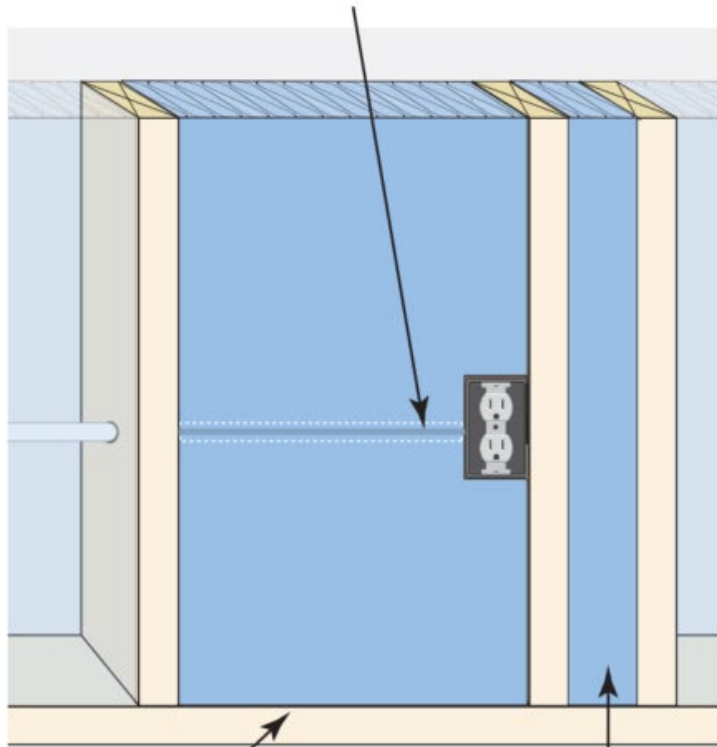
Narrow cavity not insulated

Wall Insulation Details

Compression / Incomplete Fill


Passing Grade 

Insulation is slit around electrical wire

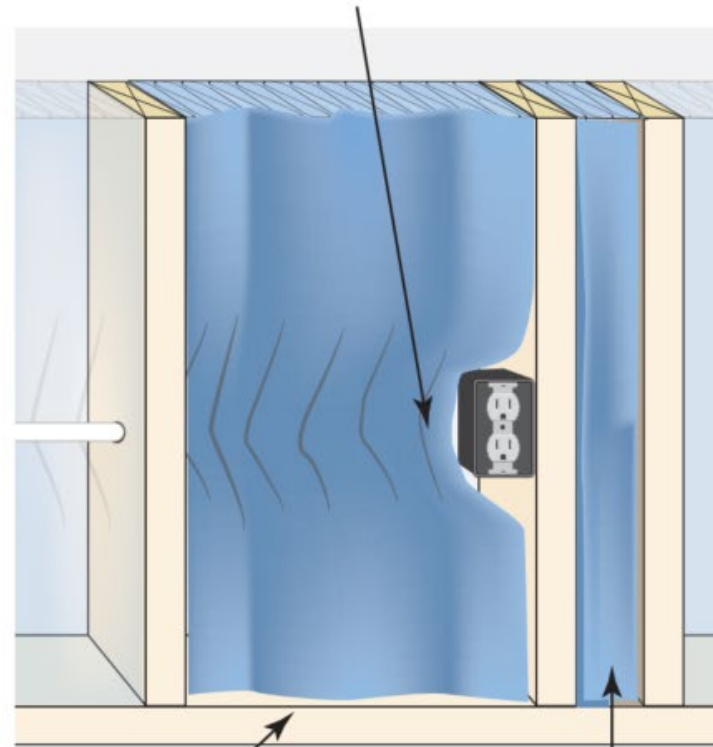


Insulation extends from front to back and fully fills entire cavity

Proper width insulation fully fills narrow cavity

Unacceptable Installation 

Insulation is compressed behind electrical wire

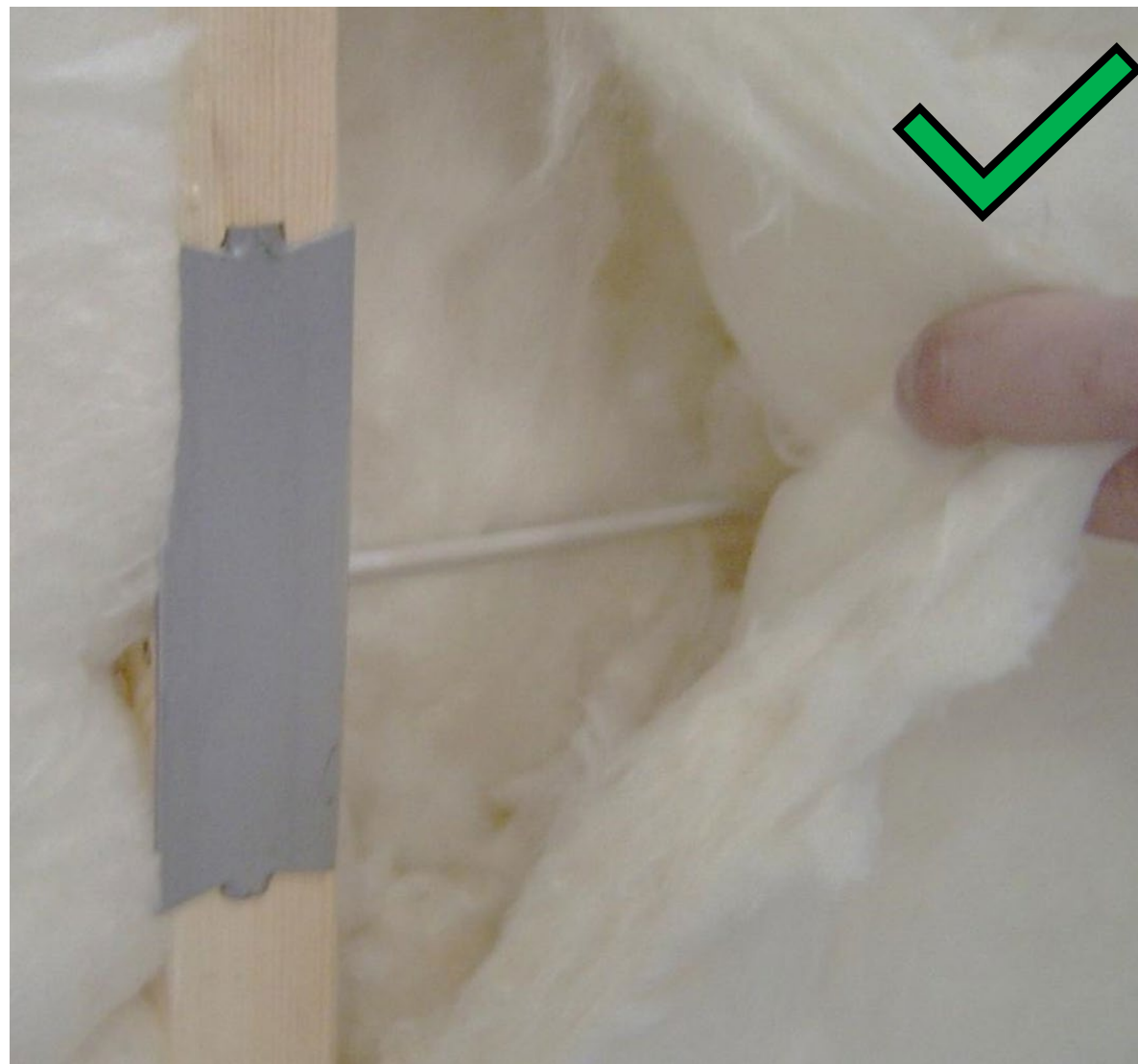


Insulation does not fully fill entire cavity

Improper width insulation is compressed into narrow cavity

Wall Insulation Details

- Batt is split to allow the wire to bisect the cavity

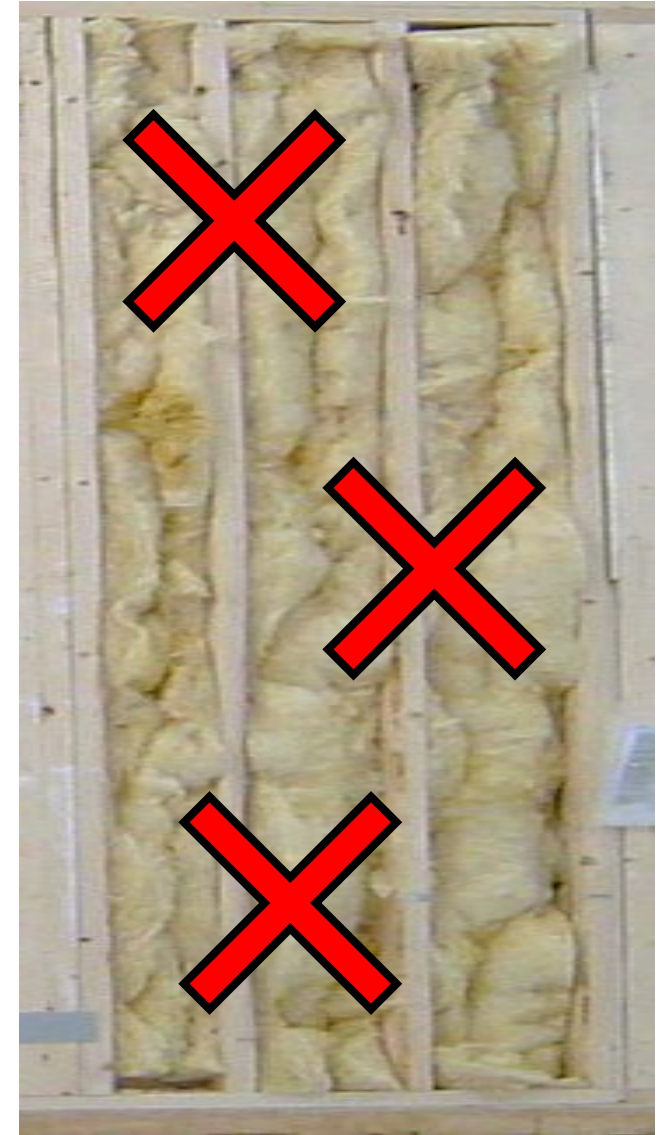
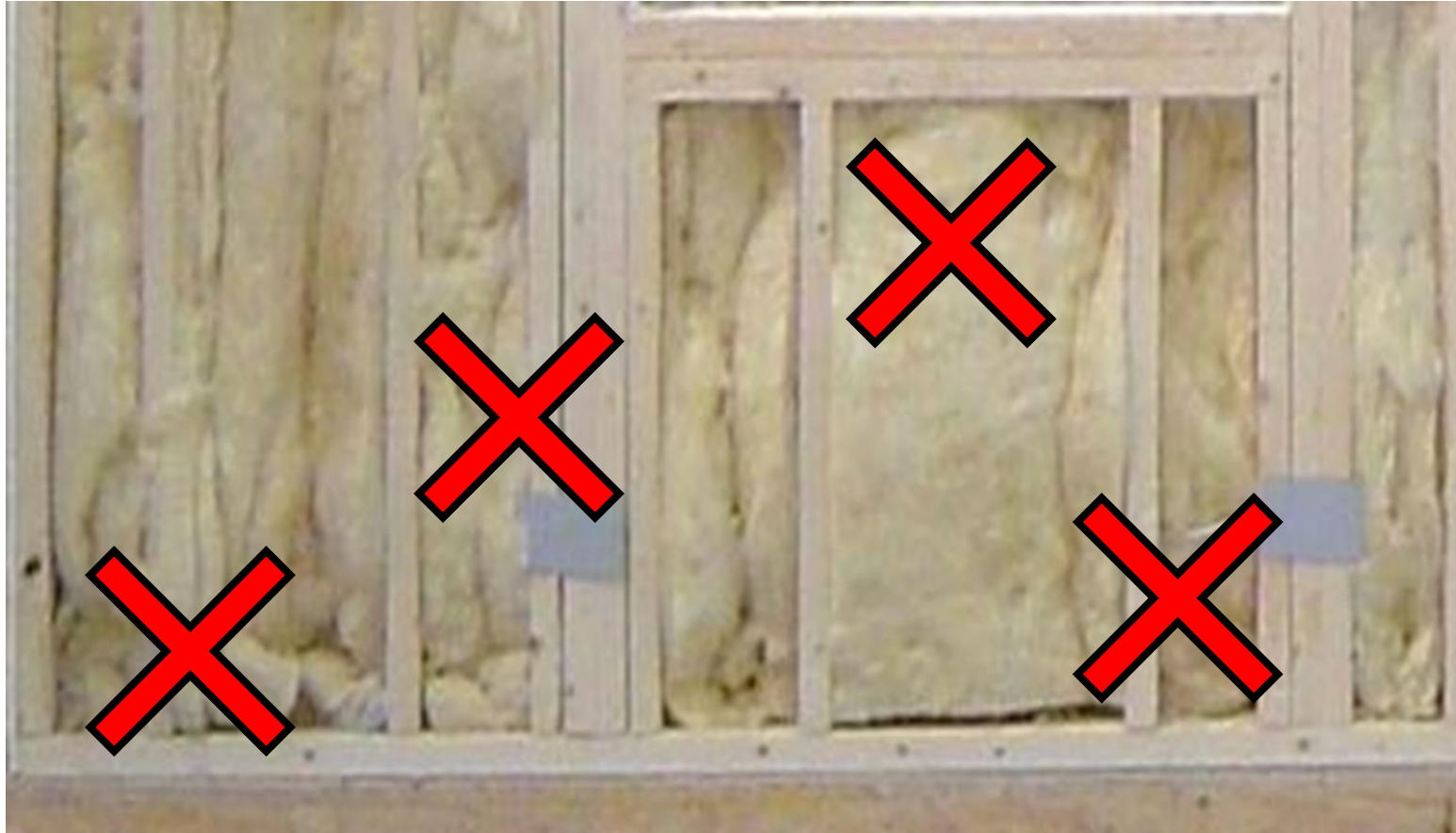


Wall Insulation Details



- Wire is compressing the insulation
- Voids around electrical outlet
- Missed a whole cavity

Wall Insulation Details



Wall Insulation Details

- Complete fill
- Goes behind tub
- Plumbing penetrations are neat



Wall Insulation Details

- Spray Polyurethane Foam is great for retrofits, if installed properly



Siding Drainage Plane Retrofit – Interior Wall Stripped to Studs



- Install vertical spacer strips into sides of cavity
- Install ½” foam board piece (~14.25” width) against strips
- Seal edges with caulk or foam
- Slightly compress batt into cavity against foam board

