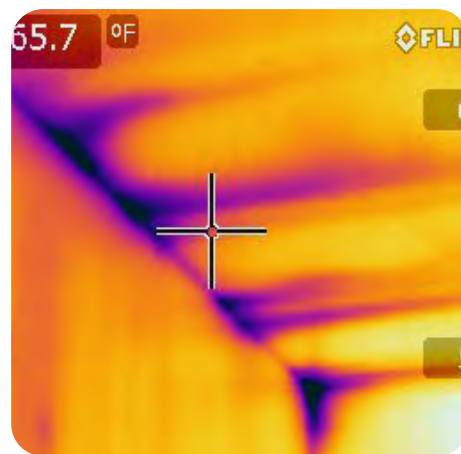
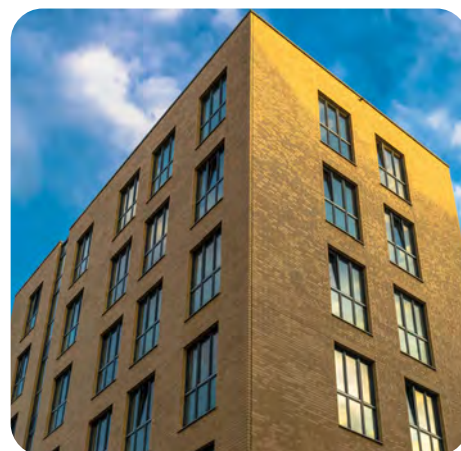


# RETROFITTING NORTH DAKOTA

## STANDARD WORK SPECIFICATION-ALIGNED FIELD GUIDE



NORTH  
**Dakota**

Be Legendary.



Last updated 22 March 2021  
Created by the Energy Smart Academy at Santa Fe Community College  
For the Weatherization Collaborative  
In alignment with the Standard Work Specifications  
Created by the National Renewable Energy Laboratory,  
found at <https://sws.nrel.gov>

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# 1-1 INTERIOR LEAD-SAFE WEATHERIZATION

Aligns with Lead RRP



## BEFORE

- ✗ Homes built before 1978 have the potential for lead paint and require special considerations during retrofitting



## AFTER

- ✓ No lead dust or debris remains inside the home
- ✓ Contaminated materials have been disposed of or cleaned properly
- ✓ Disposal containment is securely closed

## TOOLS

- Zip Walls
- HEPA Vacuum
- Hand Tools or Shrouded Power Tools
- Half or Full-face Respirator (Fit-Tested)

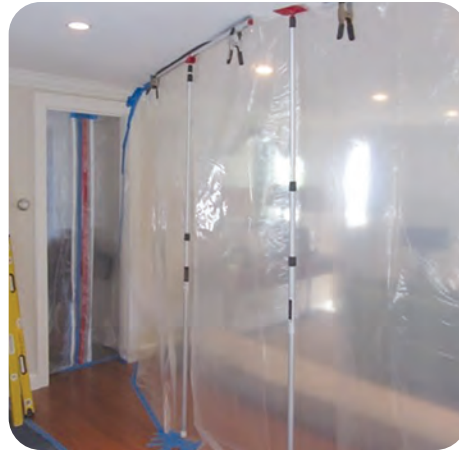
## MATERIALS

- 6-Mil Plastic Sheeting
- Signage
- Tack Pads
- Painters Tape
- Trash Bags
- Disposable Tyvek Suits
- Booties
- Nitrile Gloves
- P-100 Filters

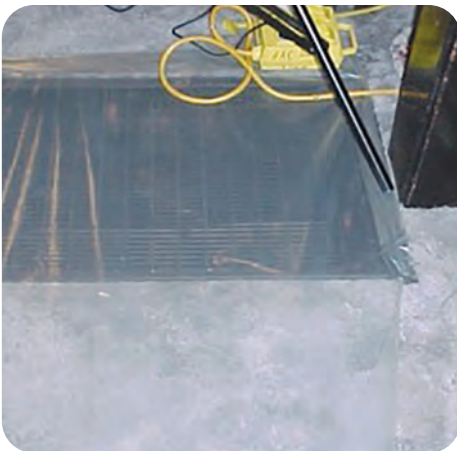
## 1-1 INTERIOR LEAD-SAFE WEATHERIZATION



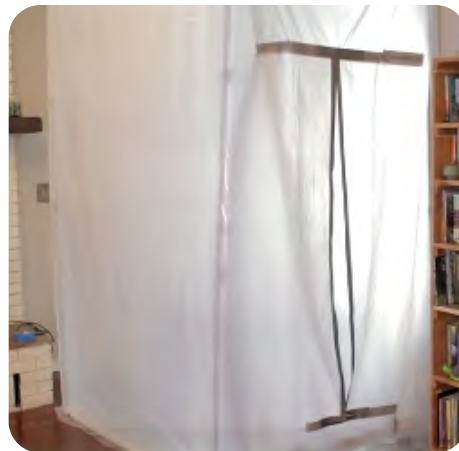
**1.** Move furniture out of work area and, if it cannot be removed, securely cover horizontal with plastic sheeting



**2.** Use disposable physical barriers to mark out and contain work area dust and debris



**3.** Six feet in any direction from the work area, cover surfaces with plastic sheeting, taped in place, including HVAC access points



**4.** Block off access doorways and install zippers to contain debris in work area

### NOTES

Half and Full-face respirators, required for Lead Renovation work, must be fit-tested on all workers at least once a year. The respirator must form a tight seal at the face and neck. Workers who have a beard cannot wear a half- or full-face respirator, since they will not form a tight seal and contaminants can bypass the respirator. Bearded workers need to wear a PAPR, or powered air-purifying respirator.





## 1-1 INTERIOR LEAD-SAFE WEATHERIZATION



- 9.** Wipe down surfaces and vacuum work area, taking special care and attention of cracks and crevices where dust and debris might collect



Folding poly to the inside and bagging.

- 10.** Carefully roll up and dispose of any plastic sheeting or other disposable materials in the work area



- 11.** Doff PPE outside, avoiding contact with contaminated surfaces of suit, gloves, etc., and dispose immediately

### NOTES

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# 1-2 EXTERIOR LEAD-SAFE WEATHERIZATION

Aligns with Lead RRP



## BEFORE

- ✗ Homes built before 1978 have the potential for lead paint and require special considerations during retrofitting



## AFTER

- ✓ Detailed attention needs to be paid to every aspect of work with lead-based paint, from start to finish

## TOOLS

- HEPA Vacuum
- Hand Tools or Shrouded Power Tools
- Half or Full-face Respirator (Fit-Tested)

## MATERIALS

- 6-Mil Plastic Sheeting
- Catchment Poly Bags
- Signage
- Tack Pads
- Painters Tape
- Trash Bags
- Scaffolding
- Disposable Tyvek Suits
- Booties
- Nitrile Gloves
- P-100 Filters

## 1-2 EXTERIOR LEAD-SAFE WEATHERIZATION



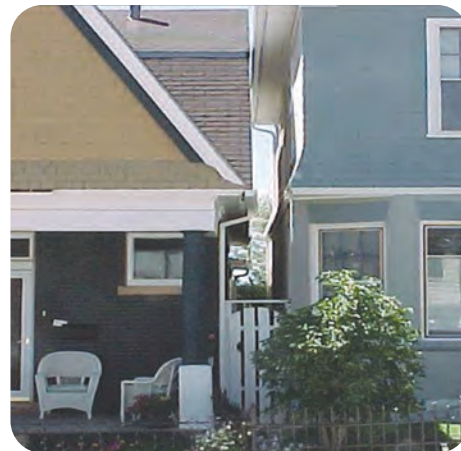
1. Create containment area with plastic sheeting 10 feet in any direction from work area



2. Post signs at least 20 feet from work area to prevent anyone from entering work area unintentionally



3. Seal off all exterior access points to home within containment area, including windows, doors, mail slots and vents



4. Where houses are located close together, vertical containment will be necessary

### NOTES

Half and Full-face respirators, required for Lead Renovation work, must be fit-tested on all workers at least once a year. The respirator must form a tight seal at the face and neck. Workers who have a beard cannot wear a half- or full-face respirator, since they will not form a tight seal and contaminants can bypass the respirator. Bearded workers need to wear a PAPR, or powered air-purifying respirator.

## 1-2 EXTERIOR LEAD-SAFE WEATHERIZATION



**5.** Tape plastic up onto work surface and utilize systems to catch debris while limiting damage to exterior plantings



**6.** Don proper PPE, including tyvek suit with hood, gloves, booties and half- or full-face respirator (see notes). Be aware of potential for thermal stress when working in full PPE



**7.** Use hand tools or shrouded power tools to limit dispersal of contaminated dust and debris



**8.** Clean work area and carefully fold and dispose of plastic sheeting



**9.** Doff PPE outside, avoiding contact with contaminated surfaces of suit, gloves, etc., and dispose immediately

### NOTES

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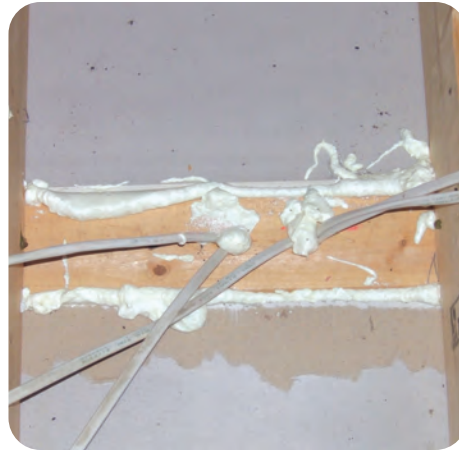
## 2-1 AIR SEAL TOP PLATES IN ATTIC

Aligns with SWS [3.0101.1](#), [3.0102.11](#)



### BEFORE

✗ Air can move around unsealed top plates in attic, making new insulation less effective



### AFTER

✓ Seal perimeter at all gaps and extend sealant up onto adjacent materials

### TOOLS

- Caulk Gun
- Spray Foam Dispensing Gun

### MATERIALS

- Caulk
- 1-part Polyurethane Spray Foam
- Mastic



Apply caulk to areas with gap 1/4 inch or smaller



Apply sprayfoam or mastic to gaps 1/4 inch to 2 inches wide

### NOTES

## 2-2 AIR SEAL AN ATTIC SOFFIT OR LARGE OPENING

Aligns with SWS [3.0101.1](#), [3.0102.9](#)



### OPTION A SEAL SOFFIT INTO CONDITIONED SPACE

Soffits, coffered ceilings and other design details can create lower sections in the ceiling line and often are not sealed or insulated properly



### OPTION B SEAL SOFFIT OUT OF CONDITIONED SPACE

From the attic side, it is best to determine if it's better to leave the soffit connected to the conditioned space (inside the house) or seal it off as part of the unconditioned space

### TOOLS

- Caulk Gun
- Utility Knife
- Measuring Tape
- Drill
- Spray Foam Nozzle

### MATERIALS

- Spray Foam
- Lumber for Support
- Expanded Polystyrene (EPS)
- Extruded Polystyrene (XPS)
- Gypsum Board
- Plywood
- Caulk
- Mechanical Fasteners

## 2-2 AIR SEAL AN ATTIC SOFFIT OR LARGE OPENING

### OPTION A - SEAL SOFFIT INTO CONDITIONED SPACE



**A-1.** For openings larger than 24 inches, support braces will be necessary



**A-2.** Attach bracing across joists securely, spacing no more than 24 inches apart



**A-3.** Apply sealant along top plates, bracing, and framing members adjacent to opening more than 24 inches apart



**A-4.** Place Infill material over opening and secure in place with mechanical fasteners



**A-5.** When support bracing has been used, screw infill material to bracing as well

#### NOTES

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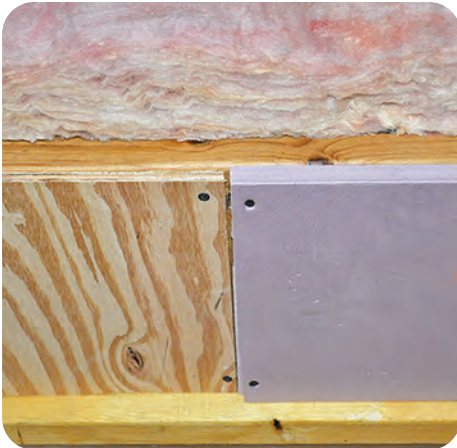
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## 2-2 AIR SEAL AN ATTIC SOFFIT OR LARGE OPENING

### OPTION B - SEAL SOFFIT OUT OF CONDITIONED SPACE



**B-1.** Seal off framed openings with rigid material, such as gypsum board, XPS, EPS, or OSB



**B-2.** Seal around infill materials

### NOTES

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## 2-3 AIR SEAL AN ATTIC CHASE OR SMALL OPENING

Aligns with SWS 3.0101.1



### BEFORE

✗ Open chases for electrical and plumbing allow air movement from subspace and/or conditioned space



### AFTER

✓ When properly sealed, air movement will cease through these spaces

### TOOLS

- Measuring Tape
- Drill
- Utility Knife
- Caulk Gun
- Spray Foam Gun

### MATERIALS

- Extruded Polystyrene (XPS)
- Expanded Polystyrene (EPS)
- Gypsum Board
- Plywood
- Spray Foam
- Mechanical Fasteners

## 2-3 AIR SEAL AN ATTIC CHASE OR SMALL OPENING



**1.** Measure the opening of the chase in a location that will maintain the pressure plane



**2.** Cut material to fit for each space where it is needed, paying attention to locations of wires and pipes



**3.** Rigid material to cover the span can be XPS, EPS, gypsum board or plywood, as appropriate for the location



**4.** Seal rigid material into place securely and air seal with caulk, spray foam or mastic



**5.** Extend sealing to adjacent materials to ensure a complete air seal

### NOTES

## 2-4 AIR SEAL BALLOON FRAMING FROM ATTIC

Aligns with SWS 3.0101.1, 3.0102.4



### BEFORE

- ✗ Balloon framing leaves cavities open from the basement to the attic, allowing for large amounts of air movement



### AFTER

- ✓ By sealing at the top of the cavity, air flow is stopped and the cavity below is another step closer to being ready to insulate

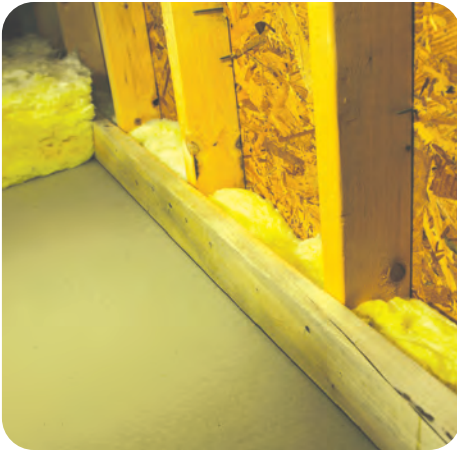
### TOOLS

- Measuring Tape
- Drill
- Utility Knife
- Saw
- Sprayfoam Gun
- Caulk Gun

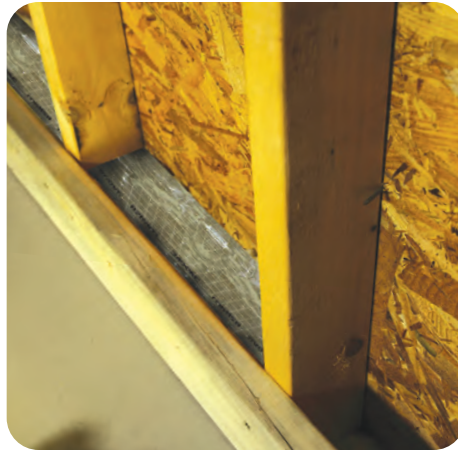
### MATERIALS

- Extruded Polystyrene (XPS)
- Gypsum Board
- Plywood
- Plastic-wrapped/ Bagged Fiberglass Batts
- 1-part Sprayfoam
- Caulk
- Mastic
- Mechanical Fasteners

## 2-4 AIR SEAL BALLOON FRAMING FROM ATTIC



**1.** Block the opening of balloon framed sidewalls in alignment with the pressure boundary



**2.** Blocking material options include lumber, gypsum board, XPS, or bagged fiberglass batts



**3.** Blocking material needs to be appropriate for potential weight load



**4.** And securely fastened rigid material to withstand pressure of dense-packing beneath



**5.** Seal any remaining gaps with caulk or 1-part spray foam, extending sealing to adjacent materials

### NOTES

# 2-5 SEAL INSULATION-CONTACT RATED CAN LIGHTS

Aligns with SWS 3.0101.1



## BEFORE

**X** Insulation-Contact rated Can lights are commonly installed in the ceiling between the upper story and the attic, meaning gaps around them allow for significant air leakage



## AFTER

**✓** By sealing around an IC-rated can light, a continuous thermal boundary is maintained

## TOOLS

• Caulk Gun

## MATERIALS

• Caulk

## NOTES

## 2-6 SEAL ELECTRICAL AND OTHER PENETRATIONS IN ATTIC

Aligns with SWS [3.0101.1](#), [6.0201.1](#), [6.0201.2](#)



**1.** Electrical, plumbing and HVAC penetrations are often oversized



**2.** For smaller gaps, caulk is enough to seal the hole



**3.** Holes larger than 1/4 inch may require support for the sealant



**4.** Inserting backer rod provides infill to support the sealant



**5.** Seal to cover entire opening, including all backer rod

### TOOLS

- Caulk Gun
- Spray Foam Gun
- Utility Knife

### NOTES

For gaps larger than 3 inches, see [2-3 Air Seal an Attic Chase or Small Opening](#)

### MATERIALS

- Caulk
- Spray Foam
- Backer Rod

## 2-7 AIR SEAL A FLOORED ATTIC

Aligns with SWS 3.0101.1



### BEFORE

- ✗ Check floor joist cavities for blocking material and penetrations



### AFTER

- ✓ Air seal cracks and penetrations in floored attic spaces

### TOOLS

- Saw
- Drill
- Measuring Tape
- Utility Knife
- Caulk Gun
- Spray Foam Gun

### MATERIALS

- Caulk
- Extruded Polystyrene (XPS)
- Lumber
- Gypsum Board
- 1-part Spray Foam
- Mechanical Fasteners
- Backer Rod

### NOTES

Spray foam will not be used in spaces that will be exposed to habitable living spaces.

## 2-7 AIR SEAL A FLOORED ATTIC



**1.** With property owner permission, remove flooring material to access cavities



**2.** Remove only as much flooring as necessary to gain access to every cavity and any large air sealing areas



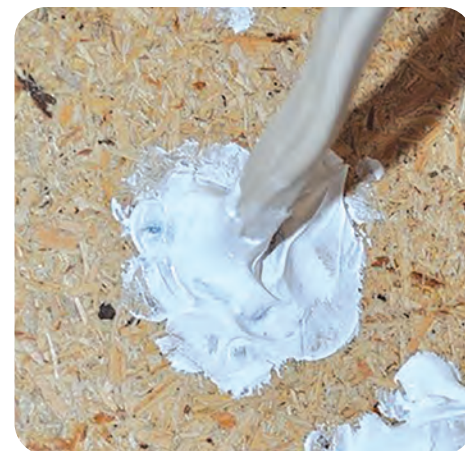
**3.** Place blocking material, as needed, and air seal to hold insulation in place



**4.** In rare cases it may be easier to access to locate blocks from below floored attic spaces



**5.** Air seal gaps and seams in joist cavities as accessible



**6.** Check for and air seal electrical, plumbing, and HVAC penetrations properly



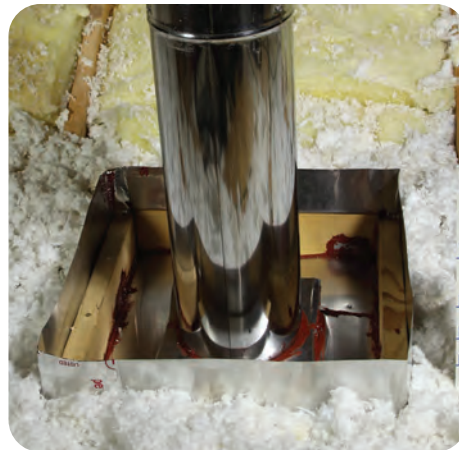
## 3-1 SEAL AROUND CHIMNEYS AND FLUES

Aligns with SWS 3.0102.2



### BEFORE

- ✗ Even high-temperature sites need air sealing



### AFTER

- ✓ Maintain 3-inch clearance from flue for all combustible materials

### TOOLS

- Caulk Gun
- Metal Snips or Nibbler
- Drill
- Tape Measure

### MATERIALS

- 26-Gauge Sheet Metal
- Mechanical Fasteners
- Lumber

## 3-1 SEAL AROUND CHIMNEYS AND FLUES



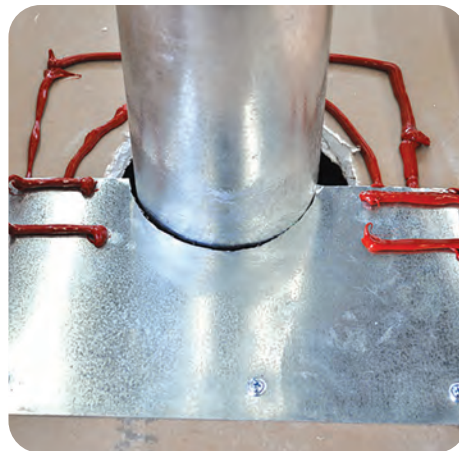
**1.** Select high-temperature caulk sealant that will adjust to temperature differences between materials



**2.** Apply unbroken ring of caulk directly to clean decking around entire perimeter of flue or chimney



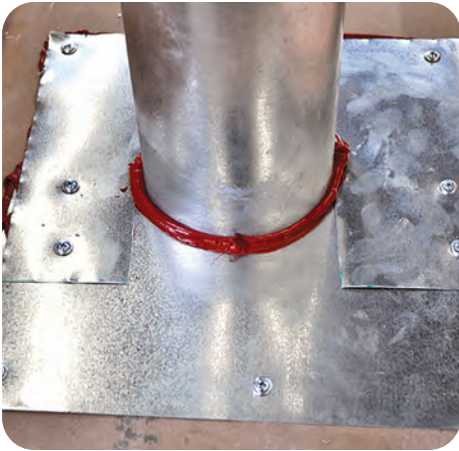
**3.** Apply unbroken ring of caulk directly to clean decking to match perimeter of sheet metal backing



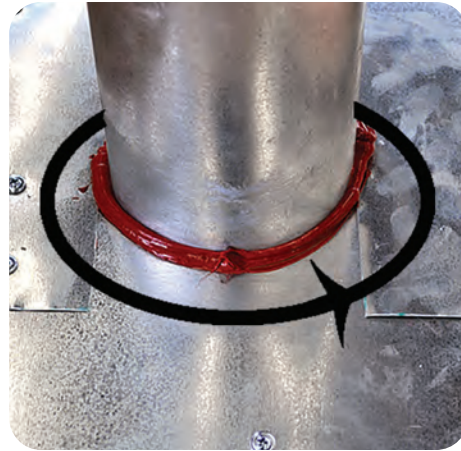
**4.** Install first layer of metal sheeting and apply additional caulk to complete new perimeter for second layer of sheeting

### NOTES

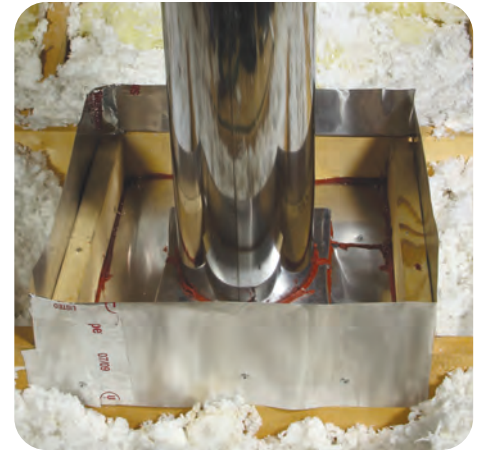
## 3-1 SEAL AROUND CHIMNEYS AND FLUES



**5.** Set second layer of sheeting to complete ring around flue or chimney. Fasten sheeting mechanically



**6.** Run bead of high-temperature caulk around flue at backing to seal remaining gaps  $< 1/4$  inch



**7.** Create a durable, fixed dam, at least 2 inches higher than final insulation level, keeping all combustible materials at least 3 inches away from flue or chimney

### NOTES

## 3-2 SEAL AROUND NON-INSULATION CONTACT-RATED (NON-IC) CAN LIGHTS

Aligns with SWS [3.0102.1](#)



### BEFORE

- ✗ Non-Insulation Contact-rated can lights create a fire hazard in well-insulated attics



### AFTER

- ✓ When boxed with appropriate clearances and fire-rated materials, fire risk is mitigated

### TOOLS

- Measuring Tape
- Utility Knife
- Caulk Gun

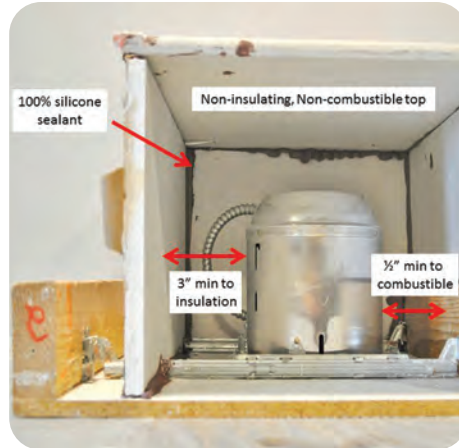
### MATERIALS

- 5/8 Inch Gypsum Board
- High-Temperature Caulk
- 100% Silicone Sealant

## 3-2 SEAL AROUND NON-INSULATION CONTACT- RATED (NON-IC) CAN LIGHTS



1. Clear any debris from around non-IC-rated can light



2. Enclosure has 3 inches of clearance from lamp to insulation on all sides, at least 1/2 inch from any combustible material, such as wood



3. Premade boxes can make installation easier when installation site is clear of framing members

### NOTES

Non "Insulation Contact" Can Lights are designed to vent heat from the lamp into the cavity around them. They are safe to use in non-insulated cavities, such as the ceiling/floors between different stories in a home. IC-rated Can Lights have a secondary housing to keep the heat of the lamp from contacting the insulation. They are also recommended for use with lower wattage lamps.

## 3-2 SEAL AROUND NON-INSULATION CONTACT- RATED (NON-IC) CAN LIGHTS



- 4.** Seal box on all sides and edges to make continuous barrier from attic, using high temp caulk where appropriate



- 5.** Top of box must be R-1 or less and left free of insulation. Flag enclosure for added visibility

### NOTES

With the help of a licensed electrician, there is also the option of replacing old can lights with air-tight units or LED retrofit inserts. Check program requirements.

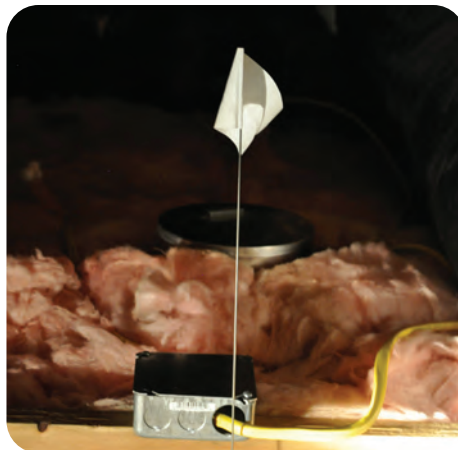
## 4-1 PREPARE ATTIC FLOOR FOR INSULATION

Aligns with SWS [4.0103.1](#), [4.0103.2](#), [4.0103.3](#), [4.0103.4](#), [4.0103.5](#), [4.0103.6](#), and [4.0103.8](#)

### BEFORE YOU BEGIN



- ✓ Check for live knob & tube wiring and dam off when possible, or replace with modern wiring



- ✓ Cover junction boxes and attach flag for visibility

### TOOLS

- Non-Contact Tester
- Utility Knife
- Drill
- Hole Saw
- Caulk Gun
- Staple Gun
- Metal Snips
- Nibbler

## 4-1 PREPARE ATTIC FLOOR FOR INSULATION



**1.** Remove stored materials



**2.** Run exhaust fan ducts to outside, insulate to R-8



**3.** Ensure air sealing, if any, is completed



**4.** Install baffles, if needed. Ensure 2 inches of gap for airflow

### MATERIALS

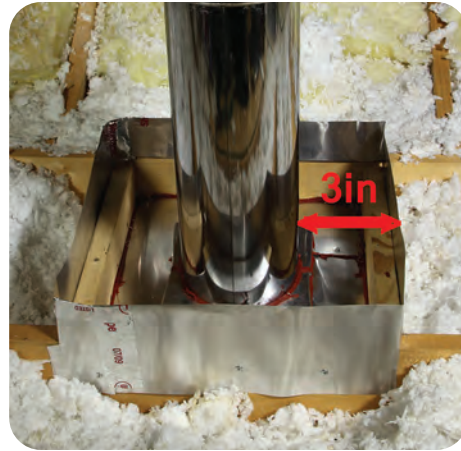
- Plywood
- Drywall
- XPS
- Junction Box Covers
- Flags
- Vent Caps
- Rigid Duct
- Mechanical Fasteners
- Foil Tape
- R-8 Duct Insulation
- Soffit Baffles
- Depth Rulers
- 26-Gauge Steel Sheeting
- High-Temperature Caulk



## 4-1 PREPARE ATTIC FLOOR FOR INSULATION



**5.** Depth rulers installed, 1 per 300 square feet



**6.** All dams are built, as needed

### NOTES

Knob-and-tube can be replaced by a duly qualified professional.

# 5-1 DAM, SEAL & INSULATE AN ATTIC HATCH

Aligns with SWS [3.0103.1](#)



## BEFORE

✗ Uninsulated attic access points allow conditioned air to escape the home in all seasons



## AFTER

✓ Safely and durably sealing and insulating attic access doors prevent air movement and reduces heating and cooling loads

## TOOLS

- Measuring Tape
- Saw
- Drill
- T-Square
- Utility Knife
- Caulk Gun

## MATERIALS

- Lumber
- Mechanical Fasteners
- Extruded Polystyrene (XPS) or Other Rigid Foam Insulation Board
- Foam Tape
- Adhesive
- Latch (optional)

## 5-1 DAM, SEAL & INSULATE AN ATTIC HATCH



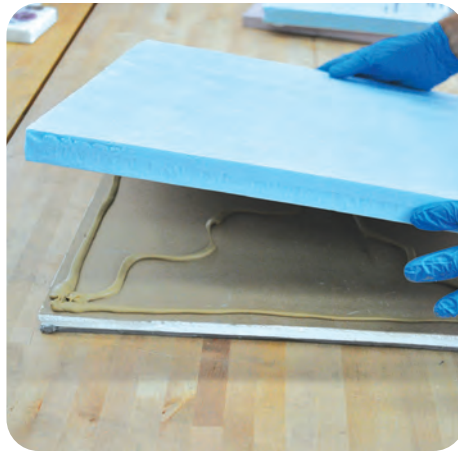
**1.** Rigid, durable attic hatch blocking/dam is installed in a permanent way



**2.** Dam is at least 2 inches taller than the final attic insulation depth



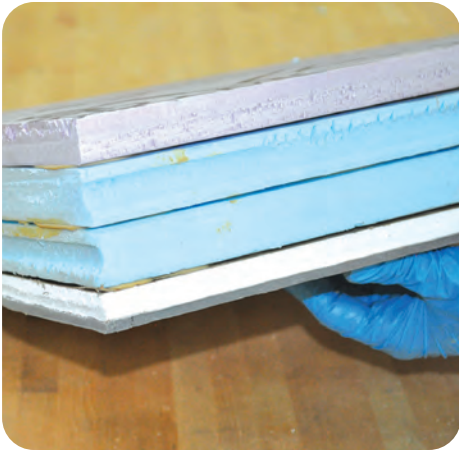
**3.** Cut gypsum board to hatch size for "friction fit" and air seal bottom of hatch with unbroken ring of foam tape



**4.** Cut and stack rigid foam insulation, gluing with appropriate adhesive, to build up R-value

### NOTES

## 5-1 DAM, SEAL & INSULATE AN ATTIC HATCH



**5.** Hatch is insulated to proper R-value (the maximum R-value structurally allowable, up to the final insulation level of surrounding attic)



**6.** Trim is air-sealed with appropriate material



**7.** For vertical accesses, run weatherstripping or foam tape to air seal at these doorways too. Hold vertical accesses closed with latch if necessary

### NOTES

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## 5-2 DAM, SEAL & INSULATE A PULL-DOWN ATTIC STAIRWAY

Aligns with SWS 3.0103.1



### BEFORE

✗ Pull-down stairs can be a weak point in thermal/pressure boundaries, as well as creating a place where insulation can fall down into the home



### AFTER

✓ Attic pull-down stairs are safely and durably sealed and insulated to prevent air movement

### TOOLS

- Measuring Tape
- Utility Knife
- Saw
- Caulk Gun
- Spray Foam Gun
- Drill

### MATERIALS

- Extruded Polystyrene (XPS)
- Expanded Polystyrene (EPS)
- Polyiso
- Plywood
- 1-Part Spray Foam
- Spray Adhesive
- Caulk Adhesive
- Foil Tape
- Mechanical Fasteners
- Foam Tape
- Weatherstripping
- Latches

## 5-2 DAM, SEAL & INSULATE A PULL-DOWN ATTIC STAIRWAY



1. Build cover above and around pull-down stair, taller than final insulation height



2. Insulate top and sides of dam cover, to appropriate R-value



3. Air seal all edges of trim



4. Air seal with foam tape or weatherstripping



5. Install latches to ensure hatch remains closed and air sealed if it does not remain closed with a 'friction fit'

### NOTES

# 6-1 INSULATE AN UNFLOORED ATTIC

Aligns with SWS [4.0103.2](#), [4.0103.4](#), [4.0103.6](#)



## BEFORE

Ensure that attic prep work has been completed before starting installation (See 4-1 Prep Attic Floor for Insulation)

## AFTER

### FINAL CHECKLIST

- ✓ Appropriate insulation material used
- ✓ Correct depth, as specified in work order
- ✓ Insulation level is even

## TOOLS

- Measuring Tape
- Insulation Machine
- Staple Gun

## MATERIALS

- Loose fill fiberglass or cellulose (as per work order)
- Staples

## 6-1 INSULATE AN UNFLOORED ATTIC

Description / Comment	
Attic Insulation - Blown Fiberglass - R-38	
Attic Insulation - Blown Fiberglass - R-38	

**Nature Blend™ Loose Fill Formula**

Coverage Chart for Thermal Acoustical Application

R-Value @ 2" F.T.	Initial Density Thickness (Inches)	Minimum Density Thickness (Inches)	No. Joints (joints square per assembly)			2" x 8", 10" O.C.		
			Bags Per 1000 Sq. Ft.	Net Coverage Sq. Ft. Per Bag	Minimum Weight Per Sq. Ft.	Bags Per 1000 Sq. Ft.	Net Coverage Sq. Ft. Per Bag	Minimum Weight Per Sq. Ft.
13	4.4	4.0	17.4	57.5	0.39	15.8	63.5	0.35
19	6.1	5.5	27.9	35.8	0.61	25.3	39.6	0.56
22	6.9	6.2	33.2	30.1	0.73	30.5	32.8	0.67
25	7.8	7.0	38.6	25.9	0.85	35.6	28.0	0.79
30	9.2	8.3	47.6	21.0	1.05	44.6	22.4	0.98
35	11.4	10.3	62.0	16.1	1.35	58.9	17.0	1.30
49	14.6	13.1	82.0	12.2	1.80	78.7	12.7	1.73
60	17.7	15.9	101.9	9.8	2.24	96.6	10.1	2.17



1. Verify against work order that correct insulation material is being installed
2. Verify insulation depth/density against manufacturer's density chart
3. While installing, regularly check depth of insulation for even coverage and to meet required depth



4. Ensure that insulation does not get into dammed-off areas, such as around chimneys and flues and inside soffit baffles
5. When complete, post insulation certificate by attic entrance

**NOTES**

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## 6-2 INSULATE UNDER A FLOORED ATTIC

Aligns with SWS 4.0103.6



### BEFORE

✘ Attics with flooring often hide uninsulated cavities



### AFTER

✔ An insulated attic floor provides a continuous, contiguous, safe, and compliant thermal boundary that prevents air movement

### TOOLS

- Measuring Tape
- Utility Knife
- Insulation Machine
- Drill
- Hole Saw
- Prybar
- Caulk Gun

### MATERIALS

- Loose Fiberglass or Cellulose Insulation
- Extruded Polystyrene (XPS)
- Caulk
- Mechanical Fasteners
- Gypsum Board
- Plugs



## 6-2 INSULATE UNDER A FLOORED ATTIC



**5.** Blocking still needs to be put into place



**6.** Blow insulation to completely fill cavities to prescribed density



**7.** Fill and reseal access holes to prevent air movement

### NOTES

## 6-3 INSULATE AN ATTIC STAIRWAY

Aligns with SWS [4.0104.1](#), [4.0104.2](#), [4.0104.3](#), [4.0104.4](#),  
[4.0201.2](#), [4.0201.3](#), [4.0202.1](#)



### BEFORE

✗ Attic stairways can offer a unique set of insulation challenges. Clearly define where the thermal and pressure boundary are going to be located before starting insulation



### AFTER

✓ Insulation provides a continuous, contiguous, safe, and compliant thermal boundary that prevents air movement between the attic and the remainder of the home

### TOOLS

- Measuring Tape
- Drill
- Utility Knife
- Hole Saw
- Insulation Machine
- Spray Foam Gun

### MATERIALS

- Kraft-Faced Fiberglass Batts
- Loose Cellulose or Fiberglass Insulation
- Netting
- Furring Strips
- Staples
- Mechanical Fasteners
- Extruded Polystyrene (XPS)
- 1-Part Spray Foam
- House Wrap
- Plywood
- Gypsum Board

## 6-3 INSULATE AN ATTIC STAIRWAY



**1.** If walls are accessible from the attic side, choose between batt or blown-in insulation



**2.** Block off open cavities along the line of the thermal/pressure boundary



**3.** Air seal around blocking material



**4.** Cut batts to size for each individual cavity, ensuring no gaps remain, locating kraft-paper toward conditioned space



**5.** For batt insulation, cover installed batts with backing. For blown-in, attach netting to framing members, cut holes in netting and blow in insulation to 3.5 pounds per cubic inch

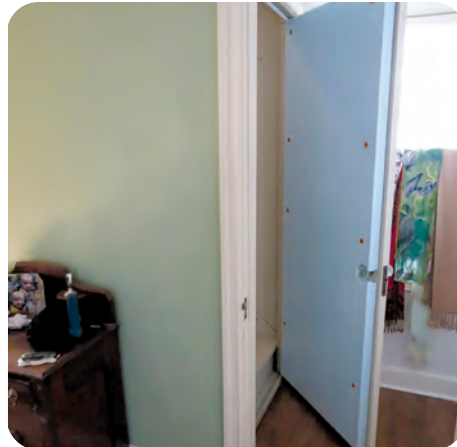


**6.** If walls are enclosed from attic side, drill holes in stairways walls

## 6-3 INSULATE AN ATTIC STAIRWAY



**7.** Dense pack stairway walls



**8.** Weatherstrip and insulate door



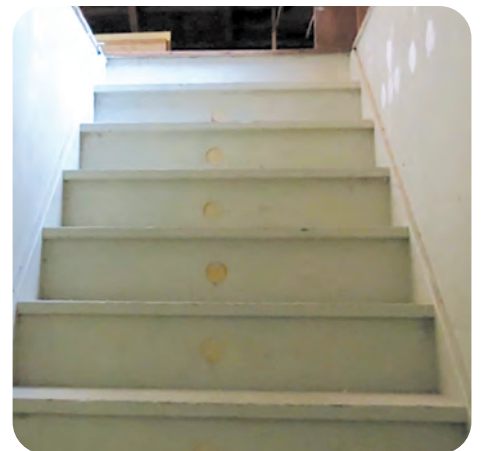
**9.** Insulate under stairway using insulation indicated by work order



**10.** Seal off insulation from conditioned space in home



**11.** If backside of stairs is sealed, blow insulation into cavity behind stairs



**12.** Plug access holes from blown insulation

### NOTES

# 7-1 PREPARE A MANUFACTURED HOME CEILING FOR INSULATION

Aligns with SWS [4.0103.6](#), [4.0103.9](#), [4.0103.10](#), [4.0103.11](#), [4.0103.12](#)



## BEFORE YOU BEGIN

Make any repairs and preparation as noted from assessment, as well as fixing any new issues that could cause the ceiling to be compromised with the additional weight of insulation



## AFTER

### FINAL CHECKLIST

- ✓ Vents all terminate to outside and are properly sealed
- ✓ Flues are dammed properly
- ✓ Ceiling is in good condition to hold weight

## TOOLS

- Measuring Tape
- Utility Knife
- Zip Tie Tensioner

## MATERIALS

- R-8 minimum Flex Duct insulation
- Duct Insulation with Vapor Retarder
- Water Heater Blanket with Vapor Retarder
- Zip Ties
- Twine
- Spray Adhesive
- Mastic
- UL 181 Fiberglass Mesh Tape

## 7-1 PREPARE A MANUFACTURED HOME CEILING FOR INSULATION



1. Ensure plumbing and exhaust vents terminate outside



2. Dam around high temperature flues (note: flue in image is in need of work)



3. Replace non-IC rated can lights with IC-rated cans



4. Repair roof leaks or other damage, as possible, or defer job if necessary

### NOTES

Check with your state program to find out deferral thresholds and procedures



# 7-2 MH INSULATION: GABLE END BLOW METHOD

Aligns with SWS 4.0103.9



### BEFORE

✗ Manufactured housing often does not meet regional standards for insulation



### AFTER

✓ Fill entire cavity and reseal gable ends

### TOOLS

- Drill
- Utility Knife
- Hole Saw or Saws-All
- Caulk Gun

### MATERIALS

- Fiberglass or Cellulose Loose Insulation
- Mechanical Fasteners
- Caulk/Sealant

### NOTES

## 7-2 MH INSULATION: GABLE END BLOW METHOD



**1.** Verify integrity of ceiling to hold weight of insulation



**2.** Ground blower hose to reduce chance of electrical build-up



**3.** Remove or fold up gable end to access attic



**4.** Insert blower hose as far as possible and then retract slowly to fill cavity entirely, on each side of marriage wall



**5.** Fill cavity and leave appropriate documentation



**6.** Reseal gable end or install gable vent at peak that has no more than 1/2 inch mesh screen. Repeat all steps from other end, if needed.

# 7-3 MH INSULATION: EDGE BLOW METHOD

Aligns with SWS 4.0103.10



## BEFORE

✗ Manufactured housing often does not meet regional standards for insulation



## AFTER

✓ Verify reinstallation and proper sealing of edge of roof to ensure no water or pest intrusion

## NOTES

## TOOLS

- Drill
- Utility Knife
- Insulation Machine

## MATERIALS

- Fiberglass or Cellulose Loose Insulation
- Blocking Material
- Butyl Tape

## 7-3 MH INSULATION: EDGE BLOW METHOD



**1.** Verify integrity of ceiling to hold weight of insulation



**2.** Prepare stable work area to access roof edge



**3.** Unfasten and remove J channel from edge of roof



**4.** Clean old butyl tape or putty from J channel and store J channel somewhere safe until it can be reinstalled



**5.** Remove staples holding down edge of roof



**6.** Insert blocks to hold roof edge up approximately 6 inches

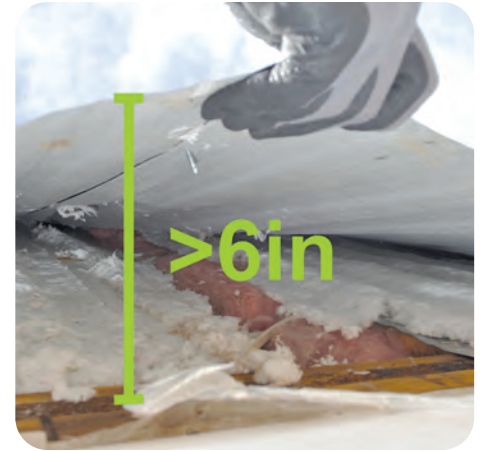
## 7-3 MH INSULATION: EDGE BLOW METHOD



**7.** Ground the fill hose to reduce chance of electrical build-up



**8.** Insert blower hose as far as possible into cavity and retract slowly while filling space between trusses



**9.** Work down the edge of the roof until entire cavity is full



**10.** Remove blocks and reattach edge of roofing over exterior sidewall paneling



**11.** Replace butyl tape on J channel



**12.** Reattach J channel, lapping over edge of roof. Repeat entire process for other side, if necessary

## 7-4 MH INSULATION: RIDGE BLOW METHOD

Aligns with SWS [4.0103.11](#)



### BEFORE

✗ Manufactured housing commonly is underinsulated, particularly older models



### AFTER

✓ After accessing from ridge, ridge cap can be installed or a series of vent caps

### TOOLS

- Drill
- Saw
- Insulation Machine
- Caulk Gun
- Metal Sheers

### MATERIALS

- Loose Fiberglass Insulation
- Sealant
- 26-Gauge Metal Sheeting
- Vent Caps
- Mechanical Fasteners
- Elastomeric Coating

## 7-4 MH INSULATION: RIDGE BLOW METHOD



**1.** Remove ridge cap or cut access holes at ridge, leaving one side attached to put back in place



**2.** Insert blower hose



**3.** Fill all accessible areas



**4.** If not installing ridge or cap vents, replace flaps, patch over with metal, and seal with elastomeric

### NOTES

## 7-5 MH INSULATION: INTERIOR BLOW METHOD

Aligns with SWS [4.0103.12](#)



**1.** Drill holes in ceiling to fill each ceiling joist cavity



**2.** Blow insulation into ceiling cavity to appropriate R-value for region



**3.** Continue throughout house to ensure even coverage and no gaps



**4.** Seal all holes securely

### TOOLS

- Hole Saw
- Vacuum
- Insulation Machine
- Caulk Gun

### MATERIALS

- Cellulose or Fiberglass Loose Insulation
- Plugs
- Sealant

### NOTES



## 7-6 MH INSULATION: TOP FILL BLOW METHOD

Aligns with SWS [4.0103.11](#)



### BEFORE

✘ Attics in older manufactured housing are often underinsulated or poorly insulated



### AFTER

#### FINAL CHECKLIST

- ✓ Provide a Continuous and safe thermal barrier
- ✓ Protect integrity of roof

### TOOLS

- Saw
- Insulation Machine
- Caulk Gun
- Paint Brush
- Drill

### MATERIALS

- Cellulose or Fiberglass Loose Insulation
- All-Weather Adhesive
- Sheet Metal
- Mechanical Fasteners
- Elastomeric Paint

## 7-6 MH INSULATION: TOP FILL BLOW METHOD



1. Drill or cut uniform access holes in the roof adequately spaced to access the entire roof cavity



2. Blow insulation into attic cavity to capacity



3. Run a continuous bead of flexible and durable all-weather adhesive around the access hole



4. Install a durable metal patch of equal or greater gauge than the roof material that overlaps the opening at least 2 inches on all sides, and fastening in place every 2 inches along perimeter



5. Apply elastomeric paint over patch that laps at least 6 inches on all sides to create a continuous seal

### NOTES

## 8-1 AIR SEAL ABOVE THE KNEE WALL

Aligns with SWS [3.0101.1](#), [3.0102.11](#)



### BEFORE

✗ Knee walls are part of the thermal and pressure boundary



### AFTER

✓ Air sealing from above continues the pressure boundary while supporting future insulation

### TOOLS

- Measuring Tape
- Utility Knife
- Saw
- Drill
- Caulk Gun
- Spray Foam Gun

### MATERIALS

- Extruded Polystyrene (XPS)
- Plywood
- Gypsum Board
- Lumber
- Mechanical Fasteners
- Caulk
- Spray Foam
- Mastic

## 8-1 AIR SEAL ABOVE THE KNEE WALL



**1.** After clearing away debris, measure gap above knee wall in line with pressure boundary



**2.** Cut blocking material (XPS, wood, gypsum board) to fit gap



**3.** Securely fit infill or blocking material in place



**4.** Ensure blocking material is located in line with preferred pressure boundary

### NOTES



## 8-2 AIR SEAL BENEATH THE KNEE WALL

Aligns with SWS [3.0101.1](#)



### BEFORE

✗ Knee walls are part of the thermal and pressure boundary



### AFTER

✓ Air sealing from below allows areas of the attic floor to be treated separately according to whether they fall in or out of the pressure boundary

### TOOLS

- Measuring Tape
- Utility Knife
- Saw
- Drill
- Caulk Gun
- Spray Foam Gun

### MATERIALS

- Extruded Polystyrene (XPS)
- Plywood
- Gypsum Board
- Lumber
- Mechanical Fasteners
- Caulk
- Spray Foam
- Mastic

## 8-2 AIR SEAL BENEATH THE KNEE WALL



**1.** After clearing away debris, measure gap below knee wall in line with pressure boundary



**2.** Cut blocking material (XPS, wood, gypsum board) to fit gap



**3.** Securely fit infill or blocking material in place



**4.** Ensure blocking material is located in line with preferred pressure boundary



**5.** Seal continuously around blocking material to preserve pressure boundary

### NOTES

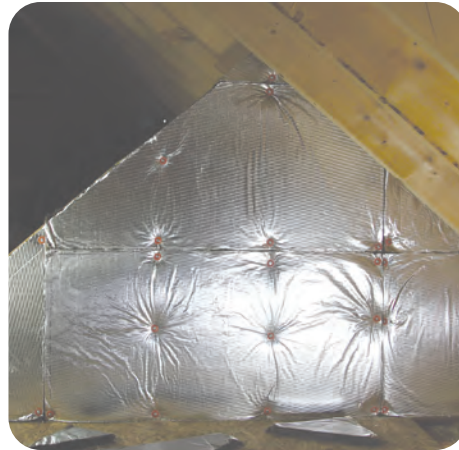
## 8-3 INSULATE AN ATTIC KNEE WALL WITH BATTS

Aligns with SWS [4.0104.2](#), [4.0104.3](#)



### BEFORE

✗ Air sealed knee walls are ready for insulation



### AFTER

✓ Once insulated, this knee wall provides a continuous, contiguous, safe, and compliant thermal boundary that prevents air movement

### TOOLS

- Measuring Tape
- Utility Knife
- Staple Gun

### MATERIALS

- Fiberglass Batts
- Staples
- Nylon Strap
- Mechanical Fasteners
- House Wrap
- Radiant Barrier



## 8-3 INSULATE AN ATTIC KNEE WALL WITH BATTS



**1.** Measure cavities



**2.** Cut batts for exact fit



**3.** Install batts with minimal compression



**4.** Install backing material

### NOTES

## 8-5 INSULATE AN ATTIC KNEE WALL WITH BLOWN INSULATION

Aligns with SWS [4.0104.1](#)



### BEFORE

✗ Air sealed knee walls are ready for insulation



### AFTER

✓ Once insulated, this knee wall provides a continuous, contiguous, safe, and compliant thermal boundary that prevents air movement

### TOOLS

- Measuring Tape
- Utility Knife
- Drill
- Staple Gun
- Hole Saw
- Insulation Machine

### MATERIALS

- Extruded Polystyrene (XPS)
- Gypsum Board
- House Wrap
- Radiant Barrier
- Mechanical Fasteners
- Furring Strips
- Loose Fiberglass Insulation

## 8-5 INSULATE AN ATTIC KNEE WALL WITH BLOWN INSULATION



**1.** Securely install backing material over entire knee wall



**2.** Cut holes in backing material to allow access to all cavities



**3.** Blow insulation into cavities to meet dense-pack standards



**4.** Fill all cavities



**5.** Replace access hole plugs in backing material, if possible



**6.** Seal access holes permanently and completely

### NOTES

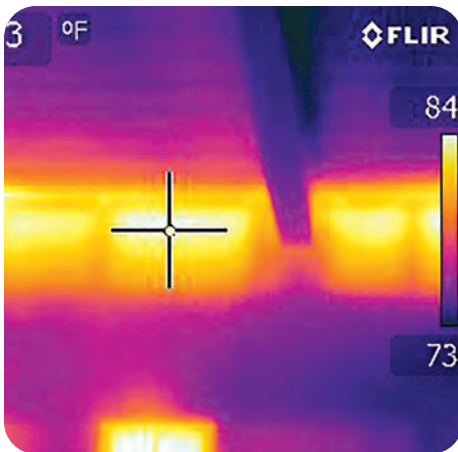
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# 9-1 DENSE-PACK A SIDEWALL VIA EXTERIOR BLOW

Aligns with SWS [4.0202.1](#)



## BEFORE

✗ Walls that are missing insulation or underinsulated are an opportunity for energy savings



## AFTER

✓ When properly insulated, walls will allow minimal heat and air transfer

## TOOLS

- Measuring Tape
- Utility Knife
- Pry-Bar
- Siding Remover
- Hole Saw
- Drill
- Insulation Machine

## MATERIALS

- Plastic Sheeting
- Painters Tape
- Loose Cellulose or Fiberglass Insulation
- Plugs
- Caulk
- Spray Foam
- Mechanical Fasteners

## 9-1 DENSE-PACK A SIDEWALL VIA EXTERIOR BLOW



- 1.** Protect work area from debris and dirt



- 2.** Ensure balloon-framed walls are blocked at top and bottom



- 3.** Ensure wall integrity is complete (no holes)



- 4.** Remove siding as needed



- 5.** Drill holes as required based on building frame design and exterior materials



- 6.** Fill cavities completely and to proper density

## 9-1 DENSE-PACK A SIDEWALL VIA EXTERIOR BLOW



**7.** If possible, ensure all cavities are filled before completing job



**8.** Patch holes

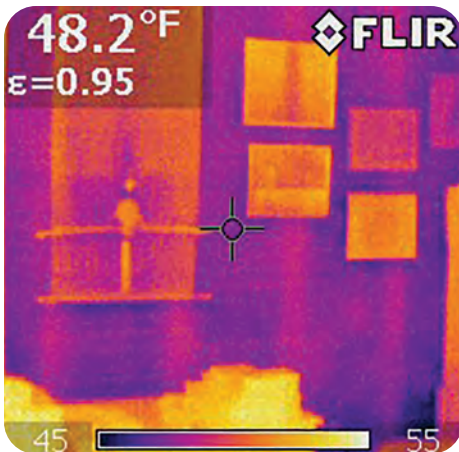


**9.** Replace and/or repair siding

### NOTES

## 9-2 DENSE-PACK A SIDEWALL VIA INTERIOR BLOW

Aligns with SWS [4.0202.1](#)



### BEFORE

✗ Older houses often are lacking in insulation



### AFTER

✓ Inconspicuous capped, patched, or covered holes are the ideal

### TOOLS

- Measuring Tape
- Utility Knife
- Hole Saw
- Drill
- Insulation Machine
- Infrared Camera

### MATERIALS

- Plastic Sheeting
- Loose Cellulose or Fiberglass Insulation
- Gypsum Board
- Joint Compound
- Caulk
- Mechanical Fasteners
- Chair Rail
- Plugs
- Painters Tape

## 9-2 DENSE-PACK A SIDEWALL VIA INTERIOR BLOW



**1.** Protect work area from debris and dust



**2.** Ensure balloon-framed walls are blocked at top and bottom



**3.** Ensure wall integrity is complete (no holes)



**4.** Drill holes as required based on building design

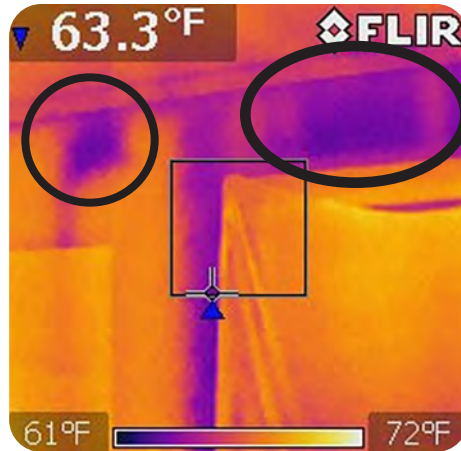
### NOTES



## 9-2 DENSE-PACK A SIDEWALL VIA INTERIOR BLOW



**5.** Fill cavities completely and to proper density



**6.** If possible, ensure all cavities are filled before completing job (note: dark areas were missed)



**7.** Patch holes. Use chair rail if preferred.

### NOTES

# 10-1 INSULATE MANUFACTURED HOME SIDEWALLS WITH BATTS

Aligns with SWS [4.0202.3](#)



## BEFORE

✗ Manufactured housing sidewalls present a unique challenge when it comes to insulation



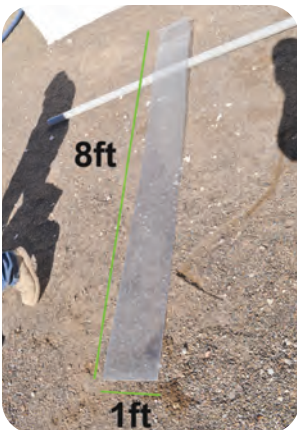
## AFTER

✓ Properly installed insulation will have no gaps and compressed as little as possible

## TOOLS

- Drill
- Measuring Tape
- Utility Knife
- Batt Stuffer

## BEFORE YOU BEGIN



Prepare insulation stuffer, if necessary

## MATERIALS

- Wrapped Fiberglass Batts
- Mechanical Fasteners

## 10-1 INSULATE MANUFACTURED HOME SIDEWALLS WITH BATTS



**1.** Remove siding as needed, starting from bottom and taking note of any obstacles that may compress insulation



**2.** Measure cavity size



**3.** Plastic-wrapped fiberglass batts provide both insulation value and vapor retarder for unsealed cavities



**4.** Cut batt to length for cavity



**5.** Fold batt over end of insulation stuffer



**6.** Insert batt into cavity, sliding under top belt rail to top of cavity, and ease stuffer back out to allow batt to fill in space



# 10-2 INSULATE MANUFACTURED HOME SIDEWALLS WITH BLOWN INSULATION

Aligns with SWS 4.0202.4, 4.0202.5



## BEFORE

✗ Older manufactured housing is often lacking insulation since it did not have to be built to a particular jurisdiction's codes



## AFTER

✓ When properly insulated, siding will not bulge or be dented from installation

## TOOLS

- Drill
- Insulation Machine

## MATERIALS

- Loose Fiberglass Insulation
- Mechanical Fasteners

## 10-2 INSULATE MANUFACTURED HOME SIDEWALLS WITH BLOWN INSULATION



**1.** Ensure the integrity of the wall to be insulated, both from exterior and interior



**2.** Remove siding as needed, from the bottom



**3.** Fill cavity with blown insulation, ensuring to get past belt rails and electrical



**4.** Reinstall siding



**5.** Be prepared to adapt insulation strategy dependent upon exterior materials

### NOTES

# 11-1 INSTALL WEATHERSTRIPPING ON AN EXTERIOR DOOR

Aligns with SWS 3.0202.1



## BEFORE

✘ Daylight visible around an exterior door indicates air infiltration



## AFTER

### FINAL CHECKLIST

- ✓ Door closes and opens easily
- ✓ Weatherstrip makes a good seal with the door
- ✓ Weatherstrip does not get flattened in a way that will lead to damage when used

## TOOLS

- Tape Measure
- Snips
- Drill with Appropriate Bits

## MATERIALS

- Weatherstripping

## 11-1 INSTALL WEATHERSTRIPPING ON AN EXTERIOR DOOR



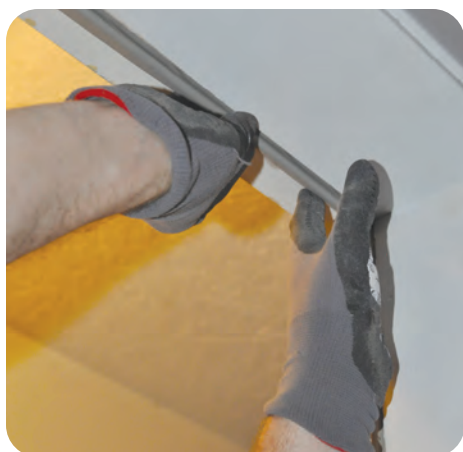
1. Measure doorway for weatherstripping



2. Measure door top or bottom as well for weatherstripping and potential door bottom or sweep



3. Notch upper ends of side weatherstripping to allow for top piece



4. Fit weatherstripping snugly into rabbet, if one exists, and against other pieces



5. Fasten weatherstripping securely when no rabbet exists

### NOTES

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## 11-2 INSTALL A DOOR SWEEP OR DOOR BOTTOM ON AN EXTERIOR DOOR

Aligns with SWS [3.0202.1](#)



### BEFORE

✗ Air and water can come in under doors when there is no door bottom or sweep



### AFTER

#### FINAL CHECKLIST

- ✓ Ensure a good seal to prevent air infiltration
- ✓ Ensure unimpeded door operation

### NOTES

Door bottoms commonly are installed on new doors, those that have wooden thresholds, or to replace older existing door bottoms. For houses with a rubber threshold, door sweeps are more common.

### TOOLS

- Measuring Tape
- Metal Snips
- Saw
- Drill
- Caulk Gun

### MATERIALS

- Mechanical Fasteners
- Caulk

## 11-2 INSTALL A DOOR SWEEP OR DOOR BOTTOM ON AN EXTERIOR DOOR

### STEPS 1-3: FOR DOOR SWEEP AND DOOR BOTTOM



**1.** Measure width of door and ensure that door sweep is appropriate length



**2.** Adjust threshold to ensure that it is seated tightly



**3.** Apply caulk to threshold at floor on interior, and exterior if possible, to minimize water intrusion

### STEPS 4-6: FOR DOOR SWEEP



**4.** Install door sweep on interior face of door, centering on door face



**5.** Attach door sweep using mechanical fasteners



**6.** Evenly place mechanical fasteners along entire length of door sweep

## 11-2 INSTALL A DOOR SWEEP OR DOOR BOTTOM ON AN EXTERIOR DOOR

### STEPS 4-8: FOR DOOR BOTTOM



- 4.** With threshold adjusted, measure door opening height



- 5.** Remove door from opening if height of door needs to be shortened to make room for door bottom



- 6.** Trim door, if possible, to ensure good fit of door bottom



- 7.** Trim sweep to match width of door



- 8.** Ensure that door bottom sits tight against the door and reinstall door

### NOTES

# 12-1 AIR SEAL SILL PLATE AND RIM JOIST

Aligns with SWS 3.0104.1



## BEFORE

✗ Air movement around sill plates and near rim joists needs to be addressed before insulating

## AFTER

✓ Once air sealed, the cavity is ready for insulation

## TOOLS

- Spray Foam Applicator
- Spray Foam Gun
- Caulk Gun

## NOTES

## MATERIALS

- 2-Part Spray Foam
- 1-Part Spray Foam
- Backer Rod
- Machine Mesh
- Steel Wool
- Caulk

## 12-1 AIR SEAL SILL PLATE AND RIM JOIST



**1.** For exterior holes larger than 1/4 inch, steel wool or other pest blocking material before sealing



**2.** Cut backing material to fill space



**3.** Seal over to hold backing material in place and air seal



**4.** Seal penetrations on subfloor as well, looking out not only for current electrical and plumbing, but also vacated holes



**5.** Push sealant into seams where framing members meet



**6.** Create a continuous seal on all seams

## 12-2 INSULATE RIM JOIST

Aligns with SWS [4.0401.1](#), [4.0401.2](#), [4.0401.3](#)



### BEFORE

✗ Basement and crawlspace rim joists must be addressed when part of the thermal boundary



### AFTER

✓ Foam products require a thermal barrier or coating, such as 1/2-inch gypsum board, to separate them from permanently habitable spaces

### TOOLS

- Measuring Tape
- Utility Knife
- Spray Foam Applicator
- Spray Foam Gun
- Drill
- Caulk Gun

### MATERIALS

- Polyisocyanurate Foam Board
- Plastic-Wrapped Fiberglass Batts
- Extruded Polystyrene (XPS)
- 2-Part Spray Foam
- 1-Part Spray Foam
- Gypsum Board
- Mechanical Fasteners
- Caulk

## 12-2 INSULATE RIM JOIST



**1.** Measure each individual cavity to be insulated and take note of obstacles for insulation



**2.** Cut insulation, either rigid foam board or wrapped batts, for each individual cavity



**3.** Ensure space is filled with no gaps or misalignment, and insulation tight to rim joist



**4.** Ensure insulation is secured in place and will not move over time

### NOTES

As long as foam is not over 3.25 inches thick and space is not permanently habitable, insulation does not need to be covered by thermal barrier

## 12-2 INSULATE RIM JOIST



**5.** If foam insulation is over 3.25 inches thick or space is permanently habitable, insulation needs to be covered by a thermal barrier, such as gypsum board



**6.** When using wrapped or faced batts, ensure facing is to the conditioned side of the cavity and that batt is uncompressed



**7.** Seal edges of the wrap or facing to surrounding surface to ensure a continuous barrier



**8.** 2-part sprayfoam can also be used as rim joist insulation

### NOTES



# 12-3 INSULATE BASEMENT WALLS IN CONDITIONED SPACE

Aligns with SWS 4.0402.4, 4.0402.5



## BEFORE

✗ An uninsulated wall in a "conditioned" space allows the loss of conditioned air



## AFTER

✓ A sealed continuous air barrier finishes off an insulated basement wall, providing air sealing and thermal comfort

## TOOLS

- Caulk Gun
- Spray Foam Gun
- Metal Snips
- Measuring Tape
- Utility Knife
- Drill
- Staple Gun
- Taping Knife
- Mudding Trowel

## MATERIALS

- |                                |                              |                  |
|--------------------------------|------------------------------|------------------|
| • Backer Rod                   | • Extruded Polystyrene (XPS) | • Joint Compound |
| • Metal Lath                   | • Staples                    | • Joint Tape     |
| • Spray Foam                   | • Gypsum Board               |                  |
| • Caulk                        | • Luan                       |                  |
| • Fiberglass Kraft-Faced Batts | • Mechanical Fasteners       |                  |

## 12-3 INSULATE BASEMENT WALLS IN CONDITIONED SPACE



**1.** Check wall for penetrations and seal as needed



**2.** Check wall for water intrusion that needs to be mitigated first. All bulk sources of moisture should be directed away from the foundation walls



**3.** If insulation has vapor retarder on only one side, install it facing the conditioned space



**4.** Install insulation to prescribed R-value in full contact with the entire perimeter of foundation wall from ceiling to floor



**5.** Install a sealed air barrier on the conditioned side of the insulation. When using foam, gypsum board must be at least 1/2 inch to meet building codes for a thermal barrier

### NOTES

## 12-4 INSULATE CONDITIONED CRAWLSPACE WALL

Aligns with SWS [4.0402.2](#), [4.0402.3](#)



### BEFORE

✘ Unvented crawlspaces are sometimes considered to be part of the conditioned space, so the walls need insulation



### AFTER

#### FINAL CHECKLIST

- ✓ Insulation is or has class II vapor retarder
- ✓ Vapor retarder faces conditioned space
- ✓ Insulation laps underneath ground vapor retarder at foundation wall

### TOOLS

- Measuring Tape
- Utility Knife
- Drill
- Spray Foam Gun
- Half- or Full-Face Respirator

### MATERIALS

- Polyisocyanurate Foam Board
- Nylon Fasteners
- 2-Part Spray Foam



# 13-1 AIR SEAL SMALL PENETRATIONS IN A SUBFLOOR

Aligns with SWS [3.0101.1](#), [3.0104.1](#)



Many types of caulks and sealants will easily span and seal a 1/4-inch gap



One-part spray foams can also span up to 3 inches to create an air seal

## TOOLS

- Caulk Gun
- Spray Foam Gun
- Utility Knife

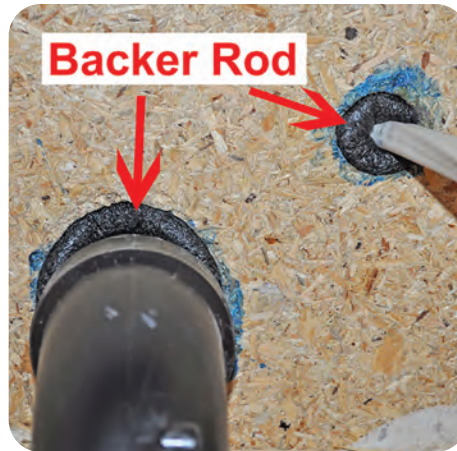
## MATERIALS

- Caulk Sealant
- One-Part Spray Foam
- Backer Rod

## 13-1 AIR SEAL SMALL PENETRATIONS IN A SUBFLOOR



**1.** For small penetrations, caulk or sealant is often enough to seal the gap



**2.** Use a backer rod or other infill material when sealing a gap larger than 1/4 inch with caulk



**3.** Seal over the backer rod to establish the air seal



**4.** Spray foam can also be used in areas with slightly larger penetrations

### NOTES

## 13-2 AIR SEAL LARGE PENETRATIONS IN A SUBFLOOR

Aligns with SWS [3.0101.1](#), [3.0104.1](#)



### BEFORE

- ✘ Larger penetrations in the subfloor, especially plumbing chases, need to be air sealed



### AFTER

- ✔ Depending on the size of the gap, one-part spray foam or a combination of infill material and foam or caulk can be used

### TOOLS

- Measuring Tape
- Utility Knife
- Drill
- Spray Foam Gun
- Caulk Gun

### MATERIALS

- One-Part Spray Foam
- Two-Part Spray Foam
- Caulk
- Extruded Polystyrene (XPS)
- Mechanical Fasteners

## 13-2 AIR SEAL LARGE PENETRATIONS IN A SUBFLOOR



1. One-part spray foam expands to fill large holes, but needs support for holes over 5 inches



2. For larger holes, rigid infill material is needed



3. Cut rigid infill with attention to locations of pipes and electrical



4. Secure rigid infill in place and seal smaller gaps around infill with appropriate materials



5. Use appropriate materials for high-temperature locations, such as around flues and chimneys

### NOTES



## 13-3 AIR SEAL BALLOON FRAMING AT SUBFLOOR

Aligns with SWS [3.0101.1](#), [3.0102.4](#)



### BEFORE

✗ Balloon-framed walls have an open cavity that runs from the basement to the attic, allowing for large amounts of air flow via stack effect



### AFTER

✓ Securely sealing off these cavities prevents air movement, as well as providing a barrier to hold in insulation and providing fire blocking

### TOOLS

- Measuring Tape
- Utility Knife
- Saw
- Drill
- Spray Foam Gun
- Caulk Gun
- Chip Brush

### MATERIALS

- Extruded Polystyrene (XPS)
- Expanded Polystyrene (EPS)
- Gypsum Board
- Lumber
- Mechanical Fasteners
- 1-Part Spray Foam
- 2-Part Spray Foam
- Caulk
- Mastic

## 13-3 AIR SEAL BALLOON FRAMING AT SUBFLOOR



1. Measure opening



2. Cut blocking material to fit



3. Seal all edges with caulk, foam or mastic

### NOTES

Spray foam will not be used in spaces that will be exposed to habitable living space.

# 14-1 INSULATE A SUBFLOOR WITH BATTS ABOVE UNCONDITIONED SPACE

Aligns with SWS [4.0301.1](#), [4.0301.6](#), [4.0302.1](#)



## BEFORE

✗ Uninsulated, unconditioned spaces drive down the energy efficiency of HVAC systems



## AFTER

### FINAL CHECKLIST

- ✓ Vapor retarder faces warm side of floor
- ✓ Consistent cover across subfloor

## TOOLS

- Measuring Tape
- Utility Knife
- Drill

## MATERIALS

- Kraft-Faced Fiberglass Batts
- Strapping
- Netting
- Rigid Barrier Such as Extruded Polystyrene (XPS)
- Mechanical Fasteners

## 14-1 INSULATE A SUBFLOOR WITH BATTS ABOVE UNCONDITIONED SPACE



**1.** Ensure air sealing is complete



**2.** Insulation R-value matches work order



**3.** Batt vapor retarder faces warm side of floor



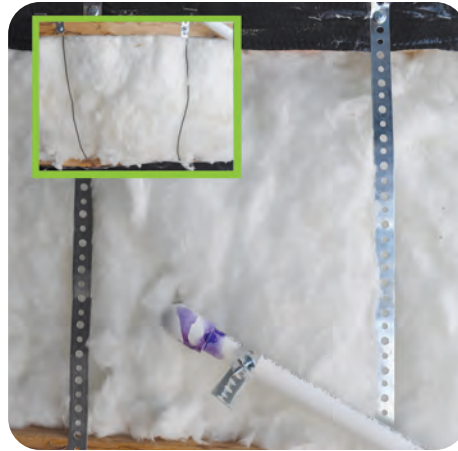
**4.** Batts installed with no gaps

### NOTES

## 14-1 INSULATE A SUBFLOOR WITH BATTS ABOVE UNCONDITIONED SPACE



**5.** Batts are in good contact with subfloor



**6.** Batts held in place with physical fasteners, with minimal compression



**7.** In areas where exposure to outside elements or vermin may be a concern, such as cantilevered or exposed floors, a rigid barrier is an extra layer of protection

### NOTES

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# 14-2 INSULATE A SUBFLOOR WITH BLOWN INSULATION ABOVE UNCONDITIONED SPACE

Aligns with SWS [4.0301.2](#), [4.0301.3](#), [4.0301.4](#), [4.302.2](#), [4.0302.3](#)

## BEFORE YOU BEGIN



Uninsulated, unconditioned spaces drive down the energy efficiency of HVAC systems

### Description /Comment

Floor Insulation - Loose-fill + Rigid Barrier - R-19

Floor Insulation - Loose-fill + Rigid Barrier - R-19

Floor Insulation - Loose-fill + Rigid Barrier - R-19

- ✓ Review work order to verify if dense-pack or loose fill is required. Netting a subfloor will mean loose fill, but a rigid barrier can mean either.

## TOOLS

- Measuring Tape
- Utility Knife
- Scissors
- Caulk Gun
- Insulation Machine
- Pressure Gauge
- Hole Saw

## MATERIALS

- Netting
- Rigid Barrier  
Such as Extruded Polystyrene (XPS)
- Staples
- Mechanical Fasteners
- Caulk
- Cellulose or Fiberglass Loose Insulation

## 14-2 INSULATE A SUBFLOOR WITH BLOWN INSULATION ABOVE UNCONDITIONED SPACE



**1.** Verify all air sealing and prep work is complete



**2.** Attach rigid barrier to cover entire cavity



**3.** Seal seams between sheets of rigid material to prevent air movement and insulation leakage



**4.** Cut an access hole into each cavity of the floor, large enough for fill tube



**5.** Use appropriate fill tube to correspond with work order requirements



**6.** Fill cavity completely to density required by work order

## 14-2 INSULATE A SUBFLOOR WITH BLOWN INSULATION ABOVE UNCONDITIONED SPACE



**7.** Plug access hole either with original material cut out or appropriate replacement



**8.** Seal around plug to keep it secure and air tight



**9.** For work orders that require netting, secure a smooth layer of netting across the bottom of floor joists



**10.** Keep staples close together



**11.** Cover the entire cavity to ensure continuous insulation coverage and prevent insulation from blowing out the ends



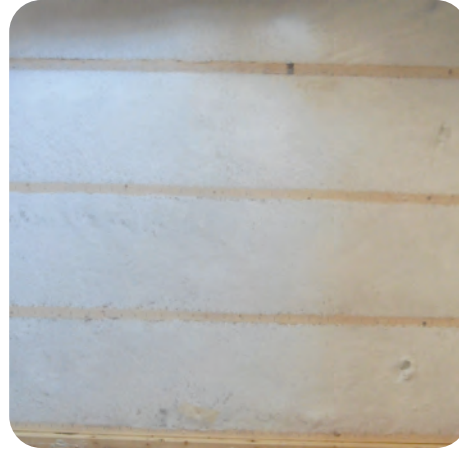
**12.** Cut access hole for fill tube



## 14-2 INSULATE A SUBFLOOR WITH BLOWN INSULATION ABOVE UNCONDITIONED SPACE



**13.** Loose fill netting to required density



**14.** Ensure insulation coverage is even and continuous throughout floor cavities

### NOTES

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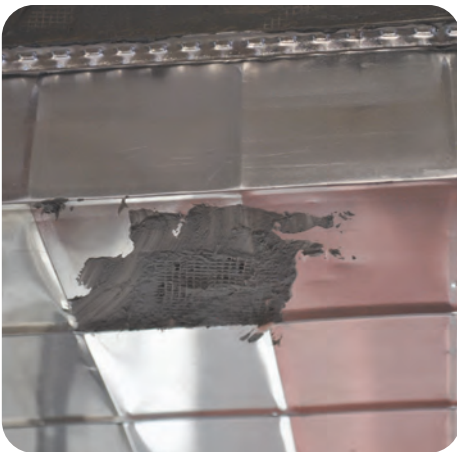
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# 15-1 INSULATE A MANUFACTURED HOME BELLY

Aligns with SWS [4.0302.9](#), [4.0302.1](#), ([3.0102.5](#),  
[3.0102.6](#), [3.0102.7](#))

## BEFORE YOU BEGIN



### CHECKLIST

- ✓ Air and duct sealing complete
- ✓ Electrical/plumbing issues fixed
- ✓ Belly board repaired/replaced

## TOOLS

- Measuring Tape
- Utility Knife
- Drill
- Insulation Machine
- Pressure Gauge
- Saw

## MATERIALS

- Belly Wrap
- Belly Board
- Caulk
- Mechanical Fasteners
- Mastic
- Spray Foam
- Extruded Polystyrene (XPS)

## 15-1 INSULATE A MANUFACTURED HOME BELLY



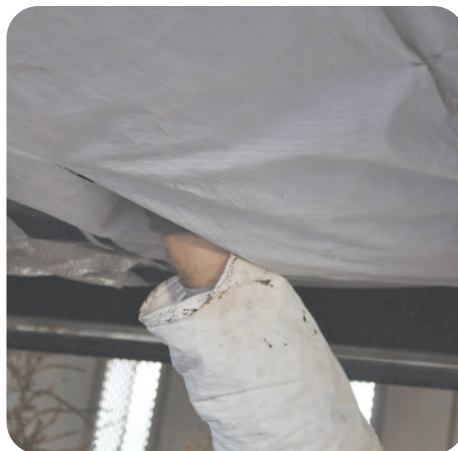
**1.** Remove old insulation and make repairs as needed



**2.** Attach new belly wrap



**3.** Seal seams of belly wrap



**4.** Cut access holes to ensure entire cavity will receive continuous and consistent insulation

### NOTES

## 15-1 INSULATE A MANUFACTURED HOME BELLY



**5.** Fill entire belly cavity to prescribed R-value



**6.** Apply waterproof, permanent adhesive to patch for belly wrap, with patch sized at least 3 inches larger than hole in barrier



**7.** Stitch staple patch to ensure permanent adhesion

### NOTES

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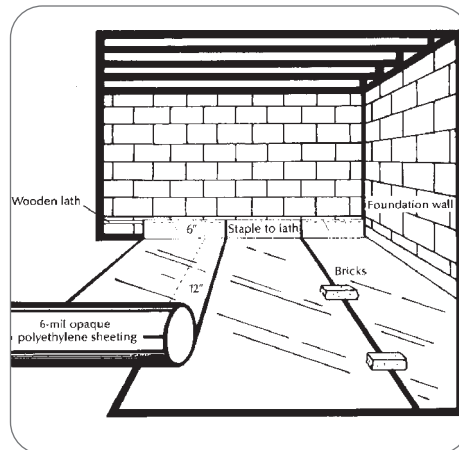
# 16-1 INSTALL A CRAWLSPACE VAPOR RETARDER

Aligns with SWS [2.0202.1](#), [2.0202.2](#), [2.0202.3](#), ([3.0104.1](#))



## BEFORE

- ✗ Moisture and resultant mold issues in crawlspaces can cause extensive damage to floor assemblies and foundations



## AFTER

- ✓ A well-installed vapor retarder helps to minimize ground moisture vapor and soil gas, such as radon

## TOOLS

- Utility Knife
- Measuring Tape
- Caulk Gun

## MATERIALS

- 6 Mil Plastic Sheeting
- Durable Adhesive Tape
- Furring Strips
- Mechanical Fasteners
- Ballast
- Sealant

## 16-1 INSTALL A CRAWLSPACE VAPOR RETARDER



**1.** Clear out storage and debris



**2.** Select appropriate materials



**3.** Spread out plastic as flat as possible



**4.** Extend plastic a minimum of 6" up walls, piers and columns

### NOTES

## 16-1 INSTALL A CRAWLSPACE VAPOR RETARDER



**5.** Use a minimum 12" reverse shingle overlap and tape seams



**6.** Plastic needs to be fastened in durable way: e.g. tape, sealant, screws



**7.** Use ballast to hold down vapor retarder

### NOTES

## 16-2 REPAIR AN EXISTING CRAWLSPACE VAPOR RETARDER

Aligns with SWS [2.0202.1](#), [2.0202.2](#), [2.0202.3](#), ([3.0104.1](#))



### BEFORE

✘ Improperly installed and damaged vapor retarders do not prevent moisture and resultant mold issues in crawlspace



### AFTER

✔ A well-installed vapor retarder helps to minimize ground moisture vapor and soil gas, such as radon

### TOOLS

- Utility Knife
- Measuring Tape
- Caulk Gun

### MATERIALS

- 6-Mil Plastic Sheeting
- Durable Adhesive Tape
- Furring Strips
- Mechanical Fasteners
- Ballast
- Sealant



## 16-2 REPAIR AN EXISTING CRAWLSPACE VAPOR RETARDER



**1.** When repairing along the ground, ensure seams overlap uphill in a reverse shingle pattern



**2.** Overlap seams by at least 12 inches



**3.** Spread out plastic as flat as possible



**4.** Plastic needs to be fastened in durable way: e.g. tape, sealant



**5.** Ensure plastic extends a minimum of 6 inches up walls, piers and columns and is securely attached

### NOTES

# 17-1 VENT A CLOTHES DRYER

Aligns with SWS [6.0101.1](#), [6.0101.2](#), [6.0202.1](#)



## BEFORE

✗ Dryer vents with long bumpy runs create a fire hazard



## AFTER

✓ When properly vented, dryers run more efficiently, are safer, and last longer

## TOOLS

- Metal Snips or Grinder
- Flathead Screwdriver
- Utility Knife

## MATERIALS

- 28-Gauge Rigid or Semi-Rigid Metal Ducting
- Worm-Drive Clamps
- Backdraft Damper
- Duct Insulation
- Foil Tape



## 17-1 VENT A CLOTHES DRYER



**5.** Termination has backdraft damper and no cage



**6.** Duct in uninsulated space is insulated



**7.** If duct run must exceed 35 feet, install booster fan

### NOTES

# 18-1 INSTALL EXHAUST FAN FLEX DUCT (BATH FAN ONLY)

Aligns with SWS [6.0101.1](#), [6.0101.2](#), [6.0201.1](#)



## BEFORE

✗ Exhausting moisture from bath fans into the attic or crawlspace can cause mold and rot in building materials



## AFTER

✓ Bath fans must exhaust to the exterior of the home

## TOOLS

- Measuring Tape
- Utility Knife
- Zip Tie Tensioner
- Drill

## MATERIALS

- Flex Ducting with R-8 Insulation (unless ducting will be buried in insulation)
- Zip Ties
- Support Strapping
- Mechanical Fasteners

## 18-1 INSTALL EXHAUST FAN FLEX DUCT (BATH FAN ONLY)



**1.** Ensure proper connection of duct to bath fan



**2.** Ensure flex ducting runs smoothly with no kinks or u-turns



**3.** Create the shortest run possible to an exterior termination and provide adequate support as needed without compressing the duct

### NOTES

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## 18-2 INSTALL A HARD-DUCTED EXHAUST VENT

Aligns with SWS [6.0101.1](#), [6.0101.2](#), [6.0201.1](#), [6.0201.2](#)



### BEFORE

- ✗ Kitchens and bathrooms must be ventilated to control moisture, vapor, and combustion gases

### TOOLS

- Measuring Tape
- Hole Saw
- Drill
- Caulk Gun

### AFTER

#### KITCHEN CHECKLIST

- ✓ Located within 5 feet of primary cooking surface
- ✓ At least 100 cfm but not more than 3 sones
- ✓ Efficacy of 2.8 cfm/watt or more

#### BATHROOM CHECKLIST

- ✓ Located in center of room
- ✓ At least 50 cfm but not more than 2 sones
- ✓ Efficacy of 4 cfm/watt or more

### MATERIALS

- Mastic
- Brush
- Foil Tape
- Duct Insulation
- 28-Gauge Ducting
- Vent Termination
- Caulk

## 18-2 INSTALL A HARD-DUCTED EXHAUST VENT



**1.** Fasten rigid duct using three equally spaced screws



**2.** Keep duct run as short as possible with few turns, and run to exterior – either via roof or sidewall



**3.** Seal all joints with mesh and mastic or foil tape



**4.** Completely seal joints

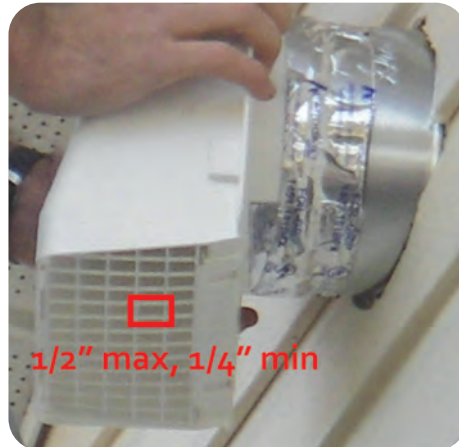
### NOTES



## 18-2 INSTALL A HARD-DUCTED EXHAUST VENT



**5.** Locate exterior vent based on duct run and size hole less than 1/2 inch larger than duct



**6.** Chose appropriate exterior termination to match size of duct while minimizing water intrusion and pest infestation. Seal around exterior termination as needed



**7.** Ducting that runs through unconditioned space will be insulated to R-8

### NOTES

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## 19-1 SEAL DUCTS WITH MASTIC

Aligns with SWS [5.0106.1](#), [6.0101.2](#), [6.0101.3](#), ([5.0105.1](#),  
[5.0105.2](#), [5.0105.3](#))



### CHECKLIST

- ✓ Ensure ducts are properly connected
- ✓ Ensure ducts are properly supported

### TOOLS

- Drill
- Zip Tie Tensioner
- Caulk Gun

### MATERIALS

- Mastic
- Fiberglass Mesh Tape
- Chip Brush
- Mechanical Fasteners
- 26-Gauge Metal Sheeting
- Duct or Electrical Tape (for temporary use)
- Flexible Caulking
- Butyl Tape

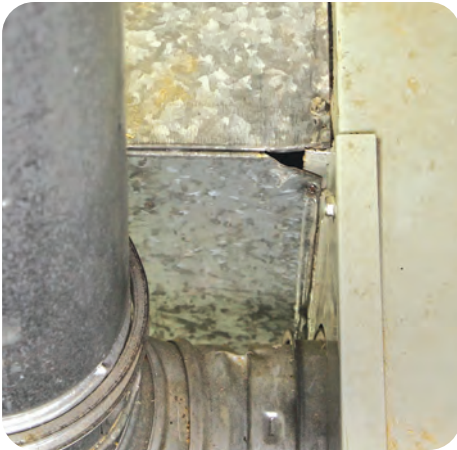
### NOTES

Mastic alone can be used for gaps <math>< 1/8\text{-inch}</math>, when gap is located more than 10 inches from air handler and static pressure is less than 1 iwc.



## 19-1 SEAL DUCTS WITH MASTIC

### METHOD B - FOR MEDIUM GAPS (1/4-3/4 INCH) SUCH AS MINOR HOLES AND PENETRATIONS IN DUCT SYSTEM



**B-1.** Small holes and penetrations require one additional step



**B-2.** Apply temporary tape as a backer to hold mastic



**B-3.** Apply mastic over the tape



**B-4.** Push fiberglass mesh into the mastic

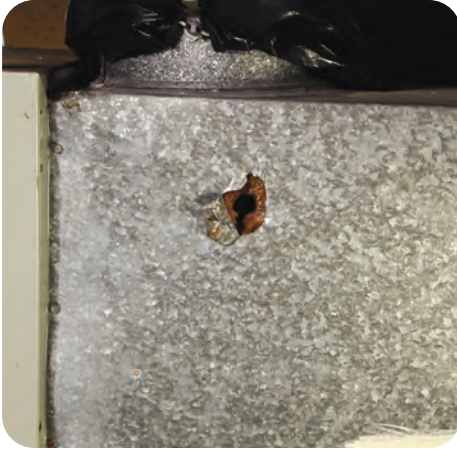


**B-5.** Apply additional mastic over mesh and tape, extending at least 1 inch past edges of tape in all directions

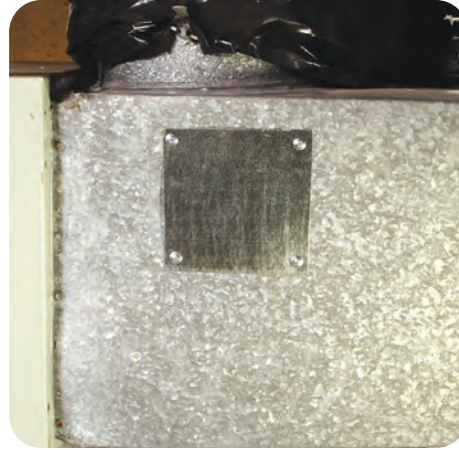
#### NOTES

## 19-1 SEAL DUCTS WITH MASTIC

### METHOD C - FOR LARGER GAPS OR HOLES (OVER 3/4 INCH)



**C-1.** Larger holes require a different process



**C-2.** Cut patch that will extend over entire gap or hole and affix with mechanical fasteners



**C-3.** Apply mastic over edges and fasteners of patch and push fiberglass mesh into it



**C-4.** Apply additional mastic over mesh, extending at least 1 inch past tape and seam in all directions

#### NOTES





# 20-1 INSULATE HARD PIPE DUCTS

Aligns with SWS [5.0107.1](#), [5.0105.2](#), ([6.0202.1](#))



## BEFORE YOU BEGIN

### VERIFY DUCTS ARE:

- ✓ Connected properly
- ✓ Supported properly
- ✓ Air-sealed properly



## AFTER

Well-supported and uniformly-insulated ducts perform at higher efficiency

## TOOLS

- Measuring Tape
- Utility Knife

## MATERIALS

- Duct Insulation (min R-8) with Exterior Vapor Retarder
- UL-181 Tape
- Twine
- Zip Ties



## 20-1 INSULATE HARD PIPE DUCTS



1. Layer insulation around duct, fitting between duct and construction members as necessary and able



2. Tape joints to secure insulation in place



3. Insulation will not be compressed



4. Tape around circumference of duct at regular intervals



5. Twine or zip ties can also be used to offer additional support for insulation – but need not to cause compression on the insulation

### NOTES



Weatherization  
Works

## 20-2 INSULATE FLEX DUCTS

Aligns with SWS [5.0107.1](#), [5.0105.2](#)



### TOOLS

- Measuring Tape
- Utility Knife
- Zip Tie Tensioner

### BEFORE YOU BEGIN

#### VERIFY DUCTS ARE:

- ✓ Connected properly
- ✓ Supported properly
- ✓ Air-sealed properly

### AFTER

Ducts in unconditioned spaces require a minimum R-8 insulation. If exposed to the exterior, R-12.

### MATERIALS

- Duct Insulation (min R-8) with Exterior Vapor Retarder
- UL-181 Tape
- Twine
- Zip Ties

## 20-2 INSULATE FLEX DUCTS



**1.** Secure duct liner to hard connections with zip tie and tensioner tool



**2.** Pull insulation over hard connections as needed



**3.** Secure vapor retarder layer at boots



**4.** Seal new joints

### NOTES

## 20-3 INSULATE SUPPLY BOOTS

Aligns with SWS [5.0107.1](#), [5.0107.2](#)



**X** Exposed duct boots are a prime location for energy loss

### BEFORE YOU BEGIN

Ensure ducts are:

- ✓ Properly connected
- ✓ Properly supported
- ✓ Properly air-sealed

### TOOLS

- Measuring Tape
- Utility Knife
- Zip Tie Tensioner

### MATERIALS

- R-8 Minimum Flex Duct insulation
- Duct Insulation with Vapor Retarder
- Water Heater Blanket with Vapor Retarder
- Zip Ties
- Twine
- Spray Adhesive
- Mastic
- UL 181 Fiberglass Mesh Tape

## 20-3 INSULATE SUPPLY BOOTS



**1.** Insulate all exposed metal of the boot



**2.** Ensure a complete vapor barrier by sealing all seams with mastic

### NOTES

- R-8 minimum for ducts in unconditioned spaces.
- R-12 minimum for ducts exposed to outside elements.

## 20-4 INSULATE PLENUM

Aligns with SWS 5.0107.1



### BEFORE

- ✘ Return and supply plenums left uninsulated with contact to unconditioned spaces allow for energy loss



### AFTER

#### FINAL CHECKLIST

- ✓ Ducts are connected properly
- ✓ Ducts are supported properly
- ✓ Ducts are air-sealed properly

### TOOLS

- Measuring Tape
- Utility Knife

### MATERIALS

- R-8 Minimum Duct Insulation
- Spray Adhesive
- Twine
- Mechanical Fasteners
- Extruded Polystyrene
- Gypsum Board
- Mastic
- UL-181 Mesh Tape
- Butyl Tape

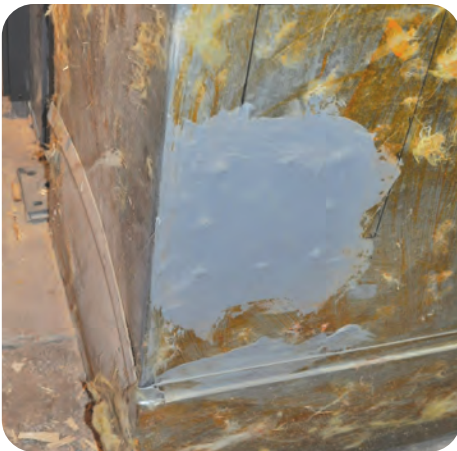
## 20-4 INSULATE PLENUM



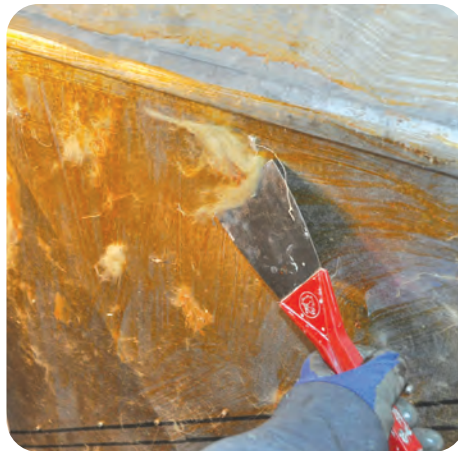
1. Cover any unnecessary holes in the air handler cabinet



2. Check return cavities inside building envelope to ensure they are sealed off from unconditioned spaces



3. Patch holes in ducts and plenum with appropriate materials (see 19-1 Seal Ducts with Mastic)



4. Prepare plenum by removing any residue from old insulation

### NOTES

Expanded  
Polystyrene (EPS) is  
not appropriate for use  
in high-temperature  
areas - particularly  
inside framed  
return platforms





## 20-4 INSULATE PLENUM



**9.** Spray adhesive over area where piece will be installed



**10.** Ensure smooth and unrippled adhesion of insulation to metal of plenum



**11.** Spray adhesive along vapor retarder at seam to seal closed



**12.** Ensure overlapping flap securely adhered to the lower layer to maintain complete vapor barrier, or tape seams with UL-181 tape



**13.** Support insulation to prevent movement over time, securing in place without puncturing vapor retarder

# 21-1 WINDOW INSTALLATION

Aligns with SWS 3.0201.9



## BEFORE

**X** Single pane aluminum-frame windows offer little to no thermal break from outdoors



## AFTER

### FINAL CHECKLIST

- ✓ Window opens and closes properly
- ✓ All exterior edges are air-sealed
- ✓ Water will flow away from window

## TOOLS

- Measuring Tape
- Utility Knife
- Drill
- Spray Foam Gun
- Vacuum

## MATERIALS

- Plastic Sheeting
- Shims
- Flashing Tape
- Mechanical Fasteners
- Backer Rod
- Spray Foam

## 21-1 WINDOW INSTALLATION



**1.** Measure window to be replaced



**2.** Remove existing window



**3.** Clean up sash or jam and repair any issues



**4.** Replace flashing as needed



**5.** Dry fit window



**6.** Level the window using shims and secure with mechanical fasteners

## 21-1 WINDOW INSTALLATION



**7.** Ensure window is operational



**8.** Caulk all exterior edges



**9.** Insulate and seal rough opening with backer rod and/or spray foam



**10.** Replace trim

### NOTES

## 21-2 DOOR INSTALLATION

Aligns with SWS 3.0202.2



### BEFORE

**X** In rare cases, doors are too damaged to be retrofitted and must be replaced



### AFTER

#### FINAL CHECKLIST

- ✓ Weatherstrip and door bottom installed
- ✓ Door opens and closes properly
- ✓ All exterior trim is caulked
- ✓ Water will flow away from the door

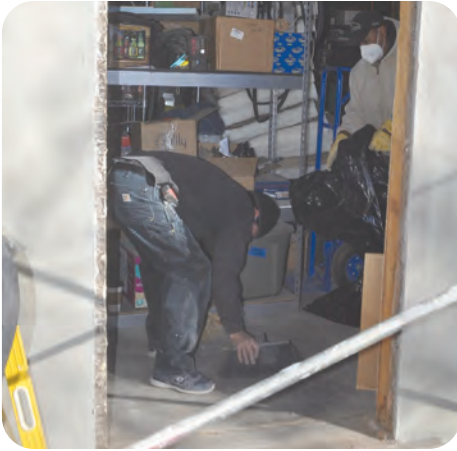
### TOOLS

- Measuring Tape
- Utility Knife
- Saw
- Drill
- I-beam Level
- Caulk Gun
- Spray Foam Gun
- Jamb Saw

### MATERIALS

- Lumber
- Shims
- Mechanical Fasteners
- Adhesive
- Spray Foam
- Caulk
- Insulation
- Weatherstrip
- Door Bottom
- Lock set

## 21-2 DOOR INSTALLATION



1. Remove old door and clear away debris



2. Measure opening and ensure that the door on location is the proper size



3. Prepare opening by ensuring that jacks are plumb and threshold is level



4. Frame in and adjust opening as necessary to accommodate new door



5. Attach flashing, if necessary, to protect any new materials from water intrusion



6. Using shims, locate door in frame, adjusting for level and plumb, and attach securely

## 21-2 DOOR INSTALLATION



- 7.** Ensure door is fully operational and lock set is aligned



- 8.** Insulate gaps between door jamb and frame



- 9.** Seal rough opening, to prevent both air and water intrusion



- 10.** Replace trim



- 11.** Seal along threshold, ensuring water will flow away from door

### NOTES

Check file for age  
of house and complete  
any required lead  
testing before work  
begins.

## 22-1 WINDOW GLASS REPLACEMENT

Aligns with SWS 3.0201.1, 3.0201.4



### BEFORE

✘ Broken, cracked or missing glass breaks the pressure and thermal boundary



### AFTER

✔ Newly installed glass is sealed to prevent air and water infiltration

### TOOLS

- Heavy Work Gloves
- Glass Cutter
- Scraping Tool

### MATERIALS

- Cleaning Solution
- New Window Pane
- Silicone Caulk
- Window Glazing
- Tape



## 22-1 WINDOW GLASS REPLACEMENT



**1.** Remove all broken glass



**2.** Clean all debris, caulk, etc., from sash



**3.** Measure rough opening for window pane, size pane 1/8-3/16 inches less than RO



**4.** Run interior bead of caulk

### NOTES



# 23-1 INSULATE AN ELECTRIC DOMESTIC HOT WATER HEATER

Aligns with SWS 7.0301.2



## BEFORE YOU BEGIN

Check data plate on water heater to find existing insulation level (if any) and verify additional insulation is not prohibited



## AFTER

- ✓ A properly insulated water heater safely reduces standby losses

## TOOLS

- Utility Knife

## MATERIALS

- Water Heater Insulation Blanket
- Foil Tape
- Tie Strap
- Wire
- Twine

## 23-1 INSULATE AN ELECTRIC DOMESTIC HOT WATER HEATER



**1.** Insulate tank with minimum R-10 or better



**2.** Ensure a continuous vapor barrier with no gaps



**3.** Do not obstruct temperature and pressure relief valve (T&P)



**4.** Tape all seams and edges airtight



**5.** Cut flaps at access plates, tape them shut and then label from the exterior



**6.** Secure seams with tie strap, wire or twine and minimal compression

### NOTES

# 23-3 INSULATE DOMESTIC HOT WATER (DHW) PIPES

Aligns with SWS 7.0301.1



Insulate pipes to a minimum R-3 at least 6 feet from DHW on both hot and cold lines



Insulation should be continuous with no gaps

## TOOLS

- Utility Knife
- Measuring Tape

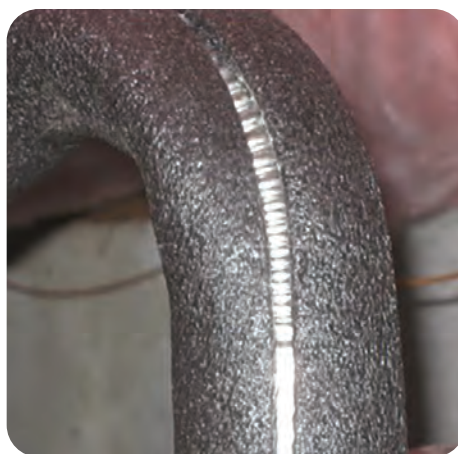
## MATERIALS

- Pipe Insulation
- Tape or Tie Straps

## 23-3 INSULATE DOMESTIC HOT WATER (DHW) PIPES



Keep insulation back at least 6 inches from draft diverter and single wall pipe



Do not rely on manufactured adhesive seam seal to hold closed



Secure seams with tape



When path is partially obstructed or curved, shape insulation to the location to eliminate gaps

### NOTES

## 24-1 INSTALL A LOW-FLOW SHOWERHEAD

Aligns with SWS 7.0201.1



### BEFORE

✗ Higher flow showerheads waste water and cause water heaters to run more than necessary



### AFTER

✓ Low-flow showerheads must be 2.5 gallon per minute (gpm) or less flow rate, to reduce heating load and encourage lower water use.

### TOOLS

- Adjustable Wrench
- Pipe Wrench
- Channel Locks
- Buffer Material
- Rag
- Toothbrush/Wire brush

### MATERIALS

- Thread Tape
- New Showerhead

## 24-1 INSTALL A LOW-FLOW SHOWERHEAD



**1.** Carefully remove old showerhead with adjustable wrench, taking care not to loosen shower arm



**2.** If old showerhead does not have flat sides at connection, wrap with buffer material, such as a piece of rubber



**3.** Then use pipe wrench or channel locks to loosen connection at shower arm



**4.** Clean threads of shower arm well to remove old residue



**5.** Wrap new thread tape around threads



**6.** Install new showerhead according to occupant needs, such as hand-held, shutoff or swivel



## 24-1 INSTALL A LOW-FLOW SHOWERHEAD



**7.** Ensure that connections will not leak while preventing damage by using buffer material



**8.** Use thread tape at all connections



**9.** Verify proper water flow and that there are no leaks

### NOTES

# 24-2 INSTALL A LOW-FLOW FAUCET AERATOR

Aligns with SWS 7.0201.1



## BEFORE

✗ Faucets without aerators produce excess flow and old aerators can impinge flow or cause leakage



## AFTER

✓ Low-flow faucet aerators limit flow to 2.2 gpm or less and reduce heating load by encouraging lower water use

## TOOLS

- Adjustable Wrench/  
Aerator Wrenches
- Soft Rag

## MATERIALS

- Thread Tape
- WaterSense Aerator

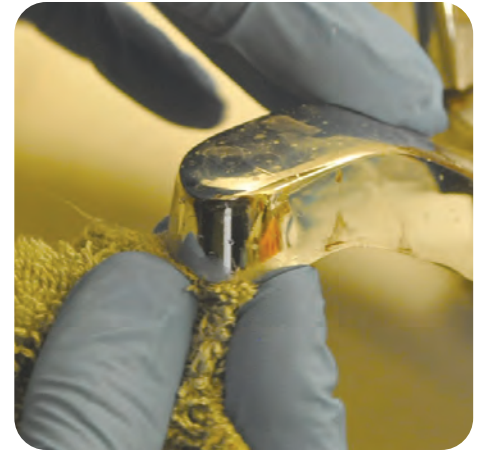
## 24-2 INSTALL A LOW-FLOW FAUCET AERATOR



**1.** Using adjustable wrench or aerator wrench, gently remove old aerator, taking care not to damage faucet



**2.** Once loose, continue removal by hand



**3.** Clean threads of the faucet with a soft rag to remove any debris



**4.** Verify size and type of aerator will work with faucet

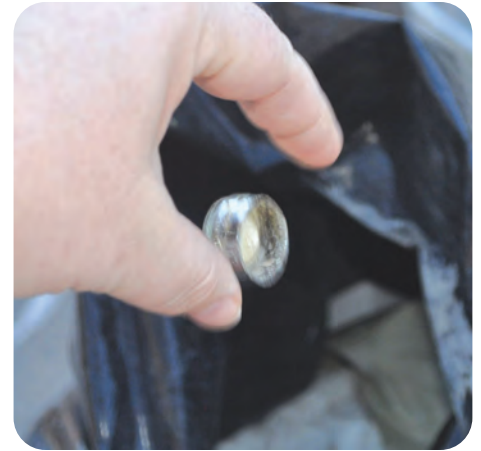


**5.** Wrap thread tape around new aerator if male, or faucet threads if it takes a female aerator



**6.** Carefully install new aerator, ensuring any necessary rubber washers are in place and taking care not to cross-thread

## 24-2 INSTALL A LOW-FLOW FAUCET AERATOR



- 7.** Do not overtighten aerator
- 8.** Run water through new aerator to verify it is not cross-threaded and no water is leaking around sides
- 9.** Remove old aerator from property and permanently dispose of it

### NOTES

For kitchen sinks, 1.0-1.5 gpm save water without affecting performance. For lavatory sinks, as low as 0.5 gpm is adequate.

## 25-1 INSTALL ROOF VENT

Aligns with SWS [6.0101.2](#), [6.0201.1](#), [6.0201.2](#), [4.0188.2](#)



### BEFORE

✘ Kitchens, bathrooms, and attics all have requirements for ventilation to the exterior, as well as dryer and combustion exhaust venting



### AFTER

✔ A properly installed vent preserves the integrity of the roof

### TOOLS

- Measuring Tape
- Drill
- Hole Saw
- Caulk Gun
- Utility Knife
- Mastic Brush

### MATERIALS

- Vent with Collar
- Caulk
- Mechanical Fasteners
- Joint Tape
- Mastic



## 25-1 INSTALL ROOF VENT



**4.** From roof side, cut hole slightly larger than termination collar. If shingle roof, cut just below one layer of shingles in order to preserve overlap

**5.** Run sealant around perimeter of vent and tuck under any surrounding uphill shingles. Seal uphill shingles over vent



**6.** Collar should extend down through roof into attic

**7.** Slide vent ducting to collar, sized to match the duct diameter, and attach with mechanical fasteners

**8.** Seal duct joints with mesh and mastic to complete vent installation. Insulate as required





## Index of Standard Work Specifications Referenced in Field Guide:

\*\*Note: Inclusion on this list does not imply that every Specification within the cited Detail is addressed in the Field Guide. Job Aids in parentheses ( ) presume referenced SWS has been followed.

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<b><u>2.0202.2</u></b>	Vented Subspaces – Ground Cover	<u>16-1, 16-2</u>
<b><u>2.0202.3</u></b>	Pier and Skirting Foundations – Ground Cover	<u>16-1, 16-2</u>
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<b><u>3.0102.6</u></b>	MH Belly Repair – Soft Bottom Replacement	<u>(15-1)</u>
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<b><u>3.0102.9</u></b>	Sealing Dropped Soffits/Bulkheads	<u>2-2</u>
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<b><u>4.0103.6</u></b>	Accessible Attic – Dense Pack Insulation	<u>4-1, 6-1, 7-1</u>
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<b>2020 SWS</b>	<b>Detail Title</b>	<b>Job Aids</b>
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**STATE OF NORTH DAKOTA  
DEPARTMENT OF COMMERCE  
STANDARD WORK SPECIFICATIONS  
FOR SINGLE-FAMILY HOMES,  
MANUFACTURED HOMES,  
AND MULTI-FAMILY HOMES**

**ND Department of Commerce  
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## **2 – Health and Safety**

### **2.01 - Safety Devices**

#### **2.0101.1 Hardwired (interconnected) Smoke Alarms**

**Section:** Health and Safety

**Topic:** Safety Devices

**SubTopic:** Smoke Alarms

##### **Desired Outcome**

Properly selected and installed interconnected smoke alarms

##### **2.0101.1a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select hardwired (interconnected) smoke alarms that are listed and labeled in accordance with UL 217

##### **Objective**

Ensure proper equipment selection

##### **2.0101.1b Location**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install hardwired (interconnected) smoke alarms in the locations required by the Authority Having Jurisdiction (AHJ)

##### **Objective**

Ensure proper location

### **2.0101.1c Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install hardwired (interconnected) smoke alarms in accordance with the manufacturer's instructions

#### **Objective**

Ensure proper installation

### **2.0101.1d Occupant notification**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Provide occupants the manufacturer's written instructions

#### **Objective**

Ensure occupants have access to written user's manuals

## **2.0101.2 Battery-Operated Smoke Alarms**

**Section:** Health and Safety

**Topic:** Safety Devices

**SubTopic:** Smoke Alarms

#### **Desired Outcome**

Properly selected and installed battery-operated smoke alarms

### **2.0101.2a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select battery-operated smoke alarms that are listed and labeled in accordance with UL 217 and have sealed, non-replaceable, 10-year batteries

#### **Objective**

Ensure proper equipment selection

### **2.0101.2b Location**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install battery-operated smoke alarms in the locations required by the Authority Having Jurisdiction (AHJ)

#### **Objective**

Ensure proper location

### **2.0101.2c Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install battery-operated smoke alarms in accordance with the manufacturer's instructions

#### **Objective**

Ensure proper installation

## **2.0101.2d Occupant notification**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Provide occupants the manufacturer's written instructions

### **Objective**

Ensure occupants have access to written user's manuals

## **2.0102.1 CO Detection and Warning Equipment**

**Section:** Health and Safety

**Topic:** Safety Devices

**SubTopic:** Carbon Monoxide (CO) Alarms

### **Desired Outcome**

Properly selected and installed CO alarms

### **2.0102.1a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select CO alarms that are listed and labeled in accordance with UL 2034, or approved by the authority having jurisdiction, and have a minimum of:

10-year manufacturer's warranty

Contain internal non-replaceable batteries

### **Objective**

Ensure proper equipment selection

### **2.0102.1b Location**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install CO alarms in the locations required by the Authority Having Jurisdiction (AHJ)

#### **Objective**

Ensure proper location

### **2.0102.1c Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install CO alarms in accordance with the manufacturer's instructions

#### **Objective**

Ensure proper installation

### **2.0102.1d Occupant notification**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Provide occupants the manufacturer's written instructions

#### **Objective**

Ensure occupants have access to written user's manuals



## **2.0103.1 Temperature and pressure relief valve**

**Section:** Health and Safety

**Topic:** Safety Devices

**SubTopic:** Water Heating

### **Desired Outcome**

Safely discharge excessive energy (pressure or temperature) from water heating system

### **2.0103.1a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select temperature and pressure relief valve in accordance with IRC and according to manufacturer specifications that comply with ANSI Z21.22

### **Objective**

Ensure proper equipment selection

### **2.0103.1b Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Temperature and pressure relief valve will be installed in compliance with IRC, HUD code, and according to manufacturer specifications

### **Objective**

Ensure proper installation

### **2.0103.1c Discharge**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install discharge tube of temperature and pressure relief valve so that it:

Discharges to a readily observable location either 6 inches or less from the floor or overflow pan or to the outdoors

Discharges in a manner that does not cause personal injury or structural damage

Flows by gravity and without any trap

Is not directly connected to the dwelling drainage system

Does not contain any valves or tees, nor end with a threaded connection

#### **Objective**

Ensure proper discharge location

## **2.02 - Moisture**

### **2.0201.1 Gutters**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Drainage

#### **Desired Outcome**

Direct bulk water away from dwelling

#### **2.0201.1a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Size gutters appropriately for the area drained

## **Objective**

Properly sized gutters

### **2.0201.1b Attachment**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Attach gutters to dwelling using screws

Fasten gutter sections with mechanical fasteners

## **Objective**

Durable attachment

### **2.0201.1c Slope**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Slope all gutters toward the downspout(s) a minimum of 1/4" per 10 feet

## **Objective**

Ensure complete drainage

### **2.0201.1d Sealing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Make all seams watertight using compatible sealant

**Objective**

Prevent water leaks

**2.0201.2 Downspouts**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Drainage

**Desired Outcome**

Direct bulk water away from dwelling

**2.0201.2a Selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Size and number of downspouts shall be appropriate for the area drained

**Objective**

Properly sized downspouts

**2.0201.2b Attachment**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Mechanically attach downspouts to gutter

Mechanically attach downspout(s) to dwelling a minimum of every 4' of length

**Objective**

Durable attachment

### **2.0201.2c Drainage**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Assemble downspout sections so that the upper section is inside the lower section

Drain downspouts a minimum of 6' away from the structure

#### **Objective**

Bulk water directed away from dwelling

### **2.0201.3 Grading**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Drainage

#### **Desired Outcome**

Direct bulk water away from dwelling

### **2.0201.3a Slope**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Slope ground away from the house at least 6" per 10'

#### **Objective**

Ensure positive drainage away from dwelling

### **2.0201.3b Vegetation removal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

With occupant approval:

Clear all vegetation within 3' of the home or

Trim all landscaping so that it is at least 1' away from the home

### **Objective**

Stop vegetation from preventing drainage

## **2.0201.4 Sump Pumps**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Drainage

### **Desired Outcome**

Remove bulk water from inside the foundation

### **2.0201.4a Selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select a sump pump that will meet the flow requirements of the home.

Select the most energy efficient pump available, prefer Electrically Commutated Motors (ECM) when possible.

### **Objective**

Efficient, properly sized sump pump

### **2.0201.4b Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install sump pumps per the manufacturer's instructions

Install a check valve to prevent water from reentering the sump well

**Objective**

Properly installed sump pump

**2.0201.4c Discharge**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Discharge sump water a minimum of 10' away from the building

**Objective**

Discharge water away from foundation

**2.0201.4d Commissioning**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify safe operation and ensure that all operable floats are functioning as intended

**Objective**

Verify correct operation

**2.0201.4e Occupant notification**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Provide occupant with manufacturer's instructions and all manuals

## **Objective**

Ensure occupant is aware of function and maintenance

## **2.0202.1 Un-Vented Subspaces - Ground Cover**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Ground Vapor Retarders

### **Desired Outcome**

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

### **2.0202.1a Preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove all vegetation and organic material from area to be covered

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, glass, sheet metal screws, etc.)

## **Objective**

Minimize punctures

### **2.0202.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

## **Objective**

Durable material selected



### **2.0202.1c Coverage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

#### **Objective**

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

### **2.0202.1d Drainage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

The ground vapor retarder will not interfere with the established drainage pattern (e.g., to sump pits, French drains, etc.)

#### **Objective**

Ensure proper drainage

### **2.0202.1e Seams/connections**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

Seal all seams and connections to foundations and piers air tight with a durable, compatible, sealant

Mechanically attach ground vapor retarder to foundation and piers where practical

**Objective**

Provide airtight seal for ground vapor retarder

**2.0202.1f Fastening**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Fasten ground vapor retarder to ground with durable fasteners or ballast(s) when installed on sloping ground, or space is accessed for routine maintenance or storage

**Objective**

Prevent movement and uplift of the air barrier and ground moisture barrier

**2.0202.1g Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Seal all penetrations in the ground vapor retarder with a compatible sealant

**Objective**

Ensure ground vapor retarder is air tight

**2.0202.1h Signage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install a durable (minimum of 10-year service life), easily seen sign, sized a minimum of 8.5" x 11" at each access to the space

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

Caution not to damage the ground vapor retarder, air barrier, insulation, and mechanical components specific to the space

Immediate repairs are needed in the case of damage

### **Objective**

Provide essential safety and maintenance information

## **2.0202.2 Vented Subspaces - Ground Cover**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Ground Vapor Retarders

### **Desired Outcome**

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

### **2.0202.2a Preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove all vegetation from area to be covered

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, wood, glass, sheet metal screws, etc.)

### **Objective**

Minimize punctures

### **2.0202.2b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

## **Objective**

Durable material selected

### **2.0202.2c Coverage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

## **Objective**

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

### **2.0202.2d Drainage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

The ground vapor retarder will not interfere with the established drainage pattern (e.g., to sump pits, French drains, etc.)

## **Objective**

Ensure proper drainage

### **2.0202.2e Seams**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

## **Objective**

Keep bulk moisture under ground cover

### **2.0202.2f Fastening**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Fasten ground vapor retarder to ground with durable fasteners or ballast(s) when installed on sloping ground, or space is accessed for routine maintenance or storage

## **Objective**

Prevent movement and uplift of the air barrier and ground moisture barrier

### **2.0202.2g Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Seal all penetrations in the ground vapor retarder with a compatible sealant

## **Objective**

Ensure ground vapor retarder is air tight

### **2.0202.2h Signage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install a durable (minimum of 10-year service life), easily seen sign, sized a minimum of 8.5" x 11" at each access to the space

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

Caution not to damage the ground vapor retarder, air barrier, insulation, and mechanical components specific to the space

Immediate repairs are needed in the case of damage

### **Objective**

Provide essential safety and maintenance information

## **2.0202.3 Pier and Skirting Foundations - Ground Cover**

**Section:** Health and Safety

**Topic:** Moisture

**SubTopic:** Ground Vapor Retarders

### **Desired Outcome**

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

### **2.0202.3a Preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

### **Specification**

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, glass, sheet metal screws, etc.)

### **Objective**

Minimize punctures

### **2.0202.3b Coverage**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

### **Specification**

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

### **Objective**

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

### **2.0202.3c Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

### **Specification**

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

### **Objective**

Durable material selected

### **2.0202.3d Seams**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

### **Specification**

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

### **Objective**

Keep bulk moisture under ground cover

### **2.0202.3e Fastening**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

### **Specification**

Fasten ground vapor retarder to ground with durable fasteners

## **Objective**

Prevent movement of the ground moisture barrier

## **2.03 - Electrical**

### **2.0301.1 Junctions/Splices Enclosed**

**Section:** Health and Safety

**Topic:** Electrical

**SubTopic:** High Voltage (50 volts or more)

#### **Desired Outcome**

Prevent electrocution

#### **2.0301.1a Junction box covers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Cover all junction boxes with a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed cover per the NEC

#### **Objective**

Junction boxes are securely covered with appropriate, durable covers

#### **2.0301.1b Wiring Splices**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Enclose all wiring splices inside a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed electrical enclosure per the NEC



## **Objective**

Wiring splices are safely enclosed in appropriate enclosure

## **2.0301.2 Knob and Tube Wiring - Isolation**

**Section:** Health and Safety

**Topic:** Electrical

**SubTopic:** High Voltage (50 volts or more)

### **Desired Outcome**

Prevent electrocution and reduce fire hazards

### **2.0301.2c Clearance**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Maintain a minimum of 3" of clearance around live knob and tube wiring

## **Objective**

Prevent fire hazards

### **2.0301.2d Marking**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Mark all live knob-and-tube wiring with caution tape that is visible from at least 5' away and post appropriate signage

## **Objective**

Provide essential safety and maintenance information and maintain safe operation of knob-and-tube wiring

## **3 – Air Sealing**

## **3.01 – General Pressure Boundary**

### **3.0101.1 Air Sealing Holes**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** General Air Sealing

#### **Desired Outcome**

Prevent air movement through holes @ 50 Pascals of pressure

#### **3.0101.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

#### **Objective**

Select safe and effective sealant

#### **3.0101.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

## **Objective**

Select safe and effective materials

### **3.0101.1c Backing, infill, and support**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

If backing or infill is installed, it will not bend, sag, or move once installed, and will adequately support any insulation installed on the surface

For small holes (less than 1/4"):

if using, install backing or infill material at least 1/8" below the surface where sealant is applied

For medium holes (1/4" to 3"):

install backing or infill in or over all holes to be sealed

For large holes (greater than 3"):

install rigid backing or infill in or over all holes to be sealed

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Support material installed for any walking/working surface (attics or floors) will support the weight of a worker and any insulation applied in the area

Mechanically fasten backing or infill materials sufficient to prevent movement

### **Objective**

Prevent excessive sealant movement and support applied loads

### **3.0101.1d Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

### **Objective**

Surface is clean and ready to accept sealant

### **3.0101.1e Sealant application**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections in sealing surface while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

### **Objective**

Fully adhered, airtight, and durable seal

### **3.0101.1f High-temperature application**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

## **Objective**

Prevent a fire hazard

## **3.0102.1 Sealing Non-Insulation Contact (IC) Recessed Light**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Specific Air Sealing

## **Desired Outcome**

Airtight, durable, and fire safe enclosure that remains in place and prevents air movement @ 50 Pascals of pressure

## **3.0102.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

## **Objective**

Select safe and effective sealants

### **3.0102.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0102.1c Clearance**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Maintain a minimum clearance of 3" between enclosure and all portions of fixture (e.g. wiring, box, and ballast)

Enclosure must be at least as tall as the surrounding insulation

#### **Objective**

Prevent overheating of fixture

### **3.0102.1d Enclosure top**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Enclosure top must be R-1 or less and left free of insulation

## **Objective**

Prevent heat buildup

### **3.0102.1e Structural soundness**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Enclosure must withstand applied loads

## **Objective**

Durable enclosure

### **3.0102.1f Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

## **Objective**

Surface is clean and ready to accept sealant

### **3.0102.1g Sealant application**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the enclosure while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Sealant exposed to the interior of the enclosure must meet the same fire rating as the enclosure

### **Objective**

Fully adhered, safe, and durable sealant

### **3.0102.1h Marking**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Visibly flag enclosure above the final insulation level

### **Objective**

Visually identify enclosure for future access

## **3.0102.2 Sealing High-Temperature Devices**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Specific Air Sealing

### **Desired Outcome**

Fully adhered, airtight, fire safe, and durable seal that prevents air movement @ 50 Pascals of pressure

### **3.0102.2a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**



Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers) and are rated for the operating temperature of the device they are in contact with, and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0102.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers) and are rated for the operating temperature of the device they are in contact with, and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0102.2c Clearance and isolation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Maintain a minimum clearance of 3" between combustible materials or sealants and any portion of the high-temperature device (e.g. chimney, vent, flue)

Install a rigid, fixed dam higher than the insulation while that maintains a minimum 3" clearance between high-temperature devices and combustible materials

Do not allow combustible insulation between a high-temperature device and a dam unless insulation material is rated for contact with the device

## **Objective**

Prevent fire hazards

### **3.0102.2d Backing and infill**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install non-combustible backing or infill in any gap or crack greater than 1/4"

Install rigid non-combustible backing or infill for gaps or cracks greater than 1" using mechanical fasteners

Once installed, backing or infill will not bend, sag, or move

## **Objective**

Prevent excessive sealant movement

### **3.0102.2e Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

## **Objective**

Surface is clean and ready to accept sealant

### **3.0102.2f Sealant application**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a continuous seal at all seams, cracks, joints, edges, and penetrations of the sealing area while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

## **Objective**

Fully adhered sealant

### **3.0103.1 Access Doors and Hatches**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Intentional Attic Openings

## **Desired Outcome**

Attic access door safely and durably sealed and insulated to prevent air movement @ 50 Pascals of pressure

### **3.0103.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0103.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0103.1c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

## **Objective**

Surface is clean and ready to accept sealant

### **3.0103.1d Seal framing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a continuous seal at all seams, cracks, joints, and edges of access framing while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

## **Objective**

Prevent air and moisture movement

### **3.0103.1e Seal access panel**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Seal access using gaskets, weather stripping or equivalent method

Permanently attach gaskets, weatherstripping, etc. per manufacturer's instructions

Secure attic door or hatch with a latch, lock or frictionally engaging components

## **Objective**

Prevent air and moisture movement

### **3.0103.1f Damming**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install a rigid and durable dam having a height greater than the insulation at attic opening and does not interfere with the operation of the access

**Objective**

Prevent insulation movement

**3.0103.1g Insulate opening**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Insulate access to the same R-value as adjoining insulated assembly

Permanently fasten insulation to access in complete contact with the air barrier

**Objective**

Align thermal barrier

**3.0103.1h Durability**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Completed measure will have a minimum expected service life of 20 years

**Objective**

Ensure minimum service life

**3.0103.1 Access Doors and Hatches**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Intentional Attic Openings

## **Desired Outcome**

Attic access door safely and durably sealed and insulated to prevent air movement @ 50 Pascals of pressure

### **3.0103.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

#### **Objective**

Select safe and effective sealants

### **3.0103.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0103.1c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

### **Objective**

Surface is clean and ready to accept sealant

### **3.0103.1d Seal framing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Apply a continuous seal at all seams, cracks, joints, and edges of access framing while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

### **Objective**

Prevent air and moisture movement

### **3.0103.1e Seal access panel**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**



Seal access using gaskets, weather stripping or equivalent method

Permanently attach gaskets, weatherstripping, etc. per manufacturer's instructions

Secure attic door or hatch with a latch, lock or frictionally engaging components

### **Objective**

Prevent air and moisture movement

### **3.0103.1f Damming**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install a rigid and durable dam having a height greater than the insulation at attic opening and does not interfere with the operation of the access

### **Objective**

Prevent insulation movement

### **3.0103.1g Insulate opening**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Insulate access to the same R-value as adjoining insulated assembly

Permanently fasten insulation to access in complete contact with the air barrier

### **Objective**

Align thermal barrier

### **3.0103.1h Durability**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Completed measure will have a minimum expected service life of 20 years

## **Objective**

Ensure minimum service life

## **3.0103.4 Tenting of Wet Sprinkler Systems**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Intentional Attic Openings

## **Desired Outcome**

Contiguous thermal and pressure boundary that prevents sprinkler system from freezing

## **3.0103.4a Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

## **Objective**

Select safe and effective sealants

### **3.0103.4b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0103.4c Enclosure construction**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install a rigid enclosure around entire sprinkler system exposed within the attic maintaining a minimum 3" clearance from all portions of the system

#### **Objective**

Durably enclose entire sprinkler system

### **3.0103.4d Insulation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Insulate enclosure to an equivalent R-value as the rest of the attic

#### **Objective**

Prevent sprinkler system from freezing

### **3.0103.4e Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the enclosure while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Sealant exposed to the interior of the enclosure must meet the same fire rating as the enclosure

#### **Objective**

Fully adhered, safe, and durable sealant

### **3.0103.4f Fire safety**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Foam plastics, where permissible, will be provided with ignition and thermal barriers as required by applicable fire safety code

#### **Objective**

Prevent fire hazards

## **3.0104.1 Closed Crawlspace Air Sealing**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Foundation Spaces

## **Desired Outcome**

Reduce moisture, soil gases, and pests in foundation spaces with durable seals that remain in place and prevent air movement @ 50 Pascals of pressure

### **3.0104.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Verify that all exterior bulk moisture is directed away from the foundation with appropriate drainage techniques and exterior foundation drainage details are functioning properly (e.g. rain screens, weep holes)

#### **Objective**

Prevent bulk moisture intrusion

### **3.0104.1b Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

#### **Objective**

Select safe and effective sealants

### **3.0104.1c Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

### **Objective**

Select safe and effective materials

### **3.0104.1d Backing and infill**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

### **Objective**

Prevent pest intrusion and secure sealants

### **3.0104.1e Support**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

## **Objective**

Air barrier materials remain in place and support applied loads

### **3.0104.1f Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

## **Objective**

Surface is clean and ready to accept sealant

### **3.0104.1g Existing vent openings**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Permanently close vent openings using a durable, rigid, and pest resistant material

## **Objective**

Fully aligned pressure boundary

### **3.0104.1h Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of foundation walls, sills, floors, etc. that are adjacent to unconditioned spaces while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Weatherstrip exterior access doors/hatches and seal door/hatch framing using compatible sealant

## **Objective**

Prevent air and moisture intrusion

### **3.0104.1i Adjacent spaces**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install a continuous air barrier and vapor barrier between adjacent unconditioned spaces and closed crawlspace

## **Objective**

Prevent moisture intrusion

### **3.0104.1j Fire safety**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install only noncombustible materials and sealants in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Foam plastics, where permissible, will be provided with ignition and thermal barriers as required by applicable fire safety code

## **Objective**

Prevent fire hazards

## **3.0104.2 Installing New Crawlspace Access**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Foundation Spaces

**Desired Outcome**



Provide safe, durable, and appropriate access that remains in place and prevents air movement between conditioned and unconditioned spaces @ 50 Pascals of pressure

### **3.0104.2a Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

#### **Objective**

Select safe and effective sealants

### **3.0104.2b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

## **Objective**

Select safe and effective materials

### **3.0104.2c Backing and infill**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

## **Objective**

Prevent pest intrusion and secure sealants

### **3.0104.2d Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

## **Objective**

Surface is clean and ready to accept sealant

### **3.0104.2e Access construction**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Access openings through the floor will be a minimum of 18" by 24" or as constrained by existing framing members

Openings through a perimeter wall will be not less than 16" by 24" or as constrained by existing framing members

When any portion of the through-wall access is below grade, an area way not less than 16" by 24" will be provided

Under-floor spaces containing appliances will be provided with an unobstructed access large enough to remove the largest appliance but not less than 30" high and 22" wide and no more than 20 feet away from the appliance measured along the center line of the passageway from the opening to the appliance

### **Objective**

Provide adequate access to foundation space

### **3.0104.2f Appliance access**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

A level service space at least 30" deep and 30" wide will be present at the front or service side of the appliance

If the depth of the passageway or the service space exceeds 12" below the adjoining grade, the walls of the passageway will be lined with concrete or masonry extending 4" above the adjoining grade in accordance with Chapter 4 IRC

### **Objective**

Provide adequate access to appliances in foundation spaces

### **3.0104.2g Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of access framing while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Install weather stripping, gaskets, or equivalent to exterior access doors/hatches

### **Objective**

Prevent air, moisture, and pest intrusion

### **3.0104.2h Security**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install a latch, clasp, handle or equivalent that securely fastens access door/hatch closed and is designed for an optional lock installation

#### **Objective**

Prevent unauthorized access

### **3.0104.3 Slab Foundation Sealing**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Foundation Spaces

#### **Desired Outcome**

Effective, durable air barrier between the conditioned space and the ground that remains in place and prevents air movement @ 50 Pascals of pressure

#### **3.0104.3a Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0104.3b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

### **Objective**

Select safe and effective materials

### **3.0104.3c Backing and infill**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

### **Objective**

Prevent pest intrusion and secure sealants

### **3.0104.3d Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0104.3e Air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of the slab while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

#### **Objective**

Prevent air, moisture, and pest intrusion

### **3.0104.3f High-temperature application**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

#### **Objective**

Prevent a fire hazard

## **3.0104.4 Covers for Intentional Slab Penetrations**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Foundation Spaces

**Desired Outcome**

Reduce moisture, soil gases, and pests in foundation spaces

**3.0104.4a Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**

Select safe and effective sealants

**3.0104.4b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

### **Objective**

Select safe and effective materials

### **3.0104.4c Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

### **Objective**

Surface is clean and ready to accept sealant

### **3.0104.4d Sealing sump pump wells**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Cover sump pump wells or pits with an airtight cover that allows for all necessary penetrations to be tightly sealed

Sump pump covers must allow bulk moisture to drain from above the cover utilizing trapped or one-way ball valve fittings, or equivalent

### **Objective**

Reduce soil gas, moisture and air intrusion, and allow proper drainage pattern

### **3.0104.4e Covering other water containing pits**



Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Cover all exposed water sources with an operable (able to be opened for maintenance) access

Covers must be rigid, durable, and suitable for high-moisture exposure

Required cap penetrations will be close fitting (do not have to be airtight) and not interfere with drainage of water from above or below the basement floor

### **Objective**

Reduce soil gas and moisture accumulation

## **3.0105.1 Isolating Garage From Living Space**

**Section:** Air Sealing

**Topic:** General Pressure Boundary

**SubTopic:** Attached Garages

### **Desired Outcome**

Garage isolated outside the dwelling pressure boundary with durable, safe seals that remain in place and prevent air movement @ 50 Pascals of pressure

### **3.0105.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0105.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0105.1c Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

### **Objective**

Surface is clean and ready to accept sealant

### **3.0105.1d Backing and infill**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

### **Objective**

Prevent pest intrusion and secure sealants

### **3.0105.1e General air sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections between garage and living space while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

### **Objective**

Prevent air, pollutant, and pest intrusion

### **3.0105.1f Ductwork**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Seal all accessible ductwork joints and connections with UL 181B or 181B-M welds, gaskets, adhesive mastics, or mastic-plus- embedded-fabric systems

Where the same duct system serves any other living space, all supply and return openings in the garage (including intentional openings designed to heat or cool the garage space) must be disconnected, capped with sheet metal using mechanical fasteners, and completely sealed

### **Objective**

Prevent ductwork from distributing pollutants

### **3.0105.1g Doors adjacent to conditioned spaces**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install weather stripping, door sweep, and/or threshold if needed so that door is significantly airtight

If door is replaced, door must meet fire separation requirements

#### **Objective**

Existing door openings prevent air, pollutant, and pest intrusion and new doors meet fire safety requirements as well

### **3.0105.1h Glass doors or windows**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Replace, point, and glaze broken glass panes in doors or windows where needed

Where glazing is permitted by code, verify that replacement glass meets the intended fire resistance of the assembly penetrated and is safety glazing

Glazing located in walls connecting garages to conditioned spaces with fire-resistance ratings may be prohibited; confirm that existing glazing application is consistent with all applicable building codes

#### **Objective**

Safely prevent air, pollutant, and pest intrusion

### **3.0105.1i High-temperature application**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

### **Objective**

Prevent a fire hazard

## **3.02 – Shell Components**

### **3.0201.1 Window Air Sealing**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

### **Desired Outcome**

Weathertight window repairs

### **3.0201.1a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0201.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0201.1c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.1d Operation and fit**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Adjust window sash(es) to properly fit the jamb and allow for ease of operation and security

Verify intentional drainage is functioning correctly

### **Objective**

Proper window sash operation and drainage

### **3.0201.1e Sash stops**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install new or adjust existing sash stops so as to eliminate visible gaps between the stop and window jamb while ensuring sash operates smoothly and securely

### **Objective**

Operable, weathertight sash

### **3.0201.1f Weather stripping**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove existing weather stripping or sealing strips that are damaged

Install continuous and complete weather stripping on the bottom of the lower sash where it makes contact with the sill and at the top of the upper sash where it makes contact with the upper part of the window frame while maintaining the operability of the window

Mechanically installed weather stripping will be sealed to surface

## **Objective**

Complete seal of window sash

### **3.0201.1g Sash locks**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Adjust existing lock or install new lock so that the rails of the upper and lower sashes are flush and in full contact and no gaps are visible between the sash(es)

## **Objective**

Securely fastened sash

### **3.0201.1h Exterior weatherproofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Replace any missing/damaged weatherproofing on exterior portions of window (flashing, glazing, caulking, sealant, paint, etc.)

Seal any holes in frame left by abandoned hardware

Do not seal weep holes or intentional drainage locations

## **Objective**

Prevent water intrusion

### **3.0201.1i Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**



Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**3.0201.2 Window Sash Replacement**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

**Desired Outcome**

Weathertight window repairs

**3.0201.2a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**

Select safe and effective sealants

**3.0201.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0201.2c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.2d Sash replacement**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install new sash per manufacturer's instructions

Ensure lower sash has a bottom rail bevel that is matched to the bevel of the lower sill

Ensure new sash seals against all stops, jambs, existing sash, etc. with no visible gaps

Adjust window sash(es) to properly fit the jamb and allow for ease of operation and security

### **Objective**

Weatherproof sash installation

### **3.0201.2e Weatherproofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Water-seal and prime new sash if water permeable

### **Objective**

Prevent water damage

### **3.0201.2f Sash stops**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install new or adjust existing sash stops so as to eliminate visible gaps between the stop and window jamb while ensuring sash operates smoothly and securely

### **Objective**

Operable, weathertight sash

### **3.0201.2g Weather stripping**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install continuous and complete weather stripping on the bottom of the lower sash where it makes contact with the sill and at the top of the upper sash where it makes contact with the upper part of the window frame while maintaining the operability of the window

### **Objective**

Complete seal of window sash

### **3.0201.2h Sash locks**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Adjust existing lock or install new lock so that the rails of the upper and lower sashes are flush and in full contact and no gaps are visible between the sash(es)

### **Objective**

Securely fastened sash

### **3.0201.2i Disposal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Wrap old sash and any removed materials in plastic and dispose of them off-site in a manner that is compliant with local, state, and federal regulation

### **Objective**

Prevent reuse of old components and protect health and the environment

### **3.0201.2j Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**3.0201.3 Window Sill Replacement**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

**Desired Outcome**

Weathertight, fully operational window repairs

**3.0201.3a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**

Select safe and effective sealants

### **3.0201.3b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0201.3c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.3d Sill replacement**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install beveled sill flush with interior wall and sloped to the exterior of home at a minimum of 14 degrees

Apply continuous and complete seal at all connections/joints of the sill to the jambs, frame, and exterior wall

### **Objective**

Weatherproof sill

### **3.0201.3e Weatherproofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Water-seal and prime new sill if water permeable

### **Objective**

Prevent water damage

### **3.0201.3f Disposal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Wrap old sill/ and any removed materials in plastic and dispose of them off-site in a manner that is compliant with local, state, and federal regulation

### **Objective**

Prevent reuse of old components and protect health and the environment

### **3.0201.3g Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**3.0201.4 Glass Replacement**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

**Desired Outcome**

Weathertight glazing repairs

**3.0201.4a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**



Select safe and effective sealants

### **3.0201.4b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0201.4c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the glazing contact areas that will prevent a tight seal

Remove push point or stops from replacement area

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.4d New glazing selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select tempered safety glass as required by applicable codes

Select replacement glazing with comparable tint and coating (color and look) that meets or exceeds existing glazing for thickness, including multiple IG panes, inert gas, and thermal performance

Size replacement glazing 1/8" to 3/16" smaller than opening to allow for movement of frame

### **Objective**

Properly select and size replacement glazing

### **3.0201.4e New glazing installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Secure glazing in frame using push points or appropriate stops on each side of opening

Install glazing compound or sealant at all edges of the glass in accordance with manufacturer specifications

Seal glazing, stops, and exterior window surfaces in accordance with original installation design

### **Objective**

Secure and seal glazing

### **3.0201.4f Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Verify safe operation and size of egress windows as required by local codes

## **Objective**

Safe egress maintained

## **3.0201.5 Interior Fixed Storm Window Installation**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

## **Desired Outcome**

Airtight and safe fixed storm window installation

## **3.0201.5a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

## **Objective**

Select safe and effective sealants

### **3.0201.5b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0201.5c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.5d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install new storm window in compliance with the manufacturer's instructions

Storm window installation must be substantially airtight

## **Objective**

Airtight and proper installation

### **3.0201.5e Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Do not install fixed storm windows in required egress locations

## **Objective**

Safe egress maintained

## **3.0201.6 Interior Operable Storm Window Installation**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

## **Desired Outcome**

Airtight and safe operable storm window installation

### **3.0201.6a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0201.6b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0201.6c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

**Objective**

Surface is clean and ready to accept sealant

**3.0201.6d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight when closed

**Objective**

Airtight and proper installation

**3.0201.6e Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**3.0201.7 Exterior Fixed Storm Window Installation**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

**Desired Outcome**

Weathertight and safe fixed storm window installation

**3.0201.7a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**

Select safe and effective sealants

**3.0201.7b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and



low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0201.7c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.7d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight

### **Objective**

Weathertight and proper installation

### **3.0201.7e Sealing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a continuous bead of sealant under the top and side flanges of frame before installation

Do not seal the lower flange or designed drainage openings (i.e., weep holes)

## **Objective**

Weathertight installation

### **3.0201.7f Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Do not install fixed storm windows in required egress locations

## **Objective**

Safe egress maintained

## **3.0201.8 Exterior Operable Storm Window Installation**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

## **Desired Outcome**

Weathertight and safe operable storm window installation

### **3.0201.8a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **3.0201.8b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0201.8c Surface preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

## **Objective**

Surface is clean and ready to accept sealant

### **3.0201.8d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight

## **Objective**

Weathertight and proper installation

### **3.0201.8e Sealing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a continuous bead of sealant under the top and side flanges of frame before installation

Do not seal the lower flange or designed drainage openings (i.e., weep holes)

## **Objective**

Weathertight installation

### **3.0201.8f Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**3.0201.9 Window Replacement**

**Section:** Air Sealing

**Topic:** Shell Components

**SubTopic:** Windows

**Desired Outcome**

Continuous, weathertight air and thermal boundary

**3.0201.9a Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

**Objective**

Select safe and effective sealants

### **3.0201.9b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

#### **Objective**

Select safe and effective materials

### **3.0201.9c Window selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select windows that meet the SHGC, U-value, and air leakage requirements of the work order

Select windows that meet the egress and safety glass requirements of the location where they are installed

#### **Objective**

Choose correct and safe new window

### **3.0201.9d Opening preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove existing window stops, sashes, parting strips, pulleys, and weights

Insulate and seal existing window weight pockets if they will remain after new installation

Replace any damaged or rotting framing

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a level and firm installation

Seal the rough opening to the wall system's air and thermal boundary with non-expanding sealants

Install flashing to direct water away from the window opening in accordance with manufacturer's instructions

### **Objective**

Rough opening sealed, insulated, and properly prepared for installation

### **3.0201.9e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install new window in accordance with manufacturer specifications in alignment with the wall system's air and thermal boundary

Install flashing per the manufacturer's specifications

Gaps between the new window and existing opening will be sealed with low-expanding foam or equivalent sealant

Final installation will be air and watertight

**Objective**

Continuous and contiguous air and thermal boundary

**3.0201.9f Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify safe operation and size of egress windows as required by local codes

**Objective**

Safe egress maintained

**4 – Insulation**

**1.01 - Attics**

**4.0101.1 Roof Deck Insulation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Exterior Roof Insulation

**Desired Outcome**

Durable, weather-proof, and effective, exterior thermal boundary

**4.0101.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**



Verify that:

roof structure is sound and can support additional weight of insulation and roofing materials installation

all roof necessary roof penetrations are complete (ventilation, plumbing vents, combustion flues, chimneys, etc.)

### **Objective**

Ensure roof deck can be safely insulated

### **4.0101.1b General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove existing roof covering down to the roof sheathing materials including all fasteners, flashing, etc.

Air seal all holes, gaps, seams and penetrations in existing roof deck

Replace any damaged or rotten roof sheathing materials

Remove any extraneous materials or obstructions from roof deck surface

### **Objective**

Solid, clean, and airtight roof surface

### **4.0101.1c Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation materials that have a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

#### **4.0101.1d Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

##### **Objective**

Select safe, durable, and effective sealants

#### **4.0101.1e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install insulation to prescribed R-value without gaps, voids, compressions, misalignments, or wind intrusions and according to manufacturer specifications

Offset the seams of multi-layer installations a minimum of 12"

##### **Objective**

Install insulation properly

#### **4.0101.1f Air sealing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install a continuous bead of sealant along the entire perimeter of roof deck between insulation layers and roof sheathing and again at subsequent layers of insulation

Seal all seams or joints in insulation with gaskets, tapes, or equivalent material

Seal all connections, penetrations, corners, etc.

## **Objective**

Prevent air and moisture intrusion under or between insulation layers

### **4.0101.1g Water management**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install appropriate flashing and water management systems that direct bulk moisture off of roof and away from building

## **Objective**

Direct bulk moisture away from building

### **4.0101.1h Replacement roof covering**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install new roof covering in accordance with manufacturer specifications and applicable code requirements

## **Objective**

Compliant roof covering installation

### **4.0101.1i Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0103.1 Accessible Attic - Batt Installation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation

### **4.0103.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0103.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

### **4.0103.1c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a minimum of one insulation depth marker and one marker every additional 300 ft<sup>2</sup> throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

### **Objective**

Protect insulation R-value, provide depth measurement, and locate junctions for future access

### **4.0103.1d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the ceiling cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material, install it in contact with the conditioned space

## **Objective**

Continuous and contiguous pressure and thermal barrier of consistent R-value

### **4.0103.1e Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0103.2 Accessible Attic - Loose Fill Installation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

## **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation

### **4.0103.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0103.2b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

#### **4.0103.2c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a minimum of one insulation depth marker and one marker every additional 300 ft<sup>2</sup> throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

### **Objective**

Protect insulation R-value, provide depth measurement, and locate junctions for future access

### **4.0103.2d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install loose fill insulation to prescribed R-value in every joist bay in full contact with the air barrier without gaps, voids, compressions, or misalignments

### **Objective**

Continuous and contiguous pressure and thermal barrier of consistent R-value

### **4.0103.2e Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0103.3 Accessible Attic - Batt Insulation Over Existing Insulation**

**Section:** Insulation



**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

**Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation

**4.0103.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

**Objective**

Ensure space can be safely insulated

**4.0103.3b General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install a minimum of one insulation depth marker and one marker every additional 300 ft<sup>2</sup> throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

### **Objective**

Protect insulation R-value, provide depth measurement, and locate junctions for future access

### **4.0103.3c Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select only unfaced insulation batts for installation over existing batt insulation that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Prevent condensation in insulation layers and choose fire safe insulation

### **4.0103.3d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install batt insulation to prescribed R-value in full contact with the existing insulation batts without gaps, voids, compressions, or misalignments

If the top of the existing insulation is below the top of the framing, install new batts parallel with framing members

If the top of the existing insulation is above the top of the framing, install new batts perpendicular to framing members

### **Objective**

Uniform insulation depth in continuous contact with existing insulation without voids

### **4.0103.3e Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

#### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0103.4 Accessible Attic - Loose Fill Over Existing Insulation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

#### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation

### **4.0103.4a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0103.4b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

#### **4.0103.4c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a minimum of one insulation depth marker and one marker every additional 300 ft<sup>2</sup> throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

### **Objective**

Protect insulation R-value, provide depth measurement, and locate junctions for future access

#### **4.0103.4d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Install loose fill insulation to prescribed R-value in every joist bay in full contact with the existing insulation or the air barrier without gaps, voids, compressions, or misalignments

##### **Objective**

Uniform insulation depth in continuous contact with existing insulation without voids

#### **4.0103.4e Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

#### **4.0103.6 Accessible Attic - Dense Pack Insulation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

##### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0103.6a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and installation pressure

### **Objective**

Ensure space can be safely insulated

#### **4.0103.6b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

#### **4.0103.6c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

**Objective**

Durable and airtight insulation cavity that aligns with the pressure boundary

**4.0103.6d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Fill 100% of each cavity with insulation to the correct density that prevents air movement

**Objective**

Complete, consistent, and airtight insulation coverage

**4.0103.6e Close access hole**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install closure system over all access holes that is airtight, and permanent

**Objective**

Airtight, durable access closure

**4.0103.6f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0103.7 Accessible Pitched/Vaulted/Cathedralized Ceilings - Loose Fill Over**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation

### **4.0103.7a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings



Verify that installation area:

is intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0103.7b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe insulation

### **4.0103.7c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a minimum of one insulation depth marker and one marker every additional 300 ft<sup>2</sup> throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

### **Objective**

Protect insulation R-value, provide depth measurement, and locate junctions for future access

### **4.0103.7d Cellulose installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install stabilized cellulose (i.e., wet-spray applied) when available

If ceiling pitch is less than 6/12, install loose fill cellulose to prescribed R-value without gaps, voids, misalignments, or wind intrusions

If ceiling pitch is 6/12 or greater, install baffles of the same height as the insulation perpendicular to slope a maximum of every 6' that prevent loose fill insulation from sliding downward then fill each bay to prescribed R-value without gaps, voids, misalignments, or wind intrusions

### **Objective**

Cellulose insulation remains in place when installed on sloped surface

### **4.0103.7e Fiberglass installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install stabilized fiberglass (i.e., wet-spray applied) when available

If ceiling pitch is less than or equal to 6/12, install loose fill fiberglass insulation to prescribed R-value without gaps, voids, misalignments, or wind intrusions

If ceiling pitch is greater than 6/12, loose fill fiberglass insulation may not be used (dense pack fiberglass may be used)

### **Objective**

Fiberglass insulation remains in place when installed on sloped surface of appropriate pitch

### **4.0103.7f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0103.8 Loose Fill to Capacity**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier

### **4.0103.8a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

## **Objective**

Ensure space can be safely insulated

### **4.0103.8b General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings

## **Objective**

Prevent occupant exposure to construction dust

### **4.0103.8c Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select insulation materials that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select fire safe insulation

### **4.0103.8d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install blown insulation to maximum R-value from attic floor to ceiling to full capacity without dense packing, but without voids

## **Objective**

Complete and consistent insulation coverage

#### **4.0103.8e Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install closure system over all access holes that is airtight, durable, and aesthetically pleasing

##### **Objective**

Airtight, durable, and aesthetic access closure

#### **4.0103.8f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0104.1 Knee Wall - Dense Packing**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Knee Walls

##### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0104.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight and pressure, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

##### **Objective**

Ensure space can be safely insulated

#### **4.0104.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select fire safe materials

### **4.0104.1c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

## **Objective**

Durable and airtight insulation cavity that aligns with the pressure boundary

### **4.0104.1d Install backing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install airtight backing material over entire area to be insulated that will withstand dense packing pressures

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

## **Objective**

Airtight, durable insulation backing

### **4.0104.1e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Fill 100% of each cavity with insulation to the correct density that prevents air movement

### **Objective**

Complete, consistent, and airtight insulation coverage

#### **4.0104.1f Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install closure system over all access holes that is airtight and permanent

### **Objective**

Airtight, durable, access closure

#### **4.0104.1g Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential



#### **4.0104.1h Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

#### **4.0104.2 Knee Wall - Batt Insulation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Knee Walls

##### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0104.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

### **Objective**

Prepare for safe, effective, and airtight installation of dense-packed insulation

#### **4.0104.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

#### **4.0104.2c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

### **Objective**

Prevent condensation

#### **4.0104.2d Batt installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the ceiling cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material, install it in contact with the conditioned space

##### **Objective**

Continuous and contiguous thermal boundary

#### **4.0104.2e Install backing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

##### **Objective**

Airtight, durable insulation cavity

#### **4.0104.2f Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

### **4.0104.2g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0104.3 Knee Wall - Existing Batt Insulation Repair**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Knee Walls

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0104.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

##### **Objective**

Ensure space can be safely insulated

#### **4.0104.3b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select fire safe materials

### **4.0104.3c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Permanently secure existing batt insulation in full contact with the existing air barrier and sides of the existing cavity without gaps, voids, compressions, or misalignments

## **Objective**

Align pressure and thermal boundary

### **4.0104.3d Install backing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

## **Objective**

Airtight, durable insulation cavity

### **4.0104.3e Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

#### **4.0104.3f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

#### **4.0104.4 Knee Wall - Rigid Insulation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Attic Knee Walls

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0104.4a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

##### **Objective**

Ensure space can be safely insulated

#### **4.0104.4b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

##### **Objective**



Select fire safe materials

#### **4.0104.4c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Remove any existing insulation or protrusions that prevent full insulation contact with existing air barrier

##### **Objective**

Align pressure and thermal boundary

#### **4.0104.4d Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install rigid insulation to prescribed R-value using mechanical fasteners

Seal all insulation seams, joints and connections with compatible sealant (caulk, tape, mastic, etc.)

##### **Objective**

Continuous pressure and thermal boundary of correct R-value

#### **4.0104.4e Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

## **Objective**

Minimize ignition and combustion potential

### **4.0104.4f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **4.0188.1 Radiant Barriers**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Unique Installations

## **Desired Outcome**

Safely, and effectively reduce radiant heat flow while preserving attic ventilation

### **4.0188.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

existing insulation is aligned with and in full contact with the air barrier

### **Objective**

Ensure space can be safely insulated

### **4.0188.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select radiant barrier that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

### **4.0188.1c Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install radiant barrier using mechanical fasteners according to manufacturer specifications

**Objective**

Compliant installation

**4.0188.1d Air space**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install radiant barrier with the manufacturer's prescribed air space between it and the protected surface

**Objective**

Adequate air space for prescribed performance

**4.0188.1e Sealing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Seal all seams, joints, and connections of the radiant barrier airtight

**Objective**

Airtight barrier

**4.0188.1f Ventilation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

When installed on attic ceiling (i.e., roof framing) maintain a minimum clearance of 3" from ridge vents

When installed on gable walls, do not block gable vents

In vented spaces, install radiant barrier so that it withstands local wind loads

## **Objective**

Maintain adequate attic ventilation while preserving installation durability

### **4.0188.1g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, number and thickness of the air spaces, the direction of heat flow, and the installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0188.2 Unconditioned Attic Ventilation**

**Section:** Insulation

**Topic:** Attics

**SubTopic:** Unique Installations

## **Desired Outcome**

Effective, safe, and pest-resistant attic ventilation

### **4.0188.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify the presence of an effective air barrier and thermal boundary between the attic and living space

### **Objective**

Reduce moisture intrusion from living space

### **4.0188.2b Vent selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Attic vent types will be consistent with requirements for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof)

Install only passive ventilation, no powered ventilators may be installed

### **Objective**

Ensure vent meets proper performance characteristics for location and roofing type

### **4.0188.2c Vent openings**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Ventilation opening area and configuration will comply with applicable building code

### **Objective**

Provide sufficient ventilation air flow

### **4.0188.2d Vent location**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install between 40 and 50 percent of attic ventilation within 3 feet of the highest point in the ventilated space

Install attic vents in locations that prevention of entry of wind-driven precipitation

### **Objective**

Encourage proper air flow

Minimize entry of wind driven bulk moisture

### **4.0188.2e Ventilation screens**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

All attic ventilation sources with holes greater than 1/4" will have corrosion-resistant wire mesh screens installed with openings of 1/16" to 1/4"

Existing vents that are not screened will be covered with corrosion-resistant wire mesh with openings of 1/16" to 1/4"

### **Objective**

Prevent pest entry

### **4.0188.2f Ventilation baffles**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

If soffit venting is installed, mechanically fasten baffles (i.e., soffit chutes) in each truss bay that terminate at least 6" above final insulation level and provide a minimum of 1" clearance between insulation and roof deck material

## **Objective**

Ensure vent allows proper air flow without compromising insulation performance

## **4.02 - Walls**

### **4.0201.2 Batt Insulation**

**Section:** Insulation

**Topic:** Walls

**SubTopic:** Accessible Walls

#### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0201.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air ducts, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings



Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0201.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

### **4.0201.2c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials from the installation area that are installed improperly

### **Objective**

Prevent condensation

### **4.0201.2d Batt installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it in contact with the conditioned space

### **Objective**

Continuous and contiguous thermal boundary

### **4.0201.2e Install backing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install an airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

### **Objective**

Airtight, durable insulation cavity

### **4.0201.2f Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Separate all foam products from occupiable space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

#### **4.0201.2g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

#### **4.0201.3 Dense Pack Insulation**

**Section:** Insulation

**Topic:** Walls

**SubTopic:** Accessible Walls

##### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0201.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

### **Objective**

Prepare for safe, effective, and airtight installation of dense-packed insulation

#### **4.0201.3b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

#### **4.0201.3c General preparation for dense packed insulation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

### **Objective**

Airtight dense packed cavity insulation

#### **4.0201.3d Install backing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install airtight backing material over entire area to be insulated that will withstand dense packing pressures

Secure backing material using mechanical fasteners that penetrate the sub-framing a minimum of 1"

Installation must have a minimum of a 30-year service life

##### **Objective**

Airtight, durable insulation backing

#### **4.0201.3e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Fill 100% of each cavity with insulation to the correct density that prevents air movement

##### **Objective**

Complete, consistent, and airtight insulation coverage

#### **4.0201.3f Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install closure system over all access holes that is airtight and permanent

##### **Objective**

Airtight, durable, access closure

#### **4.0201.3g Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Separate all foam products from occupiable space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

##### **Objective**

Minimize ignition and combustion potential

#### **4.0201.3h Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0202.1 Dense Pack Insulation**

**Section:** Insulation

**Topic:** Walls

**SubTopic:** Enclosed Walls

**Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

#### **4.0202.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

##### **Objective**

Prepare for safe, effective, and airtight installation of dense-packed insulation

#### **4.0202.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

##### **Objective**

Select fire safe materials

#### **4.0202.1c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

##### **Objective**

Prevent occupant exposure to construction dust

Airtight, durable insulation cavities aligned with the pressure boundary

#### **4.0202.1d Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

##### **Objective**

Select safe and effective sealants



#### **4.0202.1e Access cavity**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Exterior access:

Remove the exterior cladding at the insulation access point when feasible

Neatly cut any vapor retarder installed and minimize air barrier and drainage plane disruption

Create an access hole through the sheathing sufficient to access the cavity with fill tube

Interior access:

Set up dust containment enclosure in installation area

Create access holes through the interior wall surface in a straight horizontal line sufficient to access the cavity with fill tube without damaging the wall surface

##### **Objective**

Access all wall cavities safely and prepare for access closure

#### **4.0202.1f Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Fill 100% of each cavity with insulation to the correct density that prevents air movement

##### **Objective**

Complete, consistent, and airtight insulation coverage

#### **4.0202.1g Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Exterior access holes will be closed as follows:

Plug holes in sheathing with durable materials and seal with weatherproof exterior sealant

Close weather barrier and seal seams with compatible sealant tape

Reinstall exterior cladding and secured with mechanical fasteners

Interior access holes will be closed as follows:

Interior holes will be coated and patched to match original interior surface characteristics or covered with trim as agreed upon with client

### **Objective**

Airtight, durable hole closure

### **4.0202.1h Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0202.2 Exterior Rigid Insulation**

**Section:** Insulation

**Topic:** Walls

**SubTopic:** Enclosed Walls

**Desired Outcome**

Continuous, contiguous, safe, and compliant thermal boundary

**4.0202.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

**Objective**

Ensure space can be safely insulated

**4.0202.2b Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

### **Objective**

Select safe and effective sealants

### **4.0202.2c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove all exterior cladding from the installation area

Seal all holes, gaps, and penetrations in existing sheathing airtight

Remove any existing insulation or protrusions that prevent full insulation contact with existing air barrier

Replace any rotten or structurally weak substrate

### **Objective**

Provide secure attachment for insulation in full contact with the exterior sheathing

### **4.0202.2d Water management system**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Insulation will either be installed fully in contact with the exterior sheathing, or a drainage plane will be installed that allows moisture to drain completely to outdoors from behind the rigid insulation

### **Objective**

Prevent moisture buildup behind insulation layer

#### **4.0202.2e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install continuous rigid insulation to prescribed R-value using mechanical fasteners that penetrate sub-framing a minimum of 1-1/2"

Overlap seam of multiple layers a minimum of 12"

Seal all insulation seams, joints and connections in each layer with compatible sealant (caulk, tape, mastic, etc.)

#### **Objective**

Continuous pressure and thermal boundary of correct R-value

#### **4.0202.2f Exterior cladding replacement**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Reinstall exterior cladding using mechanical fasteners over the new insulation per the manufacturer's specifications

#### **Objective**

Weather-tight cladding installation

#### **4.0202.2g Fire Safety**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

For structures covered by the International Building Code (IBC), all exterior walls to be insulated will be assessed for provision of a thermal boundary (fire stopping) when foam insulating materials are to be used (IBC 2603.4)

### **Objective**

Ensure that insulation retrofit complies with applicable code regarding fire separation

### **4.0202.2h Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.03 - Floors**

### **4.0301.1 Batt Insulation in Joisted Cavities**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary

### **4.0301.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0301.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

#### **4.0301.1c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

## **Objective**

Prevent condensation, identify utility junctions for future access

### **4.0301.1e Secure Batts**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips, or rodent barrier)

## **Objective**

Insulation remains in contact with pressure boundary

### **4.0301.1f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0301.2 Loose Fill With Netting/Fabric in Joisted Cavities**

**Section:** Insulation



**Topic:** Floors

**SubTopic:** Accessible Floors

**Desired Outcome**

Continuous, contiguous, and safe thermal boundary

**4.0301.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

**Objective**

Ensure space can be safely insulated

**4.0301.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select insulation and netting/fabric that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select fire safe materials

### **4.0301.2c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

## **Objective**

Identify utility junctions for future access

### **4.0301.2d Install netting/fabric**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install netting/fabric using mechanical fasteners spaced according to netting/fabric manufacturer specifications

Installation must have a minimum service life of 20 years

## **Objective**

Secure insulation

### **4.0301.2e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Fill netted/fabric covered cavities to capacity with loose fill insulation in accordance with manufacturer specifications

Install insulation to prescribed R-value and in continuous contact with the air barrier

**Objective**

Continuous and contiguous thermal boundary

**4.0301.2f Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install closure system over all access holes that prevents insulation loss and is permanent

**Objective**

Durable, access closure prevent insulation loss

**4.0301.2g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

**Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0301.3 Loose Fill in Joisted Cavities With Rigid Barrier**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0301.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0301.3b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

##### **Objective**

Select fire safe materials

#### **4.0301.3c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

##### **Objective**

Select safe and effective sealants

#### **4.0301.3d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

##### **Objective**

Identify utility junctions for future access

#### **4.0301.3e Install rigid barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install a rigid air barrier material over entire area to be insulated that will withstand insulation pressures

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Seal all seams, joints, connections, etc. with a compatible sealant

Installation must have a minimum of a 30-year service life

##### **Objective**

Airtight, durable insulation backing

#### **4.0301.3f Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier

### **Objective**

Complete and consistent insulation coverage

### **4.0301.3g Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install closure system over all access holes that is airtight and permanent

### **Objective**

Airtight, durable, access closure

### **4.0301.3h Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

#### **4.0301.3i Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

##### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

#### **4.0301.4 Dense Pack in Joisted Cavities With Rigid Barrier**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

##### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

#### **4.0301.4a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions



improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and installation pressure

### **Objective**

Ensure space can be safely insulated

#### **4.0301.4b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

#### **4.0301.4c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **4.0301.4d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

### **Objective**

Identify utility junctions for future access

### **4.0301.4e Install rigid barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install an air barrier material over entire area to be insulated that will withstand insulation pressures

Secure backing material using mechanical fasteners, spaced a maximum of 6" apart, that penetrate the sub framing a minimum of 1"

Seal all seams, joints, connections, etc. with a compatible sealant

Installation must have a minimum of a 30-year service life

### **Objective**

Airtight, durable insulation backing

### **4.0301.4f Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier

### **Objective**

Complete, consistent, and airtight insulation coverage

### **4.0301.4g Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install closure system over all access holes that is airtight and permanent

### **Objective**

Airtight, durable, access closure

### **4.0301.4h Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

## **Objective**

Minimize ignition and combustion potential

### **4.0301.4i Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0301.6 Cantilever Floor Joisted Cavities Batt Insulation**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

**Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

#### **4.0301.6a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

##### **Objective**

Ensure space can be safely insulated

#### **4.0301.6b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select fire safe materials

### **4.0301.6c General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Install airtight blocking between each floor joist at the interior edge of the exterior wall plate

## **Objective**

Prevent condensation, prevent air and moisture movement in attached floor cavities

### **4.0301.6d Batt installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it in contact with the conditioned space

## **Objective**

Continuous and contiguous thermal boundary

### **4.0301.6e Secure Batts**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

**Objective**

Insulation remains in contact with pressure boundary

**4.0301.6f Enclose cavity**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Mechanically fasten a continuous, airtight, rigid air barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact

**Objective**

Weathertight, pest resistant, rigid enclosure

**4.0301.6g Exterior soffit**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install durable exterior soffit material over the rigid enclosure materials

**Objective**

Protect enclosed cavity from weather

**4.0301.6h Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0301.7 Non-Joisted Floors Batt Insulation**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary

### **4.0301.7a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:



intact, able to support insulation weight, and air sealed

Verify all plumbing and ductwork will be inside the thermal boundary

Verify that existing floor air barrier is smooth and is not ribbed or fluted metal decking material

### **Objective**

Ensure space can be safely insulated

### **4.0301.7b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation and support materials that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

### **4.0301.7c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the insulation level at any utility junctions that will be covered by insulation

### **Objective**

Prevent condensation, identify utility junctions for future access

### **4.0301.7d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install batts over 100% of accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, compressions, or misalignments

If vapor retarder facing exists, install it facing the conditioned area

## **Objective**

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

### **4.0301.7e Support**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install a support system for batt insulation that is mechanically fastened to the floor deck and supports the batt insulation without compression and has a minimum service life of 20 years

## **Objective**

Secure batts to floor

### **4.0301.7f Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0301.8 Non-Joisted Floors Rigid Foam**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Accessible Floors

**Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

**4.0301.8a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Verify all plumbing and ductwork will be inside the thermal boundary

**Objective**

Ensure space can be safely insulated

**4.0301.8b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation and support materials that have a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Select fire safe materials

### **4.0301.8c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **4.0301.8d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the insulation level at any utility junctions that will be covered by insulation

### **Objective**

Prevent condensation, identify utility junctions for future access

### **4.0301.8e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

### **Objective**

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

### **4.0301.8f Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Seal all seams, joints, connections, etc. of rigid insulation at entire perimeter and at all support beams

### **Objective**

Airtight insulation that prevents condensation

### **4.0301.8g Support**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a support system for rigid insulation that is mechanically fastened to the floor deck that has a minimum service life of 30 years

### **Objective**

Secure insulation to floor

### **4.0301.8h Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

### **4.0301.8i Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0302.1 Batt Insulation With Rigid Barrier**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Exposed Floors

### **Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

### **4.0302.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

## **Objective**

Ensure space can be safely insulated

### **4.0302.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

## **Objective**

Select fire safe materials

### **4.0302.1c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

## **Objective**



Select safe and effective sealants

#### **4.0302.1d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

##### **Objective**

Prevent condensation

#### **4.0302.1e Batt installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a vapor retarder facing material install it in contact with the conditioned space

##### **Objective**

Continuous and contiguous thermal boundary

#### **4.0302.1f Secure batts**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

If insulation batts are not full cavity depth, secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

## **Objective**

Insulation remains in contact with pressure boundary

### **4.0302.1g Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

## **Objective**

Insulation protected from weather, pests, and moisture

### **4.0302.1h Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

## **Objective**

Airtight, pest resistant exterior

### **4.0302.1i Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

## **Objective**

Protect insulation from weather, light and impact

### **4.0302.1j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0302.2 Loose Fill With Rigid Barrier**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Exposed Floors

## **Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

### **4.0302.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0302.2b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

#### **4.0302.2c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

##### **Objective**

Select safe and effective sealants

#### **4.0302.2d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

##### **Objective**

Prevent condensation, identify utility junctions for future access

#### **4.0302.2e Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

### **Objective**

Insulation protected from weather, pests, and moisture

### **4.0302.2f Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier and the rigid barrier

### **Objective**

Complete and consistent insulation coverage

### **4.0302.2g Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install closure system over all access holes that is airtight, pest-resistant, and permanent

### **Objective**

Airtight, durable, access closure

### **4.0302.2h Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

### **Objective**

Airtight, pest resistant exterior

### **4.0302.2i Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

### **Objective**

Protect insulation from weather, light and impact

### **4.0302.2j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0302.3 Dense Pack with Rigid Barrier**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Exposed Floors

**Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

**4.0302.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

**Objective**

Ensure space can be safely insulated

**4.0302.3b Material selection**



Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

#### **4.0302.3c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

### **Objective**

Select safe and effective sealants

#### **4.0302.3d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

## **Objective**

Prevent insulation gaps or voids

### **4.0302.3e Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

## **Objective**

Insulation protected from weather, pests, and moisture

### **4.0302.3f Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Fill 100% of each cavity to manufacturer's density requirements keeping insulation in full contact with the air barrier

## **Objective**

Complete, consistent, and airtight insulation coverage

### **4.0302.3g Close access hole**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install closure system over all access holes that is airtight and permanent

## **Objective**

Airtight, durable, access closure

### **4.0302.3h Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

## **Objective**

Airtight, pest resistant exterior

### **4.0302.3i Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

## **Objective**

Protect insulation from weather, light and impact

### **4.0302.3j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0302.5 Rigid Insulation on Joists**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Exposed Floors

### **Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

### **4.0302.5a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0302.5b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

### **4.0302.5c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

### **Objective**

Select safe and effective sealants

### **4.0302.5d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Remove any obstacles, fasteners, or protruding objects that will prevent insulation from fully contacting the bottom of the floor joist

### **Objective**

Prevent insulation gaps or voids

### **4.0302.5e Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the floor joists without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

### **Objective**

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

#### **4.0302.5f Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

##### **Objective**

Insulation protected from weather, pests, and moisture

#### **4.0302.5g Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

##### **Objective**

Airtight, pest resistant exterior

#### **4.0302.5h Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

### **Objective**

Protect insulation from weather, light and impact

### **4.0302.5i Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

### **4.0302.5j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0302.6 Non-Joisted Floors Batt Insulation**

**Section:** Insulation

**Topic:** Floors



**SubTopic:** Exposed Floors

**Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

**4.0302.6a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

**Objective**

Ensure space can be safely insulated

**4.0302.6b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

### **4.0302.6c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

### **Objective**

Select safe and effective sealants

### **4.0302.6d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

### **Objective**

Prevent condensation

### **4.0302.6e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install batts over 100% of accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, compressions, or misalignments

If vapor retarder facing exists, install it facing the conditioned area

### **Objective**

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

### **4.0302.6f Secure batts**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

If insulation batts are not full cavity depth, secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

### **Objective**

Insulation remains in contact with pressure boundary

### **4.0302.6g Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

### **Objective**

Insulation protected from weather, pests, and moisture

### **4.0302.6h Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

### **Objective**

Airtight, pest resistant exterior

### **4.0302.6i Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

### **Objective**

Protect insulation from weather, light and impact

### **4.0302.6j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0302.7 Non-Joisted Floors Rigid Insulation**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Exposed Floors

## **Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

## **4.0302.7a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0302.7b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

### **Objective**

Select fire safe materials

#### **4.0302.7c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

## **Objective**

Select safe and effective sealants

### **4.0302.7d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Remove any existing insulation or vapor barrier materials from installation area

Remove any obstacles, fasteners, or protruding objects that will prevent insulation from fully contacting the bottom of the floor joist

## **Objective**

Prevent condensation, create uninterrupted installation surface

### **4.0302.7e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

## **Objective**

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

### **4.0302.7f Rigid protective barrier**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

## **Objective**

Insulation protected from weather, pests, and moisture

### **4.0302.7g Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

## **Objective**

Airtight, pest resistant exterior

### **4.0302.7h Weather-resistant barrier**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

## **Objective**

Protect insulation from weather, light and impact

### **4.0302.7i Ignition and thermal barriers**



Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

**Objective**

Minimize ignition and combustion potential

**4.0302.7j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

**Objective**

Comply with 16 CFR 460.17 and document contract compliance

**4.0388.1 Foundation Skirting**

**Section:** Insulation

**Topic:** Floors

**SubTopic:** Unique Installations

**Desired Outcome**

Reduce pest, wind, and water intrusion while reducing conductive heat loss in floor assembly

**4.0388.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

Verify that installation area is intact and structurally sound

Verify that all plumbing is within the thermal boundary, or insulated appropriately

Verify an appropriate class I vapor retarder is installed between the ground and the floor assembly

## **Objective**

Space safe and prepared for insulation

### **4.0388.1b Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

## **Specification**

Select materials that are corrosion and rot resistant, compatible with existing surfaces, and pest resistant

Select materials that are rated for ground contact if they touch the ground

## **Objective**

Select durable and pest-resistant materials

### **4.0388.1c Sealant selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

## **Objective**

Select durable, safe, and pest-resistant sealants

### **4.0388.1d General preparation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

## **Specification**

Remove any existing skirting materials

Remove any vegetation from installation area

## **Objective**

Installation area free of obstructions

### **4.0388.1e Coverage**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

## **Specification**

Install skirting continuously around the entire perimeter of the conditioned space

## **Objective**

Minimize pests, wind and water intrusion, and freezing of plumbing under dwelling

### **4.0388.1f Support**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Install support material as needed to adequately support new skirting to prevent failure under wind or snow loads but that allows for expansion, contraction, and frost heaving

**Objective**

Adequate yet flexible support

**4.0388.1g Fastening**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Mechanically fasten all skirting in accordance with manufacturer's specifications using corrosion resistant materials

**Objective**

Durable installation

**4.0388.1h Flashing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Install flashing that directs bulk water away from the dwelling and to outside skirting

Seal flashing to dwelling with compatible sealant

**Objective**

Prevent water from entering foundation space

**4.0388.1i Insulation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Install skirting that meets the prescribed R-value

**Objective**

Reduce conductive heat loss through floor assembly

**4.0388.1j Sealing and rodent proofing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Seal all seams, joints, connections, penetrations, etc. in the skirting with compatible sealant

Seal all exposed wood (e.g., paint, sealed, treated)

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

**Objective**

Airtight, pest resistant exterior

**4.0388.1k Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

**Objective**

Comply with 16 CFR 460.17 and document contract compliance

**4.04 – Conditioned Spaces**

**4.0401.1 SPF Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Rim/Band Joist

**Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

**4.0401.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight

**Objective**

Ensure insulation can be safely installed

**4.0401.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Select SPF that is between 0.5 and 2.0 lb/ft<sup>3</sup> in density and has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

### **Objective**

Meet fire safety requirements

### **4.0401.1c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove existing insulation and vapor retarders from installation area

Install durable backing material over any escape holes in the air barrier

Ensure utility junctions remain accessible per local code requirements

### **Objective**

Prevent condensation, prevent SPF escape

### **4.0401.1d Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

### **Objective**

Properly bonded SPF installation

### **4.0401.1e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Apply SPF to prescribed R-value in a continuous layer from subfloor surface, over band/rim joist and sill/wall plate, and in contact with foundation or ceiling below using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the interior (or warm) side of the SPF

## **Objective**

Continuous pressure and thermal boundary that prevents moisture vapor movement

### **4.0401.1f Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

If foam is no more than 3 1/4" thick and the space is not permanently habitable no thermal barrier is required

If foam is thicker than 3 1/4", doesn't meet the flame and smoke index, or is of less than 0.5 lb/ft<sup>3</sup> density, separate foam from the subspace with a suitable thermal barrier covering or coating as indicated in manufacturer's specifications and applicable building code

If code requirements are unclear, consult local code officials for clarification

## **Objective**

Minimize ignition and combustion potential

### **4.0401.1g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value



## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0401.2 Batt Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Rim/Band Joist

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0401.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

## **Objective**

Ensure space can be safely insulated

### **4.0401.2b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Select batt insulation that has a class II vapor retarder facing and that has a flame spread and smoke development index of 25/450 or less

Select encapsulation material that is a permanent air barrier, a class II vapor retarder, and has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

## **Objective**

Select materials that are fire safe and meet class II vapor retarder requirement

### **4.0401.2c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

## **Objective**

Select safe and effective sealants

### **4.0401.2d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Remove any existing insulation or vapor barrier materials from installation area

## **Objective**

Prevent condensation, align thermal and pressure boundary

### **4.0401.2e Batt installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install batt insulation to prescribed R-value in every joist bay in full contact with the rim/band joist air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it toward the conditioned space

## **Objective**

Continuous and contiguous thermal boundary

### **4.0401.2f Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Seal each cavity airtight around the perimeter of faced batts or around the perimeter of the encapsulation material

## **Objective**

Prevent air and moisture movement in cavity

### **4.0401.2g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0401.3 Rigid Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Rim/Band Joist

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0401.3a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

### **4.0401.3b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select rigid insulation that:

is a class II vapor retarder

is between 0.5 and 2.0 lb/ft<sup>3</sup> in density and has a flame spread/smoke development index equal to or less than 25/450 when tested in accordance with ASTM E84 or UL 723

### **Objective**

Prevent condensation and provide fire safe assembly

### **4.0401.3c General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any existing insulation or vapor barrier materials and protrusions from installation area

### **Objective**

Prevent condensation, uninterrupted installation area

### **4.0401.3d Batt installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install rigid insulation to prescribed R-value in every joist bay in full contact with the rim/band joist air barrier and all sides of the cavity without gaps, voids, or misalignments

### **Objective**

Continuous and contiguous thermal boundary

### **4.0401.3e Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Seal each cavity airtight around the perimeter of the rigid insulation

### **Objective**

Prevent air and moisture movement in cavity

### **4.0401.3f Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

If foam is no more than 3 1/4" thick and the space is not permanently habitable no thermal barrier is required

If foam is thicker than 3 1/4", doesn't meet the flame and smoke index, or is of less than 0.5 lb/ft<sup>3</sup> density, or the space is permanently habitable, separate foam from the subspace with a suitable thermal barrier covering or coating as indicated in manufacturer's specifications and applicable building code

If code requirements are unclear, consult local code officials for clarification

### **Objective**

Minimize ignition and combustion potential

### **4.0401.3g Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0402.1 Closed Crawlspace - Non-Foam Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Walls

### **Desired Outcome**

Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0402.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e. gutters, flashing, grading, drainage)

### **Objective**

Ensure space can be safely insulated

#### **4.0402.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that:

has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723

is, or include a facing that is, a class II vapor retarder

is non-absorbent

### **Objective**

Select fire safe and moisture resistant materials

#### **4.0402.1c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials



meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **4.0402.1d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Ensure wall vapor retarder will lap underneath the ground vapor retarder connection to the foundation wall

Remove any incomplete or unsealed vapor barrier from the foundation wall

### **Objective**

Keep bulk water below vapor retarder and prevent condensation

### **4.0402.1e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install insulation to prescribed R-value in full contact with the foundation wall from ceiling to floor with vapor retarder facing the conditioned space

### **Objective**

Contiguous and continuous thermal barrier

### **4.0402.1f Attachment**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Mechanically attach insulation to foundation wall

**Objective**

Insulation remains in place

**4.0402.1g Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Seal all seams, joints, connections, etc. of insulation and vapor retarder layer with compatible sealant (i.e., tape, mastic, adhesive)

Seal ground vapor retarder to the insulation vapor retarder with the foundation vapor retarder lapped under the ground vapor retarder

**Objective**

Airtight insulation

**4.0402.1h Termite inspection gap**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

**Objective**

Allow for termite detection

**4.0402.1i Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0402.2 Closed Crawlspace - Rigid Foam Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Walls

### **Desired Outcome**

Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0402.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e. gutters, flashing, grading, drainage)

### **Objective**

Ensure space can be safely insulated

#### **4.0402.2b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select foam insulation that:

has a flame spread/smoke development index of 75/450 or less when tested in accordance with ASTM E 84 or UL 723

is, or include a facing that is, a class II vapor retarder

is non-absorbent

### **Objective**

Select fire safe and moisture resistant materials

#### **4.0402.2c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

### **Objective**

Select safe and effective sealants

### **4.0402.2d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Ensure wall vapor retarder will lap underneath the ground vapor retarder connection to the foundation wall

Remove any incomplete or unsealed vapor barrier from the foundation wall

### **Objective**

Keep bulk water below vapor retarder and prevent condensation

### **4.0402.2e Surface preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove any protrusions or impediments from the installation area that prevent full contact of insulation with foundation wall surface

### **Objective**

Properly bonded rigid foam installation

### **4.0402.2f Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install insulation to prescribed R-value in a continuous layer in full contact with the foundation wall from ceiling to floor

If installing multiple layers, offset seams by a minimum of 12" and seal the seams and joints of each layer before installing the next layer

**Objective**

Contiguous and continuous thermal barrier

**4.0402.2g Attachment**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Attach insulation with mechanical fasteners

**Objective**

Insulation remains in place

**4.0402.2h Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Seal all seams, joints, connections, etc. of insulation and vapor retarder layer with compatible sealant (i.e., tape, mastic, adhesive)

Seal ground vapor retarder to the insulation vapor retarder with the foundation vapor retarder lapped under the ground vapor retarder

**Objective**

Airtight and vapor controlled installation

**4.0402.2i Termite inspection gap**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

## **Objective**

Allow for termite detection

### **4.0402.2j Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications and the applicable building code

If space is used for storage or occupancy, foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

## **Objective**

Minimize ignition and combustion potential

### **4.0402.2k Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0402.4 Basements - Without Groundwater Leakage**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Walls

**Desired Outcome**

Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

**4.0402.4a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e., gutters, flashing, grading, drainage)

**Objective**

Ensure space can be safely insulated



#### **4.0402.4b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Select insulation that has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723 and is not water absorbent

##### **Objective**

Fire safe and hydrophobic insulation selected

#### **4.0402.4c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

##### **Objective**

Select safe and effective sealants

#### **4.0402.4d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Remove any incomplete or unsealed vapor barrier from the foundation wall

## **Objective**

Prevent condensation

### **4.0402.4e Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install insulation to prescribed R-value in full contact with the entire perimeter of foundation wall from ceiling to floor

If insulation has a vapor retarder on only one side install it facing the conditioned space

## **Objective**

Contiguous and continuous thermal barrier

### **4.0402.4f Attachment**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Attach rigid or batt insulation with mechanical fasteners

## **Objective**

Insulation remains in place

### **4.0402.4g Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Seal all seams, joints, connections, etc. of insulation on the conditioned side of the assembly, or install a sealed air barrier on the conditioned side of the insulation (e.g., drywall, luan)

## **Objective**

Continuous air barrier on heated side of assembly

#### **4.0402.4h Termite inspection gap**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

##### **Objective**

Allow for termite detection

#### **4.0402.4i Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

##### **Objective**

Minimize ignition and combustion potential

#### **4.0402.4j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

### **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **4.0402.5 Basements - With Groundwater Leakage**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Walls

### **Desired Outcome**

Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

### **4.0402.5a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e., gutters, flashing, grading, drainage)

### **Objective**

Ensure space can be safely insulated

### **4.0402.5b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Select insulation that has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723 and is not water absorbent

### **Objective**

Fire safe and hydrophobic insulation selected

### **4.0402.5c Drainage**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install a continuous drainage plane at the interior surface of the exterior basement wall or leave an airspace of at least 1/2" between insulated wall assembly and foundation wall from the top of the wall to a drainage field at the bottom of the wall or sub-slab that drains to outdoors

If foundation is rough (i.e., rubble, stone), install a waterproof membrane to which insulation will adhere

### **Objective**

Remove bulk moisture from interior surface of basement wall

### **4.0402.5d Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install insulation to prescribed R-value in a continuous boundary around the entire perimeter of foundation wall from top of band joist to floor, in contact with any waterproof membrane that exists at the foundation wall

### **Objective**

Contiguous and continuous thermal barrier

### **4.0402.5e Termite inspection gap**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood and if subslab drainage is installed, termite treatment will be performed

### **Objective**

Allow for termite detection

### **4.0402.5f Attachment**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Attach rigid or batt insulation with mechanical fasteners or other means that has a minimum service life of 20 years

### **Objective**

Insulation remains in place

### **4.0402.5g Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Install a continuous air barrier between the foundation and the interior of the basement that spans from the slab to the subfloor above

Seal all seams, joints, connections, etc. of insulation on the conditioned side or create an airtight wall assembly on the conditioned side of the insulation

## **Objective**

Continuous air barrier on heated side of assembly

### **4.0402.5h Ignition and thermal barriers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

## **Objective**

Minimize ignition and combustion potential

### **4.0402.5i Vapor retarders**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Do not install a vapor retarder layer on either side of the wall (e.g., vinyl wallpaper, polyethylene, latex paint)

## **Objective**

Allow wall to dry to the interior

### **4.0402.5j Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

### **4.0403.1 Raised and On-Grade Slab Edge Insulation**

**Section:** Insulation

**Topic:** Conditioned Subspaces

**SubTopic:** Slabs

## **Desired Outcome**

Durable, pest-resistant, thermal break between the slab edge and outdoors

### **4.0403.1a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Verify all bulk sources of moisture have been directed away from the slab (i.e., gutters, flashing, grading, drainage)

Wall sill plate and slab edge penetration air sealing is completed

No active pest intrusions exist

## **Objective**



Ensure space can be safely insulated

#### **4.0403.1b Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Select insulation that is rated for ground contact and is a class I vapor retarder

##### **Objective**

Durable insulation selected

#### **4.0403.1c Sealant selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

##### **Objective**

Select safe and effective sealants

#### **4.0403.1d General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

##### **Specification**

Prepare slab edge to receive insulation and/or sealing materials per manufacturer specifications

**Objective**

Surface ready for insulation and sealant

**4.0403.1e Excavation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Excavate slab edge to prescribed depth and width for installation while avoiding undermining slab footing or damaging underground utilities or drainage

Protect excavation from weather until restored to original condition (e.g., density, drainage function)

**Objective**

Provide installation access and protect slab and utilities from damage

**4.0403.1f Installation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install insulation to prescribed R-value in contact with the slab edge, without voids, compressions, or misalignments and tight to any utilities penetrating the slab edge insulation

**Objective**

Continuous and contiguous thermal boundary

**4.0403.1g Flashing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Install continuous and permanent flashing to direct water away from the foundation and slab edge insulation

**Objective**

Direct bulk moisture away from slab insulation

**4.0403.1h Protective covering**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Cover exposed insulation with a durable, rigid, and pest-resistant material

**Objective**

Protect insulation from weather and impact

**4.0403.1i Sealing and pest protection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Seal all slab edge penetrations using a compatible sealant

Stuff any gaps 1/4" or greater with copper or stainless steel mesh prior to sealant application

**Objective**

Airtight and pest-resistant slab edge

**4.0403.1j Termites**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Preserve existing termite treatment and inspection gaps as required by applicable codes

## **Objective**

Prevent pest entry and maintain applicable warranties

### **4.0403.1k Back fill**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Restore excavated earth and grade to drain bulk moisture away from foundation

## **Objective**

Preserve the drainage plane of the slab edge

### **4.0403.1l Insulation - onsite documentation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

## **Specification**

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **5 – Heating and Cooling**

### **5.01 – Forced Air**

#### **5.0101.1 Thermostat Replacement**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Controls

**Desired Outcome**

Properly functioning and more efficient system

#### **5.0101.1a Pre-Work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Verify that sufficient number of thermostat wires is available to meet the needs of the replacement unit and the existing system

##### **Objective**

Sufficient wiring exists

#### **5.0101.1b Thermostat selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Select a double-setback programmable thermostat that allows for full functionality of the installed system (supplementary heat, emergency heat, fan only, ventilation control, etc.)

##### **Objective**

Versatile programmable thermostat that correctly matches system

#### **5.0101.1c Thermostat location**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

##### **Specification**

Install thermostat where it accurately reflects the temperature and humidity of the zone which it controls (i.e., not exposed to extreme temperatures, radiant heat sources, warm/cold walls, or drafts)

##### **Objective**

Temperature and humidity measurements accurate for space controlled

### **5.0101.1d Heat pump considerations**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Connect supplementary heat to second-stage heating terminal in accordance with manufacturer specifications

Install and connect outdoor temperature sensor that is compatible with the thermostat in accordance with manufacturer specifications

Calculate and select an optimum thermal balance point for supplementary heat operation in accordance with ANSI/ACCA Manual S and manufacturer specifications

#### **Objective**

Prevent supplementary heat operation when heat pump can meet heating load

### **5.0101.1e Installer programming**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Program the thermostat to match the equipment and control board settings per manufacturer specifications

Set time delay for fan start in accordance with manufacturer specifications and as appropriate for the climate zone (e.g., no time delay for hot humid climates, longer time delay for cold climates)

Program the thermostat setbacks to a schedule that accommodates the occupant and reduces overall run time

#### **Objective**

Thermostat setup to operate existing system correctly

### **5.0101.1f Penetrations**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Seal penetrations for control wiring with a durable sealant (e.g., caulk, silicone) that complies with applicable fire safety code

#### **Objective**

Minimize air leakage, prevent pest intrusion, increase temperature measurement accuracy

### **5.0101.1g Documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Provide occupants/owners with user's manual, warranty information, installation instructions and installer contact information

#### **Objective**

Control instructions available for occupant and installer

## **5.0102.1 Condensate Removal**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Condensate

#### **Desired Outcome**

Remove appliance condensation from building and prevent damage to structure

### **5.0102.1a Condensate disposal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Convey all condensate from all cooling coils, condensing furnaces, etc. to the exterior of the building

Condensate from condensing furnaces must first pass through a neutralizer if using waste lines for disposal

### **Objective**

Condensate safely drained to exterior

### **5.0102.1b Connections**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Seal all piping that conveys condensate

### **Objective**

Leak free condensate piping

### **5.0102.1c Slope**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install condensate piping with not less than 1/8" per foot (1% slope) towards the termination point

### **Objective**

Condensate drains toward termination

### **5.0102.1d Vents and traps**



Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install vents and traps on condensate drain lines in accordance with manufacturer specifications and applicable building code and in a manner that allows for cleaning of condensate lines without cutting the existing pipe

### **Objective**

Condensate drain operates as intended

### **5.0102.1e Secondary drain pan**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install a secondary drain pan under all condensing appliances installed in or above conditioned space and where water damage may occur to the structure

Install an independent condensate drain for the secondary drain pan that drains to a visible termination location

Slope drain pan towards the condensate drain

### **Objective**

Prevent water damage to dwelling

### **5.0102.1f Float switches**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install a float switch in the primary and secondary drain pan that is interlocked with the system power circuit and will break the circuit when drainage fails to remove condensate

## **Objective**

Stop system operation if condensate is not draining

### **5.0102.1g Insulation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

## **Objective**

Prevent freezing and condensation on pipes

### **5.0102.1h Pumps**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

Install condensate drain pumps when condensate cannot be drained by gravity

## **Objective**

Convey condensate to exterior without gravity assistance

### **5.0102.1i Exterior termination**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

## **Specification**

If termination of condensate drain is to the outdoors, direct it downwards with an elbow fitting at the end of the exterior termination

## **Objective**

Condensate drains to exterior and away from building

## **5.0103.1 Refrigerant Lines**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Refrigerant Loop

### **Desired Outcome**

Leak free, safe, efficient, effective, and compliant refrigerant line installation

### **5.0103.1a Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Select only manufacturer and code approved (e.g., IRC, IMC) refrigerant lines, fittings, etc.

#### **Objective**

Choose safe and compliant materials

### **5.0103.1b Sizing**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Size refrigerant lines in accordance with manufacturer specifications for the installed equipment

#### **Objective**

Piping moves appropriate volume of refrigerant without increasing compressor load

### **5.0103.1c Installation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Install refrigerant lines without kinks, crimps, or excessive bends

Route lines in a manner that protects it from damage by workers and occupants

Join lines using manufacturer-approved method(s)

Install proper filter dryer(s) on all systems

Install P-traps on suction line risers that are greater than 10' in height

Use manufacturer specifications to determine appropriate lengths and elevations of refrigerant lines between condensing units and indoor coils

### **Objective**

Durable, safe piping that moves appropriate volume of refrigerant and protects compressor functionality

### **5.0103.1d Insulation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Insulate all suction lines to a minimum of R-4 with an insulation that is a class II or better vapor retarder

Insulate all high pressure lines that pass through spaces where condensation may occur to a minimum of R-4 with an insulation that is a class II or better vapor retarder

Seal all seams, joints, etc. of insulation using compatible material (e.g., tape)

Install UV-resistant insulation on exterior lines or protected insulation from UV degradation

### **Objective**

Prevent excessive heat gain, condensation and UV degradation

### **5.0103.1e Support**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Secure and support refrigerant lines according to applicable code and in a manner that protects the line from damage by workers or occupants

#### **Objective**

Prevent excessive line movement

### **5.0103.1f Protection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

If refrigerant lines are installed where they may be contacted by vehicles, people, tree limbs, etc., install a rigid sleeve or pipe duct over them that provides adequate impact protection

#### **Objective**

Lines protected from impact damage

### **5.0103.1g Locking refrigerant caps**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

#### **Specification**

Install locking refrigerant caps on all refrigerant access ports

#### **Objective**

Protect occupants and the environment from unintentional refrigerant discharge or theft

## **5.0103.2 Refrigerant Charge**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Refrigerant Loop

### **Desired Outcome**

Properly charged system

### **5.0103.2a Pre-work qualifications**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Before adjusting refrigerant to system verify that:

system is leak free

air flow of system is correct

indoor and outdoor temperatures are within allowable range for refrigerant charge testing

### **Objective**

Prevent inaccurate refrigerant charging

### **5.0103.2b Charge**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Base refrigerant charge on manufacturer specifications for the equipment being serviced

Weigh in calculated refrigerant charge if outdoor conditions prevent accurate pressure measurements according to manufacturer specifications

### **Objective**

Accurate refrigerant charge

### **5.0103.2c Documentation**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Provide occupant/owner with refrigerant charge documentation according to ANSI/ACCA Standard 5 (HVAC Quality Installation)

### **Objective**

Provide occupant and service technicians with previous refrigerant charge information

## **5.0103.3 Thermostatic Expansion Valve (TXV)**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Refrigerant Loop

### **Desired Outcome**

Ensure thermostatic expansion valve (TXV) operates as designed

### **5.0103.3a Material selection**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

### **Specification**

Select properly sized and configured TXV based on manufacturer specifications

**Objective**

Select efficient and compatible components

**5.0103.3b Replacement**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install in compliance with manufacturer specifications

**Objective**

Safe and efficient system operation

**5.0104.1 New Duct Components**

**Section:** Heating and Cooling

**Topic:** Forced Air

**SubTopic:** Duct Installation

**Desired Outcome**

Efficient, quiet, and optimal air flow, provided through safe, durable, and sealed ducts that do not have visible air leakage @ 25 pascals

**5.0104.1a Material selection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

**Specification**

Select insulation:

with a flame spread and smoke development index of 25/50 when tested in accordance with ASTM E84 or UL 723 and that includes an exterior vapor retarder layer



Select duct materials:

with a flame spread of no more than 25 when tested in accordance with ASTM E84 or UL 723 and that are UL 181, SMACNA, NAIMA approved or conform to ASTM A653

### **Objective**

Select durable and safe materials

### **5.0104.1b General preparation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Remove all old ductwork and duct insulation from the premises

### **Objective**

Old duct materials disposed of off premises

### **5.0104.1c Duct design**

Housing Types: Single Family Site-Built Housing

### **Specification**

Design residential duct systems using friction charts and ANSI/ACCA Manual D (Residential Duct Systems) or equivalents

Do not use building cavities as ductwork under any situation

Route ducts so that standard service and repair to the building and its systems does not damage the ducts

### **Objective**

Maximize air flow

### **5.0104.1c Duct design**

Housing Types: Multifamily Housing

## **Specification**

Design residential duct systems using friction charts, ANSI/ACCA Manual D (Residential Duct Systems), or ASHRAE equivalents

Design commercial duct systems using ANSI/ACCA Manual Q (Low Pressure, Low Velocity Duct System Design), or ASHRAE equivalents

Do not use building cavities as ductwork under any situation

Route ducts so that standard service and repair to the building and its systems does not damage the ducts

## **Objective**

Maximize air flow and safeguard indoor air quality

### **5.0104.1d Termination design**

Housing Types: Single Family Site-Built Housing

## **Specification**

Design supply terminations to be capable of delivering air with the proper speed and throw to cover the entire space they serve and that do not produce noticeable flow noise when system is operating at full speed

Design return grille gross area to be equal to or larger than return box

## **Objective**

Appropriate level of air mixing, air flow, and occupant comfort

### **5.0104.1d Termination design**

Housing Types: Multifamily Housing

## **Specification**

Design terminations using ANSI/ACCA Manual T (Air Distribution Basics)

Terminations must be capable of delivering air with proper speed and throw of 80-120% of the farthest wall, floor, or ceiling they serve, and must have a noise level less than 30 decibels

Return grille gross area will be equal to or larger than return box

### **Objective**

Appropriate level of air mixing, air flow, and occupant comfort

### **5.0104.1e Protection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

During renovation or construction, block registers, grilles, and diffusers with a durable material

Do not use duct system until construction is finished

### **Objective**

Protect equipment and ducts from damage and debris collection

### **5.0104.1f Exterior duct construction**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

For exterior ducts (i.e., exposed to outdoors), use duct material that meets the following criteria:

insulation level of R-12 or greater

includes a weatherproof barrier that is resistant to ultraviolet light damage

will not be damaged by weather

### **Objective**

Prevent condensation, reduce thermal loss or gain, protected from elements

### **5.0104.1g Plenums**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

When a 90 degree turn is required in the plenum, use radius elbow fittings or square fittings with turning vanes

Supply plenum must be the same size or larger than the air handler supply opening

If equipment is installed on top of the return plenum, plenum platform must independently support the weight of the equipment

#### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1h Reducers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install reducers between sections of different size ducts in accordance with existing standards based on duct material (e.g., SMACNA, NAIMA)

#### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1i Supply branches**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install runs as short as possible

#### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1j Take-offs**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install take-offs onto the trunk in accordance with duct construction standards (SMACNA)

Install take-offs using mechanical fasteners for all applications

Take-offs that create high turbulence will not be used (e.g., elbows with integrated dampers, scoops)

#### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1k Flexible ducts**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install flexible duct as straight as possible and fully stretched without unnecessary sagging, crimping, or bends

Do not bend flexible duct more than 45 degrees without using a rigid elbow

Use a rigid connector when joining two pieces of flexible duct together

#### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1l Boots**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Use boots with a directional collar (e.g., 45 degree elbow) whenever ducting turns directly after the boot connection

If using straight boots, connect an elbow to the boot before connecting the duct

Do not connect flexible duct directly to a straight boot if it turns more than 15 degrees within 6' of boot connection

### **Objective**

Minimize static pressure and maximize air flow

### **5.0104.1m Fire protection**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install fire dampers and ductwork in accordance with applicable fire code

Install smoke alarms inside duct plenums that convey more than 2500 cfm

Seal ductwork penetrations through fire rated surfaces according to applicable code requirements for the surface

### **Objective**

Meet applicable fire code and provide functional smoke detection

### **5.0104.1n Air filtration**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Install accessible filter grills that have no air bypass around the filters

Install filter slot covers to prevent return air leakage

Avoid filters with high static pressure drop unless system is designed for them

### **Objective**

Protect equipment from dirt and debris and allow proper airflow

### **5.0104.1o Room pressure balancing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Room-to-room pressure differences shall not exceed 3 pascals with the air handler running

Install appropriate means of pressure balancing if necessary (e.g., transfer grilles, jumper ducts, individual room returns)

### **Objective**

Unrestricted air flow, minimize shell leakage caused by duct system, prevent interference with combustion appliance function

### **5.0104.1p Sealing**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Seal all ducts in accordance with SWS Subtopic "Duct Sealing"

Seal ductwork penetrations through interior walls with a durable and compatible sealant (e.g., caulk, silicone)

### **Objective**

Visibly sealed ducts and penetrations

### **5.0104.1q Fastening**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

### **Specification**

Fasten duct connections in accordance with SWS detail "Duct Repair: Mechanical Fastening"

### **Objective**

Durable duct connection

### **5.0104.1r Support**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Support ducts in accordance with SWS detail "Duct Repair: Duct Support"

#### **Objective**

Durably supported ducts

### **5.0104.1s Insulation**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Insulated ducts in accordance with SWS Detail "General Duct Insulation"

#### **Objective**

Properly insulated and condensation resistant ducts

### **5.0104.1t Manual volume dampers**

Housing Types: Single Family Site-Built Housing, Multifamily Housing

#### **Specification**

Install dampers as close to the trunk as possible and in accessible locations to the fullest extent possible

#### **Objective**

Volume dampers are accessible after interior finishes are installed

## **5.0105.1 Mechanical Fastening**

**Section:** Heating and Cooling

**Topic:** Forced Air



**SubTopic:** Duct Repair

**Desired Outcome**

Ducts securely fastened

**5.0105.1a Metal to metal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Fasten ducts with a minimum of three equally spaced galvanized or stainless steel mechanical fasteners

**Objective**

Durable joints

**5.0105.1b Flex to metal**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Fasten ducts with UL 181 approved tie bands using a tie band tensioning tool

**Objective**

Durable and sealed joints

**5.0105.1c Flex to flex**

Housing Types: Single Family Site-Built Housing, Manufactured Housing, Multifamily Housing

**Specification**

Install a rigid metal coupling of the same size as the flex duct between the two sections