

Kansas SWS Field Guide Version 2018.1



Standard Work Specifications

Field Guide for

Single-Family Homes

created by

Kansas Housing Resources Corporation and the Kansas Weatherization Network



2 Health and Safety

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2.0100.1 - Global Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0100.1e - Carbon monoxide (CO)

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

All homes will have a carbon monoxide alarm

Ambient CO will be monitored during combustion testing and testing will be discontinued if ambient CO level inside the home or work space exceeds 35 parts per million (ppm)

Objective(s):

Protect worker and occupant health



STOP WORK if CO levels are higher than 35ppm!!

Tools:

1. CO meter

Install carbon monoxide alarms

2.0100.1 - Global Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0100.1g - Confined space safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Spaces with limited ingress and egress and restricted work area will be considered confined space

Access and egress points will be located before beginning work

Inspection will be conducted for hazards, such as damaged or exposed electrical conductors, mold, sewage effluent, friable asbestos or fiberglass, pests, and other potential hazards

Adequate ventilation will be provided

Use of toxic material will be reduced

Objective(s):

Prevent build-up of toxic or flammable contaminants

Reduce risk to the workers in the confined space

Provide adequate access and egress points

Prevent electrical shock



🖬 After

Locate all access and egress points of confined spaces before entering



Perform visual inspection of confined spaces before beginning work



Check for frayed or worn electrical wires



In confined spaces, use a ventilator



Check GHS labels and Safety Data Sheets for all materials to minimize hazards

2.0100.1 - Global Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0100.1p - Lead paint assessment

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Presence of lead based paint in pre-1978 homes will be assumed unless testing confirms otherwise

The Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect workers and occupants from potential lead hazards

Follow all applicable KDHE requirements.

2.0102.1 - Insulation Worker Safety

Desired Outcome:

Work is completed safely without injury or hazardous exposure

2.0102.1b - Asbestos containing materials (ACM)

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

OSHA asbestos abatement protocol 29 CFR 1926.1101 will be followed if vermiculite insulation is present

Assess potential asbestos hazard; if unsure whether material contains asbestos, contact a qualified asbestos professional to assess the material, and to sample and test as needed

If suspected ACM is in good condition, do not disturb

If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart), immediately isolate the area(s)

For suspected ACM that is damaged or that must be disturbed as part of the retrofit activity, contact an asbestos professional for abatement or repair, in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, or remove ACM

When working around ACM, do not:

- Dust, sweep, or vacuum ACM debris
- Saw, sand, scrape, or drill holes in the material
- · Use abrasive pads or brushes to strip materials

Asbestos abatement or repair work should be completed prior to blower door testing; exercise appropriate caution when conducting blower door testing where friable asbestos or vermiculite attic insulation is present to avoid drawing asbestos fibers into the living space (i.e., use positively pressurized blower door testing) unless the material has been tested and found not to contain asbestos

Objective(s):

Protect workers and occupants from potential asbestos hazards



If materials that may contain asbestos are found in the home, do not disturb the material



If asbestos is suspected, call an EPAaccredited professional.

Materials:

- 1. Containment shroud
- 2. Caution tape

or run the blower door

See the Health and Safety Plan for additional information.



Do not disturb ACM by drilling, sanding, scraping, sawing, etc.



Do not disturb ACM by vacuuming, dusting, or sweeping

2.0102.1 - Insulation Worker Safety

Desired Outcome:

Work is completed safely without injury or hazardous exposure

2.0102.1c - Materials

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

All materials will be handled in accordance with manufacturer specifications or material safety data sheets (MSDS) standards

Objective(s):

Eliminate hazards associated with incorrect, defective, or improperly used or installed materials



New Safety Data Sheet and GHS label formatting is easier to quickly interpret

2.0103.1 - Combustion Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

2.0103.1c - Raw fuel

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Raw fuel leaks will be monitored for before entering building spaces

If leaks are found, testing will be discontinued and condition reported to occupant immediately

Objective(s):

Protect worker and occupant health



Fuel leaks need to be repaired by appropriate professional

Tools:

- 1. Gas sniffer
- 2. Bubble solution



Notify occupant of any leaks



Check all raw fuel lines for leaks



Use multiple methods to test for leakage--bubble solution



If bubbles develop, leak is present. Notify occupant



Any leaks found should be reported to occupant and work stopped



Any leaks found should be reported to occupant and work stopped

2.0103.2 - Heating and Cooling Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

2.0103.2b - Mercury

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

When replacing existing thermostats, identify and dispose of any mercury containing thermostats in accordance with Environmental Protection Agency (EPA) guidance

Objective(s):

Protect worker and occupant from mercury exposure





Mercury thermostats should be replaced and disposed of properly

Do NOT dispose of mercury thermostats in the trash--find local recycling

Paraphrased from 40 CFR 273.14: A universal waste mercury-containing thermostat or container containing only universal waste mercury-containing thermostats should be labeled or marked clearly with any of the following phrases: "Universal Waste-Mercury Thermostat(s)," "Waste Mercury Thermostat(s)," or "Used Mercury Thermostat(s)." **Contact thermostat-recycle.org or earth911.orgfor recycling options.

2.0103.2 - Heating and Cooling Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

2.0103.2c - Asbestos

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Suspected asbestos hazards will be identified in furnaces (e.g., gaskets), wood stoves, zonal heating devices, electrical wiring insulation, boilers, and pipe insulation and corrected in accordance with EPA guidance

Workers will take precautionary measures to avoid exposure

Objective(s):

Protect worker and occupant from asbestos exposure



Unsafe

Suspicious pipe insulation may contain asbestos



When asbestos is suspected, call in EPAaccredited professionals.

Refer to Kansas Health and Safety Plan for asbestos guidance. If vermiculite is found, refer to the Procedure Manual for guidance.

2.0103.2 - Heating and Cooling Worker Safety

Desired Outcome:

Work completed safely without injury or hazardous exposure

2.0103.2d - Personal protective equipment (PPE)

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Workers will wear personal protective equipment (PPE) as needed to protect themselves against exposure to hazards (e.g., pests, sewage, flooded duct work, mold, chemicals, scat, viruses)

Long sleeves and long pants should be worn as additional protection from liquid nitrogen and other hazardous materials

Objective(s):

Protect worker from exposure to hazards

Protect worker from skin contact with liquid nitrogen



Unsafe

When working with refrigerants, short sleeves are inappropriate



Safe

Workers should dress appropriately for working with refrigerant and be aware of any addition risks in their surroundings

Desired Outcome:

Site properly prepared for upgrade

2.0107.2c - Mold

Desired Outcome: Site properly prepared for upgrade

Specification(s): Appropriate remediation will be completed before upgrade

Objective(s): Ensure site is safe and ready for upgrade

Refer to the Heath and Safety Plan for additional information.

Desired Outcome:

Site properly prepared for upgrade

2.0107.2d - Plumbing and water leaks

Desired Outcome:

Site properly prepared for upgrade

Specification(s):

Plumbing leaks will be repaired before crawl space upgrade in accordance with the IRC

Objective(s):

Prepare site for upgrade

Refer to the Health and Safety Plan for additional information.

Desired Outcome:

Site properly prepared for upgrade

2.0107.2e - Pest and termite work

Desired Outcome:

Site properly prepared for upgrade

Specification(s):

Pest and termite treatment will be completed before crawl space upgrade and inspected in accordance with the IRC

Objective(s):

Prepare site for upgrade

Refer to the Health and Safety Plan for additional information.

Inspectors should be attentive to evidence of pests and termites. If conditions warrant, review the Health and Safety Policy for pest control options, and/or notify the client of required action steps prior to weatherization.

Desired Outcome:

Site properly prepared for upgrade

2.0107.2i - Non-correctable standing water

Desired Outcome:

Site properly prepared for upgrade

Specification(s):

Spaces with non-correctable standing water will not be considered for a closed crawl space

Objective(s):

Prevent possible damage to house

Measures will not be installed where standing water is present. Refer to the Health & Safety policy for additional information.

2.0107.3 - Basements and Crawl Spaces—Debris Removal

Desired Outcome:

Clean, safe, and easily accessible crawl space created

2.0107.3a - Debris removal

Desired Outcome:

Clean, safe, and easily accessible crawl space created

Specification(s):

Under-floor grade will be removed of all vegetation and organic material, as necessary and feasible.

Debris that can cause injury or puncture ground covers (e.g., nails, glass, sheet metal screws, etc.) will be removed from the crawl space

Objective(s):

Minimize punctures in ground liner

Minimize habitat for pests (Integrated Pest Management-IPM) and contaminant sources



Crawl spaces with trash and overgrowth need to be made clean and safe.



Rake up and clear away trash and overgrowth.

Tools:

- 1. Rake
- 2. Shop vacuum
- 3. PPE

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.1b - Fuel leak detection

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Inspect and test for gas or oil leakage at connections of natural gas, propane piping, or oil systems

If leaks are found, immediate action will be taken to notify occupant to help ensure leaks are repaired

The report will specify repair for leaks and replacement for hazardous or damaged gas or oil connectors and pipes

Objective(s):

Detect fuel gas leaks

Determine and report need for repair



Fuel lines should be inspected for leakage

Tools:

- 1. Gas sniffer
- 2. Spray bottle



If leaks are found, notify occupant immediately to facilitate repair

Materials:

1. Bubble solution



Inspect exterior gas and oil lines for leaks and damage



Inspect flex lines for damage, and check date on ring for pre-1973 hardware

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.1c - Venting

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

For oil systems that require a draft regulator, the presence and operability of it (that draft regulator) will be verified and tested

Combustion venting systems will be inspected for damage, leaks, disconnections, inadequate slope, and other safety hazards

Objective(s):

Determine if a regulator is present and working

Determine whether vent system is in good condition and installed properly



If vent system puts occupants at risk, it needs immediate attention



Properly vented appliances make a house healthier and more efficient

Refer to Local Codes for additional information. Adequate slope is generally a 1/4 inch per foot or greater. Inspect for proper flue clearance to combustibles. B-vent is typically 1 inch minimum clearance, single wall is typically 6 inches minimum clearance.



Determine if a draft regulator is installed and working



Inspect vent systems for damage



Inspect vent systems for disconnected pipes



Inspect vent systems for inadequate slope



Inspect for missing draft diverter

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.1d - Base pressure test

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Baseline pressure for naturally drafting vented appliances will be measured in Combustion Appliance Zone with reference to outdoors

Objective(s):

Measure pressure difference between combustion zone and the outside under natural conditions



Natural conditions--Winter set-up, Exhaust fans off, Interior doors open

Tools:

1. Manometer

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.1e - Depressurization test

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

CAZ depressurization testing will be administered for all atmospherically vented appliances located inside the pressure boundary.

Depressurization test will include exhaust fans, interior door closure, or duct leakage, or a combination thereof; the test will be done to determine the largest negative pressure per BPI Standard 1200.

Objective(s):

Determine worst-case depressurization in combustion zone due mechanical system fans



Exhaust fans on, Check interior doors, Air handler on?

Tools:

1. Manometer



Place manometer reference hose to exterior of house



Attach test hose to be used in the interior of the house



Place test hose by combustion appliance



Take baseline reading



Turn on interior exhaust fans, including any clothes dryers



Is the air handler on?



Check interior doors for pressure differential either using smoke pencil or hand



Conduct spillage and draft test under worst case CAZ depressurization

2.0201.2 - Combustion Safety - Make-up Air

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0201.2a - Outside combustion make-up air

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Where applicable, combustion air will be provided from the outside and installed in accordance with the IRC for the type of appliance installed

Objective(s):

Prevent combustion byproducts from entering the house

Image 1: For homes with one permanent opening, see 2012 IRC: G2407.6.2 (304.6.2): a minimum free area of 1 in2 per 3,000 Btu/h (734 mm2/kW) of total input rating of all appliances

Image 2: For homes with two permanent vertical duct openings, see 2012 IRC G2407.6.1 (304.6.1): a minimum free area of 1 in2 per 4,000 Btu/h (550 mm2/kW) of total input rating of all appliances

Image 3: For homes with two permanent horizontal duct openings, see 2012 IRC G2407.6.1 (304.6.1): a minimum free area of 1 in2 per 2,000 Btu/h (1,100 mm2/kW) of total input rating of all appliances.

The preference is to draw combustion air from the conditioned area of the dwelling where applicable and allowed by local code.

See Subrecipient Procedures Manual.



min free area of 1 sqin per 3,000 Btu/h (734 mm2/kW) of total input rating





min free area of 1 sqin per 4,000 Btu/ h (550 mm2/kW) of total input rating min free area of 1 sqin per 2,000 Btu/h (1100 mm2/kW) of total input rating

2.0201.2 - Combustion Safety - Make-up Air

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0201.2d - Gas ovens

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Gas ovens will be tested for CO

A clean and tune will be conducted if measured CO in the undiluted flue gases of the oven vent at steady state exceeds 450 ppm air-free.

Objective(s):

Ensure clean burn of gas ovens



If air-free CO reading exceeds 450 ppm, order a clean and tune



Test gas oven for carbon monoxide using a combustion gas analyzer

Clients will be notified if units do not improve after a clean and tune. Client education will be provided on how to minimize CO exposure such as running exhaust fans or opening a window. A CO alarm will be installed in the kitchen if the post clean and tune CO exceeds 450 ppm air-free.
2.0201.2 - Combustion Safety - Make-up Air

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0201.2e - Gas range burners

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Specify clean and tune if the flame has any discoloration, flame impingement, an irregular pattern, or if burners are visibly dirty, corroded, or bent

Objective(s):

Ensure clean burn and operation of gas range burners



Discoloration is a clear sign that a gas range needs a clean and tune



A properly operating gas range burner should have an even blue flame

CO measurement is not required. Action is based on a visual inspection only.



Gas ranges should be cleaned and tuned if improper operation is evident

2.0201.3 - Vented Combustion Appliance Safety Testing

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.3a - Spillage Test

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

In conditions with largest negative pressure as determined from Detail 2.0201.1e:

If spillage in a combustion appliance with a warm vent exceeds two minutes during pressure testing, specify measures to mitigate

If spillage in a combustion appliance with a cold vent exceeds five minutes during pressure testing, specify measures to mitigate. KANSAS will use 2 minutes.

Objective(s):

Detect excessive spillage of combustion gases





Test all sides of natural draft flues since draft may not be uniform

Test natural draft furnace or water heater for spillage in excess of 2min

Tools:

- 1. Smoke pencil
- 2. Timer

A cold vent pertains to an appliance for which the heat setting is turned to OFF. Warm vent pertains

KHRC Kansas Housing Resources Corporation and the Kansas Weatherization Network to an appliance for which the heat setting is turned to ON. Kansas will limit spillage to two minutes for either a warm or a cold vent.

2.0201.3 - Vented Combustion Appliance Safety Testing

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.3b - Carbon monoxide (CO) test in appliance vent

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

CO will be tested for in undiluted flue gases of combustion appliances

In conditions with largest negative pressure as determined from Detail 2.0201.1e:

If CO levels exceed 400 ppm air-free measurement in furnaces, service will be provided to reduce CO to below these levels (unless CO measurement is within manufacturer specifications)

If CO levels exceed 200 ppm air-free measurement in water heaters or room heaters, service will be provided to reduce CO to below these levels (unless CO measurement is within manufacturer specifications)

Objective(s):

Measure CO and report excessive levels



CO levels cannot exceed 400ppm air free, unless to manufacturer specs



Best Practice

Test CO levels in undiluted flue gases and exhaust outlets, when accessible

Health and Safety > Combustion Safety > Combustion Safety 2.0201.3b - Carbon monoxide (CO) test in appliance vent

Tools:

1. Combustion analyzer with probe

Note the air free measurement requirement. Verify that the selected monoxor setting displays air free measurement.



CO levels cannot exceed 400ppm airfree CO



Test undiluted flue gases in induceddraft furnaces--check local codes before drilling



Test undiluted flue gases in natural draft water heaters--check local codes before drilling



Test accessible exhaust outlets for direct-vent appliances



Test accessible exhaust outlets for power-vented appliances

2.0201.3 - Vented Combustion Appliance Safety Testing

Desired Outcome:

Accurate information about appliance safe operation is gathered

2.0201.3c - Final test out

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Final combustion testing will be conducted at project completion to ensure compliance with the above specifications

Objective(s):

Ensure safe operation of combustion appliance within the whole house system after any repair project



Conduct spillage testing at the end of the work day

Tools:

- 1. Manometer
- 2. Smoke pencil
- 3. Timer
- 4. Combustion analyzer with probe

Best practice is to do daily test out after air sealing measure installations. HVAC work must be completed before air sealing measures to minimize risk. Potential depressurization and drafting issues shall be identified and corrected before air sealing measures.



Set up CAZ under worst case depressurization



Complete spillage test using chemical Test for spillage on all sides of draft smoke pencil



diverter



Complete spillage testing on all combustion appliances

2.0203.2 - Combustion Flue Gas—Orphaned Water Heaters

Desired Outcome:

Flue gasses successfully removed from the house

2.0203.2b - Flue gas removal (chimney liner or approved methods)

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

A chimney liner will be installed in accordance with the IRC or applicable NFPA standard

Objective(s):

Allow water heater to vent properly

Prevent damage to the chimney







Flue liner with rain cap

Tools:

- 1. Hammer drill
- 2. Disposable brushes
- 3. Tin snips
- 4. 5/16" nut driver
- 5. Pulling cone
- 6. Rope
- 7. Caulking gun
- 8. Tape measure
- 9. 4 1/2" angle grinder with metal cutoff wheel

Materials:

- 1. Flexible chimney liner
- 2. Rain cap
- 3. Top plate
- 4. B-vent adjustable elbows
- 5. Tees (if required to connect multiple appliances)
- 6. Refractory cement
- 7. Bricks
- 8. Mortar

Connect chimney liner to appliance in accordance with applicable codes.

Flue liners should be galvanized-steel vent pipe, stainless steel pipe, Type B-vent, or a flexible metal liner and sized appropriately. A liner used to vent solid fuel may not also be used to vent liquid or gaseous fuel.

See Subrecipient Procedure Manual for additional information.



Measure from the bottom termination to the chimney crown. Add one foot to the measurement and cut the liner to length



Pull chimney liner into position (from top or bottom, whichever is easier) with a rope and pulling cone



Measure and mark the flexible chimney liner at 4 inches above the chimney



Health and Safety > Combustion Safety > Vented Gas Appliances

Cut the flexible chimney liner to length

Install top plate over opening and attach it to the liner

Fasten the rain cap to the chimney liner



Seal around penetrations in chimney with refractory (furnace) cement



Connect appliance vent to the chimney liner



Use refractory (furnace) cement to seal metal water heater or furnace vents to the masonry chimney

2.0203.2 - Combustion Flue Gas—Orphaned Water Heaters

Desired Outcome:

Flue gasses successfully removed from the house

2.0203.2d - Required combustion air

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

The minimum required volume will be 50 cubic feet per 1,000 Btu /h in accordance with IRC and authority having jurisdiction.

Exception: Existing appliances that have passed combustion safety testing per BPI 1200 are deemed to have sufficient combustion air.

Objective(s):

Determine if existing conditions meet the combustion air calculation



If measured volume is less than 50cuft per 1000Btuh, additional combustion air is needed.



If appliances have passed combustion safety testing per BPI 1200, no additional combustion air is needed.

Tools:

- 1. Measuring tape
- 2. Calculator

Where applicable, combustion air will be provided from the inside and installed in accordance with IRC for the type of appliance installed.

KHRC Kansas Housing Resources Corporation and the Kansas Weatherization Network

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Measure the CAZ width.

Measure the CAZ length.

Measure the CAZ height.

2.0203.4 - Occupant Education

Desired Outcome:

Ensure persistence of resident safety

2.0203.4a - Occupant health and safety

Desired Outcome: Ensure persistence of resident safety

Specification(s):

All homes will have a functioning CO alarm

If CO levels in interior living spaces exceed outdoor levels, potential sources will be investigated and appropriate action taken to reduce them (e.g., have a qualified professional tune, repair, or replace improperly operating combustion appliances; apply weather stripping or conduct air sealing between the garage or crawl space and the home)

Objective(s):

Ensure occupant health and safety

Ensure indoor CO levels do not exceed outdoor CO levels



ALL houses must have carbon monoxide detectors installed near sleeping areas



Best Practice

Compare indoor and outdoor CO levels. If case of elevated indoor CO levels, locate the source and fix the problem

Tools:

1. Combustion analyzer with probe

2. Personal CO monitor

KHRC Kansas Housing Resources Corporation and the Kansas Weatherization Network



Test all combustion appliances for co exhaust and check against appropriate action levels for appliance type



Do not forget to test gas ovens as a potential source of CO -- check results against action levels



If combustion appliances are source of elevated CO levels, repair or replace as necessary



Could CO infiltration be coming from outdoor sources? Air seal and weatherstrip to minimize outdoor pollutants

2.0203.4 - Occupant Education

Desired Outcome:

Ensure persistence of resident safety

2.0203.4b - Occupant education

Desired Outcome:

Ensure persistence of resident safety

Specification(s):

Occupants will be educated on the operation and maintenance of the CO alarm

Completed work on combustion appliances and recommended maintenance will be reviewed with occupant

Occupant will be provided information regarding the health effects and risk of high CO concentrations; EPA provides possible expanded actions and offers client education information in an appendix to the protocols

Objective(s):

Ensure occupant can operate and maintain installations

Inform occupant regarding possible CO hazards



Best Practice

Review CO alarm maintenance with occupant



Provide occupant with information about CO sources, risks, and symptoms

2.0301.1 - Smoke Alarm

Desired Outcome:

Properly installed smoke alarms

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0301.1b - Smoke alarm (battery operated)

Desired Outcome:

Properly installed smoke alarms

Specification(s):

When installing battery operated smoke alarms, it will be installed in accordance with manufacturer specifications

Objective(s):

Ensure proper installation

One UL 217 listed smoke alarm will be installed outside sleeping areas AND on each habitable floor within in every weatherized home. Alarms shall have non-removable, non-replaceable 10 year lithium batteries.

2.0301.2 - Carbon Monoxide Alarm or Monitor

Desired Outcome:

Properly installed CO alarms or monitors

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0301.2b - CO detection and warning equipment (battery operated)

Desired Outcome:

Properly installed CO alarms or monitors

Specification(s):

Battery-operated CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 and manufacturer specifications as required by the authority having jurisdiction

Objective(s):

Ensure proper installation

Every weatherized home shall have at least 1 CO alarm per habitable floor. Alarms shall have non-removable, non-replaceable 10 year lithium batteries. An alarm should be installed outside the primary sleeping area.

2.0403.1 - Vented Crawl Spaces—Ground Moisture Barrier

Desired Outcome:

Durable, effective ground moisture barrier provides long-lasting access and minimizes ground vapor

2.0403.1b - Coverage

Desired Outcome:

Durable, effective ground moisture barrier provides long-lasting access and minimizes ground vapor

Specification(s):

A ground moisture barrier that covers the exposed crawl space floor will be installed

Objective(s):

Reduce ground moisture entering the crawl space



Uncovered crawl space floors can cause moisture damage



Ground moisture barrier to cover 100% of floor is installed last

Foundation vents will not be modified where local codes prevent modification. Ground moisture barriers and foundation insulation will not be installed where bulk water intrusion/standing water is a concern. Floor airsealing and insulation should be used in these applications, as applicable and audit approved. Where crawlspaces are to be included in the conditioned volume, foundation vents are to be sealed from the interior with rigid board. Where floors are insulated and vents are left operable, leave floor insulation back a few inches to allow full operation of vents.

Foundation insulation will not be installed where foundation vents remain operable.

2.0403.2 - Closed Crawl Spaces—Ground Moisture Barriers

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

2.0403.2b - Coverage

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

Specification(s):

An air barrier and ground moisture barrier, covering the exposed crawl space floor, will be installed and sealed to the wall's air and moisture barrier in accordance with ASTM E1643 and manufacturer's recommendations

Ground moisture barrier will be fastened to ground in accordance with manufacturer's recommendations and extend a minimum of 6 inches up the foundation wall

Objective(s):

Reduce ground moisture entering the crawl space

Create a continuous and durable connection between the wall and ground air and moisture barriers



Before
Uncovered crawl space floors can lead to

moisture issues



Ground moisture barrier should cover 100%

of floor and at least 6" of walls

Materials:

- 1. Plastic sheeting (al least 6 mil)
- 2. Furring strips
- 3. Fasteners

Ground moisture barrier shall extend a minimum of 6 inches up the foundation walls and pillars and must be mechanically fastened or sealed with bonding agents. Best practice is to extend the moisture barrier up the foundation wall to above the exterior grade, without contact with the sill plate or any wood. This allows for a termite inspection and keeps moisture vapor from contacting wood. Barrier must be attached with a durable connection. Best practices include adhesive and mastic together, or mechanically fastened. Debris that can cause injury or puncture ground covers (e.g nails, glass, screws, etc) will be removed from the crawl space as feasible. When ground moisture barrier is installed on sloping ground, it will be fastened to ground with durable fasteners or ballast. The ground moisture barrier will not interfere with the established drainage pattern. Interior drainage collection points will be accessible from above and below the ground moisture barrier.

2.0403.2 - Closed Crawl Spaces—Ground Moisture Barriers

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

2.0403.2c - Material specification

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

Specification(s):

A ground moisture barrier with a rating of no more than 0.1 perm will be used

A ground moisture barrier will be used that meets tear and puncture resistance standard ASTM E1745

Homeowner will be advised that all plastic is biodegradable and will have a life span much shorter than the home, and it will need replacing to remain effective

Objective(s):

Reduce ground vapor entering the crawl space

Ensure crawl space is accessible for service and maintenance without destroying the integrity of the moisture barrier



Barrier must be at least 6 mil, able to withstand puncture and last 10 yrs

Materials:

- 1. Plastic sheeting (at least 6 mil)
- 2. Furring strips
- 3. Fasteners

The higher a material's perm rating, the more vapor can pass through said material. Drywall typically has a perm rating of approximately 50. For vapor retarders in basements and crawl spaces, SWS calls for materials with a perm rating of <0.1 (which translates to 6 mil or thicker). From 2007 IRC definition of vapor retarders: Class I: ≤ 0.1 perm (called impermeable), Class II: 0.1 to 1.0 perm (called semi-impermeable), Class III: 1.0 perm to 10 perms (called semi-permeable).

A ground moisture barrier will be used that meets tear and puncture resistance of 6 mil or greater.

2.0403.2 - Closed Crawl Spaces—Ground Moisture Barriers

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

2.0403.2f - Sealing seams

Desired Outcome:

Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

Specification(s):

A durable sealant compatible with the air barrier and ground moisture barrier will be used

Objective(s):

Maintain continuous air barrier and ground moisture barrier



Crawl spaces lacking moisture barrier risk moisture penetration of floor

Tools:

Utility knife

<image>

Ground moisture barriers in unvented spaces should be sealed

Materials:

1. Moisture-resistant adhesive tape

Seams should be overlapped 12 inches utilitizing a reverse or upslope technique and be permanetly sealed.



Tape wall seams and press to ensure airtight bonding of adhesive



Tape (overlapped) floor seams to prevent movement and water leakage

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0601.1a - Knob and tube identification

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Specification(s):

Contractor, assessor, auditor, or similar will inspect and assess the house to identify knob and tube wiring

Objective(s):

Ensure occupant safety

Preserve the integrity and safety of the house



Knob and tube wiring should be identified before work begins



Distinctive "knobs" are highlighted. This wiring can be a safety hazard

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0601.1b - Live wire testing

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Specification(s):

Non-contact testing method will be used to determine if wiring is live

Objective(s):

Protect occupant safety

Preserve the integrity and safety of the house



Knob & tube wiring needs to be tested to determine if still live. Red=live



👍 After

Live wiring should be dammed or professionally disabled before insulating

Tools:

1. Non-contact wire tester

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0601.1c - Isolation and protection

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Specification(s):

Proper clearance will be maintained around live knob and tube as required by the National Electrical Code (NEC) or authority having jurisdiction

When required, a dam that does not cover the top will be created to separate insulation from the wire path

Objective(s):

Ensure occupant safety

Preserve the integrity and safety of the house



Refore

Live knob & tube wiring may get hot and should not be insulated over



Dams should be installed to hold back loose fill insulation

Tools:

- 1. Drill
- 2. Tape measure
- 3. Non-contact wire tester

- Materials:
- 1. Plywood
- Drywall
 Fasteners
- NEC guidelines and local jurisdictions are very particular on the treatment of knob & tube wiring. A licensed electrician is not required to inspect and certify Knob and Tube wiring unless there is concern about the safety of it's condition or it's required by local code. Insulation may be applied under K&T as long as a 1 inch air gap is maintained. Batt insulation as a dam is allowed. The practice of using a batt to cover K&B during blowing and then removing it to create an air gap is allowed. Best Practice includes adding attic entrance signage that states "CAUTION Live Knob & Tube Wiring Present"



Have a certified electrician verify that wiring is safe to work around



A sign should be posted at all entrances to warn of knob & tube wiring



Warning sign should remind to contact certified electrician for repairs

CUIDADO! Cableado eléctrico con aisladores ceramicos vivo! En Inglés: knob & tube wiring Si es necesario realizar alguna reparación, ponerse en electricista certificado.

Many jurisdictions require a sign in Spanish as well



Damming should extend above installed height of insulation



With dams in place, insulation can begin

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

2.0601.1d - Replacement

Desired Outcome:

Live unsafe wiring identified and brought to local codes

Specification(s):

Wiring will be replaced with new appropriate wiring in accordance with the NEC National Electrical Code and local codes

Old wiring will be rendered inoperable by licensed electrician in accordance with the NEC National Electrical Code and local codes

Objective(s):

Ensure occupant safety

Preserve the integrity and safety of the house





Knob and tube wiring may get hot and cannot be insulated over

Tools:

1. Non-contact wire tester

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🖬 After

If possible, k&t wiring should be disabled and replaced with modern wiring

Materials:

- 1. Romex as needed
 - 66 of 302

NEC guidelines and local jurisdictions have many codes dealing with the treatment of knob & tube wiring. Check your local codes. K&T replacement is an option if necessary and cost allowable. Note that sidewall dense pack insulation is not allowable if K&T is present in the cavity to be insulated.



The entire knob and tube system should be disabled



Many electricians will remove old exposed wiring to prevent reactivation replaced with modern wiring



Exposed knob and tube should be



With modern wiring in place and old k&t disabled, insulation can begin

2.0701.2 - Crawl Space Information Sign

Desired Outcome:

Posted signs inside of the crawl space provide essential safety and maintenance information to occupant and users of the crawl space

Note:

2.0701.2a - Sign specifications

Desired Outcome:

Posted signs inside of the crawl space provide essential safety and maintenance information to occupant and users of the crawl space

Specification(s):

A durable, easily seen sign will be installed at all accesses inside of the crawl space (minimum 8 $\frac{1}{2}$ " x 11")

A minimum expected service life of 10 years will be ensured

Objective(s):

Prevent damage to the crawl space after upgrade



Crawl space access points should have signage to alert occupant and workers



Best Practice

Sign should be highly-visible, securelyfastened, and durable

2.0701.2 - Crawl Space Information Sign

Desired Outcome:

Posted signs inside of the crawl space provide essential safety and maintenance information to occupant and users of the crawl space

Note:

2.0701.2b - Sign content

Desired Outcome:

Posted signs inside of the crawl space provide essential safety and maintenance information to occupant and users of the crawl space

Specification(s):

Those entering the crawl space will be cautioned not to damage the air barrier, ground moisture barrier, insulation, and mechanical components specific to the crawl space type

Anyone entering the crawl space will be alerted that immediate repairs are needed in case of damage

Installer contact information will be included on the sign in case there are questions or needs for repairs

Objective(s):

Prevent damage to the crawl space after upgrade

Educate anyone entering the crawl space

Provide occupants with a way to contact the installer



Best Practice

Mount sign where clearly visible to anyone entering crawl space

Caution, do not damage: If Damaged, the following must be repaired immediately: If repairs are needed, contact:

Be sure sign includes relevant information to aid occupant in repairs

Tools:

- 1. Printer
- 2. Staple gun

Materials:

- 1. Paper
- 2. Laminant
- 3. Staples

Agency contact information should be easily identifiable. Add "PROHIBITED: Do not store hazardous or flammable material in this space"

Cuidado, no dañar:

Si está dañado, estos deben ser reparados inmediatamente:

Si es necesario realizar alguna reparación, ponerse en contacto con:

Hacer la señal en español también

3.1001.1 - Penetrations and Chases

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.1a - Pre-inspection

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

An inspection will be conducted for mold, water leaks, and water damage before sealing a chase

Repairs will be completed before work

Objective(s):

Repair moisture-related issues

3.1001.1 - Penetrations and Chases

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.1b - Backing and infill

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the hole

The infill or backing will not bend, sag, or move once installed

Objective(s):

Minimize hole size to ensure successful use of sealant

Ensure closure is permanent and supports any load (e.g., wind, insulation)

Ensure sealant does not fall out
3.1001.1 - Penetrations and Chases

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.1c - Sealant selection

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Sealants will be compatible with their intended surfaces

Sealants will allow for differential expansion and contraction between dissimilar materials

Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction

Objective(s):

Select permanent sealant

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials

3.1001.1 - Penetrations and Chases

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.1d - High temperature application

Desired Outcome:

Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Only non-combustible sealant will be used in contact with chimneys, vents, and flues

Local codes will be referenced

Objective(s):

Prevent a fire hazard



Before

Gaps around combustion exhaust flues need to be sealed

Tools:

- 1. Drill/screwdriver
- 2. Caulk gun
- 3. Metal snips



Sealed penetrations and chases should utilize high-temperature materials

Materials:

- 1. High-temperature caulking
- 2. 26-gauge steel sheeting

Refer to local codes. Adequate slope is generally a 1/4 inch per foot or greater. Inspect for proper flue clearance to combustibles. Refer to Local Codes. B-vent is typically 1 inch, single wall is typically

6 inches.

See 3.1402.1c for Clearance Requirements.



Prepare work area by removing any insulation and debris



Use high-temperature caulking (600F min)



Apply first ring of caulking to match shape of opening



Apply second ring of caulking to size and shape of rigid material



Fasten rigid material (26-gauge steel) and apply additional caulking



Fasten rigid material to cover penetration and seal against flue with caulk

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2a - Pre-inspection

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

An inspection will be conducted for mold, water leaks, and water damage before sealing a chase

Repairs will be completed before work begins

Objective(s):

Repair moisture-related issues



Investigate under insulation in chases to verify they are undamaged



Water damage in chase due to hole to the outside

Tools:

- 1. flashlight
- 2. headlamp
- 3. hammer
- 4. prybar
- 5. circular saw
- 6. reciprocating saw
- 7. borescope
- 8. mirror

Removing the batt over this chimney chase provided access to see a large hole and water damage in the chimney wall.



Locate and expose chases to prepare for inspection and capping/sealing

Clear away insulation and debris to allow inspection



Carefully investigate areas with high potential for water leaks

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2b - Standard chase (interior walls covered with drywall or plaster)

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Entire opening will be spanned with rigid material

Material will be cut to fit and fastened as required

Objective(s):

Reduce opening to what can be sealed with sealant



Unsealed standard chases covered with drywall can be leakage points

Tools:

- 1. Drill/screwdriver
- 2. Caulk gun



🖬 After

The air barrier is be maintained by capping chases with rigid material

- 1. XPS
- 2. Drywall
- 3. Caulk
- 4. Sheet metal
- 5. OSB or plywood

Air Sealing > Attics > Penetrations and Chases 3.1001.2b - Standard chase (interior walls covered with drywall or plaster)







Apply sealant all the way around opening



Trim rigid material, such as drywall or XPS, to size and place over sealant



Fasten rigid material appropriately, such as with screws

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2c - Non-standard chase (interior walls covered with wood or paneling)

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Material will be used that can be exposed to the interior of the house and meet the flame and smoke spread indexes as required in IRC

Objective(s):

Prevent a fire hazard



Paneled drop soffits typically are more combustible than plain drywall

are viable materials

Tools:

- 1. Drywall saw
- 2. Tape measure
- 3. Caulk gun
- 4. Drill

EPS or bead-board are not acceptable materials.

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Materials:

- 1. Drywall
- 2. XPS
- 3. Fire-block sealant

When sealing on attic side, drywall and XPS

4. Fasteners

Air Sealing > Attics > Penetrations and Chases 3.1001.2c - Non-standard chase (interior walls covered with wood or paneling)



Sealing with drywall reduces overall combustibility of paneled chases



Sealing with XPS also reduces overall combustibility of paneled chases

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2d - Support

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

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

Objective(s):

Ensure seal stays in place and does not sag



Before

Spans greater than 24 inches require additional bracing before capping

Tools:

- 1. Drill
- 2. Saw
- 3. Tape measure



Support should prevent cap from sagging or moving

- 1. Lumber
- 2. Drywall
- 3. Fasteners



Create bracing to support spans larger than 24", either from above or below



When supporting from above, apply adhesive between drywall and bracing



Bracing can be screwed to drywall before capping chase



Ensure new bracing is secure by using screws to fasten to joist



Once chase is capped, it is now ready to be sealed along framing

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2e - Joint seal

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections

Objective(s):

Provide airtight, durable seal that does not move, bend, or sag



Chases need to be capped and sealed to prevent leakage

Tools:

- 1. Spray foam gun
- 2. Caulk gun



Chase is sealed along all cracks, gaps, and penetrations

Materials:

- 1. Spray foam
- 2. Caulk

Always wear protective gloves when working with sealants.



Chase has been capped but needs to be sealed



Sealant is used to fill in all cracks and Cap is sealed gaps along edges of chase cap



Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

3.1001.2f - Adjacent framing

Desired Outcome:

Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

All remaining gaps at the top of the chase will be sealed

Objective(s):

Ensure airtight seal from one finished side of the chase to the other



Chases need to be capped and sealed to prevent leakage

Tools:

- 1. Spray foam gun
- 2. Caulk gun





Chase is sealed along all cracks, gaps, and penetrations

- 1. Spray foam
- 2. Caulk



Sealant is used to fill in all cracks and gaps along edges of Extend seal along adjacent framing chase cap



Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.1a - Pre-inspection

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Specification(s):

An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit

Repairs will be completed before work begins

Objective(s):

Repair moisture-related issues

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.1b - Sealing methods

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Specification(s):

Entire opening will be spanned with rigid material in line with the ceiling level

Material will be cut to fit and fastened as required

OR

Side of stud bays will be sealed with rigid material from bottom of dropped ceiling to top-plate

OR

Wall below openings will be dense packed

OR

Wall below openings will be bridged and sealed with SPF

Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference

Objective(s):

Prevent air leakage from dropped ceiling to attic



Before

Damage to an older ceiling reveals the new ceiling below

Tools:

- 1. Utility knife
- 2. Saw
- 3. Drill
- 4. Insulation machine
- 5. Caulk gun
- 6. Spray foam gun
- 7. Tape measure



Prepare work area by removing existing insulation and debris



Option 1, Step 1: Run a bead of sealant around damage in old ceiling



Option 1, Step 2: Cover openings with rigid material, either XPS or drywall



Rigid material sealed in place creates an air barrier

- 1. Caulk sealant
- 2. Rigid material -- XPS or Drywall
- 3. Spray foam
- 4. Fasteners
- 5. Dense packable insulation
- 6. Wrapped fiberglass batts



Option 2: Seal with rigid material along face of stud cavities



fastened wood plate

Option 3: Dense pack cavities through Option 4: Bridge cavities at new ceiling level with wrapped batts and SPF



Whatever option chosen, test with chemical smoke to verify no leakage

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.1c - Support

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Specification(s):

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

Objective(s):

Ensure seal stays in place and does not sag



Spans greater than 24 inches require additional bracing before capping

Tools:

- 1. Saw
- 2. Drill
- 3. Tape measure



Support should prevent cap from sagging or moving

- 1. Lumber
- 2. Drywall
- 3. Fasteners



Create bracing to support spans larger than 24", either from above or below



When supporting from above, apply adhesive between drywall and bracing



Bracing can be screwed to drywall before capping chase



Ensure new bracing is secure by using screws to fasten to joist



Once chase is capped, it is now ready to be sealed along framing

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.1d - Joint seal

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Specification(s):

Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections

Objective(s):

Provide airtight, durable seal that does not move, bend, or sag



Damage to an old ceiling reveals a newer ceiling below

Tools:

- 1. Spray foam gun
- 2. Caulk gun



No gaps should remain after sealant is applied

- 1. Caulk
- 2. Spray foam



Apply sealant to surrounding surfaces before setting cap in place



Sealant should extend along joists and into seams at top plates



Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.1e - Adjacent framing

Desired Outcome:

Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

Specification(s):

All remaining gaps will be sealed at the top of the dropped ceiling

OR

All remaining gaps at the top of the chase will be sealed

Objective(s):

Provide airtight framing from one finished side of the dropped ceiling to the other



Damage to an older ceiling reveals the new ceiling below



No gaps should remain after spray foam is applied

Tools:

- 1. Caulk gun
- 2. Spray foam gun



Caulk along all joists before setting cap

Materials:

- 1. Spray foam
- 2. Caulk sealant



Use sealant to fill all remaining gaps

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.6a - Pre-inspection

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit

Repairs will be completed before work begins

Objective(s):

Repair moisture-related issues

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.6b - Soffit general

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Air flow will be blocked at soffit in locations where access allows

Objective(s):

Provide continuous air barrier across soffit openings





Accessible drop soffits should be sealed to prevent heat gain/loss

Tools:

- 1. Utility knife
- 2. Caulk gun
- 3. Saw
- 4. Drill





Completely sealed drop soffits and chases minimize heat transfer

- 1. Caulk
- 2. Spray foam
- 3. XPS/Lumber/Sheetrock
- 4. Fasteners

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.6c - Option 1: bring soffit inside (seal at top)

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Entire opening will be spanned with rigid material in line with the ceiling level

Material will be cut to fit and fastened as required

Objective(s):

Prevent air leakage from wall to attic

Reduce opening to what can be sealed with sealant

Ensure closure is permanent and supports any load (e.g., wind, insulation)

Bring soffit into thermal boundary



Standard soffits are often open to the attic and uninsulated



Rigid material encloses the soffit into the conditioned living space

Tools:

- 1. Drill/screwdriver
- 2. Caulk gun

- Materials:
- 1. Drywall
- 2. Sealant

Option 1, bringing the soffit into conditioned space, is preferred over sealing at the bottom or side.



Soffits open to the attic need to be sealed to maintain air barrier



Apply sealant along top plates



Cap soffit with rigid material, such as drywall, cut to size



Fasten cap with screws to set sealant and create air barrier



Insulate over now-capped soffit

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.6d - Option 2: leave soffit outside (seal at bottom or side)

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Each stud bay will be spanned with rigid material will be cut to fit and fastened as required

OR

Backing at each stud bay will be provided and will be sealed

OR

Side of stud bays will be sealed with rigid material from bottom of soffit to top-plate

OR

A sealed rigid barrier will be installed at all transitions

Objective(s):

Prevent air leakage from wall to soffit

Reduce opening to what can be sealed with sealant

Ensure soffit is outside of the thermal boundary



I Before

Wall cavities are open to attic and heat transfer due to dropped soffit

Tools:

- 1. Tape measure
- 2. Utility knife
- 3. Saw
- 4. Insulation machine
- 5. Drill
- 6. Caulk gun
- 7. Spray foam gun



🖬 After

Wall cavities capped and air-sealed in one of a variety of options

- 1. XPS
- 2. Drywall
- 3. Plywood
- 4. Lumber
- 5. Fasteners
- 6. Caulk
- 7. Spray foam
- 8. Dense packable insulation
- 9. Poly-wrapped insulation



Clear work area of insulation and debris



Option 1: Span each stud bay with rigid material at level of soffit



Option 2: Backing used to fill bays and sealed with spray foam

Air Sealing > Attics > Dropped Ceilings and Soffits 3.1003.6d - Option 2: leave soffit outside (seal at bottom or side)



Option 3: Stud bay wall faced with rigid material, fastened and sealed

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Note:

3.1003.6e - Soffits containing non-IC rated recessed lights

Desired Outcome:

Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

Specification(s):

Insulation will be kept at least 3" away from the top and side of any fixtures

If dropped soffit is to be filled with insulation, then a sealed rigid barrier enclosure will be installed to maintain a 3" clearance around the entire fixture

Top of rigid barrier enclosure will be sealed with non-insulating rigid material (e.g., gypsum or equivalent perm rating and R-value)

Objective(s):

Prevent light fixture from overheating

Bring light fixture inside of the air barrier

Do not insulate over enclosures containing non-IC rated recessed lights. Areas adjacent to recessed lights can be insulated over.

3.1201.1 - Double-Hung Wood Windows

Applies to all Window Types: Single, Metal, Vinyl, etc.

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

3.1201.1a - Lead paint assessment

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

Tools:

1. Note: Mask must be worn during testing

- 2. Utility knife
- 3. Camera

Follow all applicable KDHE Lead regulations.

3.1201.1 - Double-Hung Wood Windows

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

3.1201.1c - Sash locks

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

Specification(s):

Locks will be installed so that the rails of the upper and lower sashes are flush and in full contact

No gaps will be visible between the two sashes

Locks will be installed to achieve compression of the two sashes

Objective(s):

Form a secure connection between the two sashes

3.1201.1 - Double-Hung Wood Windows

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

3.1201.1d - Replacement sills

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

Specification(s):

Beveled sill will be flush with interior wall and sloped to the exterior

Seams will be continuously and completely sealed with sealant to the jambs and to the frame

Sill will be water-sealed and primed

Objective(s):

Form a complete seal from the bottom of the lower sash to the sill

Maintain operability of the window

Allow for drainage to the exterior



Refore

Rot in and under a window sill is often a sign of a bigger problem



After

Once repaired, this window is less leaky and better supported
Tools:

- 1. Saw
- 2. Drill
- 3. Pry bar
- 4. Sander
- 5. Caulk gun

Materials:

- 1. Lumber or metal sill
- 2. Caulk
- 3. Fasteners
- 4. Flashing



Remove sill to determine full extent of rot and necessary repairs



Once rotted materials are cut away, determine sizing of new materials



Cut new materials flush to surrounding surfaces and pitch toward exterior



For exterior repairs, replace flashing



Set new sill, then replace and prime trim

3.1201.1 - Double-Hung Wood Windows

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

3.1201.1e - Sash replacement

Desired Outcome:

Windows operable and weather tight; improved energy efficiency performance of fenestration

Specification(s):

Lower sash will have the same bevel on the bottom rail as the sill

Sash will be water-sealed and primed

Objective(s):

Ensure sash remains in a fixed position when open or partially open

Maintain operability of the window

Form a complete seal from the bottom of the lower sash to the sill

3.1201.3 - Exterior Doors

Desired Outcome:

Doors operable and weather tight

Note:

3.1201.3a - Lead paint assessment

Desired Outcome:

Doors operable and weather tight

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/ May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

Follow all applicable KDHE regulations.

3.1201.3 - Exterior Doors

Desired Outcome:

Doors operable and weather tight

Note:

3.1201.3b - Door operation and fit

Desired Outcome:

Doors operable and weather tight

Specification(s):

Door will be adjusted to properly fit the jamb and allow for ease of operation (e.g., hinge replacement, re-plane door, door strike adjustment)

Objective(s):

Ensure proper operation of the door



Daylight visible around door can indicate it does not hang true and leaks

Tools:

- 1. Screwdriver
- 2. Planer



With proper adjustment, doors should hang true and minimize leakage

Materials:

1. Shims

Exterior doors only. Follow all applicable KDHE regulations.



After examining how door hangs, remove door from hinges



Adjust hinge plates to bring door back Adjust strike plate to allow for secure into true



and smooth operation



Rehang door to verify adjustments worked and door operates smoothly

3.1201.3 - Exterior Doors

Desired Outcome:

Doors operable and weather tight

Note:

3.1201.3c - Air infiltration

Desired Outcome:

Doors operable and weather tight

Specification(s):

Details that reduce air infiltration will be repaired, replaced, sealed, or installed in accordance with State Energy Conservation Code or local code—whichever is more stringent (e.g., weather stripping, door bottoms, trim replacement with foam)

After

Objective(s):

Reduce air infiltration



Daylight visible around an exterior door indicates air infiltration

Tools:

- 1. Screwdriver
- 2. Saw
- Utility knife
- 4. Caulk gun
- 5. Drill
- 6. Tape measure

Follow all applicable KDHE lead regulations.



Weatherstripping and a door bottom

minimize air infiltration around doors

2. Door bottom 3. Fasteners

1. Weatherstripping (Q-lan)

Materials:

4. Caulk



Remove leaky door in order to affix door bottom



Measure and trim door, if necessary, to allow for door bottom



Trimming to allow for door bottom



Cut door bottom to width of door



door and fasten into place



Ensure door bottom fits snugly around Measure doorway for weatherstripping



Notch upper ends of side weatherstripping to allow for top piece



Weatherstripping should fit snugly into Rehang door and verify fit, operation, rabbit and against other pieces



and lack of air infiltration

3.1201.3 - Exterior Doors

Desired Outcome:

Doors operable and weather tight

Note:

3.1201.3d - Water infiltration

Desired Outcome:

Doors operable and weather tight

Specification(s):

Details that reduce water infiltration will be repaired, replaced, sealed, or installed (e.g., adjust threshold, caulk jamb to threshold, caulk trim, flashing)

Objective(s):

Reduce water infiltration



Refore

Daylight visible under exterior doors indicate water can leak in

Tools:

- 1. Caulk gun
- 2. Screwdriver
- 3. Pry bar

Follow all applicable KDHE lead regulations.



By adjusting the threshold and sealing along it, water should be kept out

Materials:

1. Caulk sealant



Adjust threshold to minimize gap and keep water out



Caulk along threshold from inside and outside to prevent water infiltration

3.1201.3 - Exterior Doors

Desired Outcome:

Doors operable and weather tight

Note:

3.1201.3e - Occupant education and maintenance

Desired Outcome:

Doors operable and weather tight

Specification(s):

Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain weather stripping and caulk around door and trim

Objective(s):

Ensure long-term weather tightness

3.1202.1 - Fixed Frame with Wood Sash—Older House

Desired Outcome:

Applies to all types of window repairs

Glass complete and intact; improved energy efficiency performance of fenestration

3.1202.1a - Lead paint assessment

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/ May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

Follow all applicable KDHE regulations.

3.1202.1 - Fixed Frame with Wood Sash—Older House

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

3.1202.1b - Broken glass removal

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

Specification(s):

Putty and push points will be removed

Broken or cracked glass will be removed

Objective(s):

Safely remove old glass





Large pieces of glass have been removed

Broken glass with failed repairs needs to be replaced

Tools:

- 1. Putty knife
- 2. Chisel
- 3. Utility knife
- 4. Shop vaccuum
- 5. Tape measure

Always wear heavy work gloves when working with glass. See also 2.0100.1b for Hand Protection.

Materials:

1. Tape

but sash still needs preparation

Air Sealing > Windows and Doors > Repairing/Replacing Cracked and Broken Glass



Always wear heavy work gloves when working with glass



Cut through caulk bead and glazing to ease removal



Remove old putty and glazing to expose metal points holding glass in place



With points and glass removed, measure opening for replacement pane



Cut replacement glass 1/8" smaller than measured opening

3.1202.1 - Fixed Frame with Wood Sash—Older House

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

3.1202.1c - Sash preparation

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

Specification(s):

Opening will be cleaned

Objective(s):

Prepare opening for new glass



Remove all debris from sash either by sand paper, knife, or chisel

Tools:

- 1. Chisel
- 2. Utility knife



Mount new glass onto a clean surface

Materials:

- 1. Sand paper
- 2. Cleaning solution
- 3. Rags



Debris in the sash can cause new glass to seal improperly



Check closely to remove all pieces of broken glass and debris



3.1202.1 - Fixed Frame with Wood Sash—Older House

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

3.1202.1d - New glass installation

Desired Outcome:

Glass complete and intact; improved energy efficiency performance of fenestration

Specification(s):

Glass will be sized 1/8" to 3/16" smaller than opening to allow for movement of frame

Safety glass will be installed in accordance with local codes

Push points will be provided on each side to secure glass in frame

Glazing compound will be added in accordance with manufacturer specifications

Objective(s):

Ensure glazing compound will adhere to sash

Install, seal, and secure new glass in place

Allow glazing compound to harden to ensure secure installation







Replacement glass should be securely fixed with points and glazing

Air Sealing > Windows and Doors > Repairing/Replacing Cracked and Broken Glass

Tools:

- 1. Caulk gun
- 2. Tape measure
- 3. Paint brush

Materials:

- 1. Primer
- 2. Window glazing
- 3. Push points
- 4. Shims
- 5. Replacement glass
- 6. Tape

Always wear heavy work gloves when working with glass. See also 2.0100.1b for Hand Protection.



Always wear heavy work gloves when working with glass



With broken glass removed, measure opening for replacement glass



Cut replacement glass 1/8" smaller than measured opening



Use shims to center glass while installing push points



With push points in place, glaze to air seal new glass pane in sash



Secure pane in place with tape to hold until glazing sets

3.1203.1 - Replacement Window in Existing Window Frame

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

3.1203.1a - Lead paint assessment

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/ May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

Follow all applicable KDHE regulations. Ensure SHPO approval in homes 50 years old or older.

3.1203.1 - Replacement Window in Existing Window Frame

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

3.1203.1c - Replacement window installation

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Replacement window will be installed in accordance with manufacturer specifications, ensuring that the exterior stops are caulked

Objective(s):

Ensure replacement window operates properly

Ensure replacement window has a weather tight fit



Window opening ready to receive replacement window



🖬 After

Replacement window installed, with stop molding replaced and caulked

Tools:

- 1. Utility knife
- 2. Hammer
- 3. Sharp-bladed prybar
- 4. Nail set punch
- 5. Cordless driver/drill
- 6. Caulking gun
- 7. HEPA vacuum (for lead-based paint
- work)



- 1. Window, door, and trim caulk
- 2. 6-mil polyethylene plastic



Prepare and clean opening before installing new window



Check opening for plumb, level, and square



Measure diagonally both ways across opening. If measurements are equal, the opening is square



Apply caulk to stop molding and install the new window in accordance with manufacturer's instructions.



Tighten jamb adjusters and shim as necessary to achieve plumb, level, and square. Fasten window into opening



Make sure the sashes open, close, and lock properly. Check that the sashes are parallel with the frame as shown







Caulk new window to existing stop molding

Reinstall and caulk interior stop molding

Completed installation

3.1203.2 - Single-Unit Window, Mounted on Rough Opening—Newer House

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Note:

3.1203.2a - Lead paint assessment

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

Follow all applicable KDHE regulations. Ensure SHPO approval in homes 50 years old or older.

3.1203.2 - Single-Unit Window, Mounted on Rough Opening—Newer House

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Note:

3.1203.2b - Opening preparation

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Replacement window will be laid out with trim

Exterior trim will be removed or exterior siding will be cut back to fit new window with trim

Existing window will be removed

Window opening will be flashed in accordance with accepted industry standards

Objective(s):

Provide a clean and properly flashed opening for replacement window unit



Single pane window in newer home



Window is removed to allow for replacement with double pane unit

Tools:

- 1. Pry bar
- 2. Utility knife
- 3. Drill



Single pane window needs to be replaced with double pane



Cut through caulk at stops to break seal

Materials:

1. Window and door flashing



Remove stops while attempting to keep damage to rough opening to minimum



Remove interior trim



Remove exterior trim



Remove exterior fasteners to free window



Remove window from rough opening



Clean rough opening to remove old caulk and debris



Install flashing along sides and bottom of rough opening

3.1203.2 - Single-Unit Window, Mounted on Rough Opening—Newer House

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Note:

3.1203.2c - Replacement unit preparation

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Mounting detail will be determined based on depth of window and location of window liner

Objective(s):

Allow for good fit and finish of replacement window



Single pane window is being removed



Double-pane unit replaces previous singlepane one

Tools:

- 1. Tape measure
- 2. Utility knife



Measure rough opening depth to determine best method of installation



Clean old sealant off exterior surface to allow for flange installation



Install unit following appropriate detail for rough opening and unit depth

3.1203.2 - Single-Unit Window, Mounted on Rough Opening—Newer House

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Note:

3.1203.2d - Replacement window installation

Desired Outcome:

Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

Specification(s):

Replacement windows will be installed in accordance with manufacturer specifications and will be integrated with flashing

Gaps between the new window and existing frame will be sealed with low-expanding foam

Objective(s):

Ensure replacement window operates properly

Ensure replacement window is weather tight



Single pane window is being removed to install double pane unit



Double pane unit installed with trim in place

Tools:

- 1. Utility knife
- 2. Spray foam gun
- 3. Drill
- 4. Hammer
- 5. Saw

Materials:

- 1. Fasteners
- 2. Flashing
- 3. Low-expansion spray foam
- 4. Backer rod
- 5. Primed trim



Install flashing to manufacturer specs and industry standards



for easy installation



Flanges have been folded out to allow Fasten window flange securely around exterior of entire window



With window secured in place, check for proper function



Check that sash locks align properly, indicating window is plumb



Fill interior gap with compressible foam or appropriate sealant



Prime and replace interior trim and, if needed, sill



Replace exterior trim and patch exterior siding or finish as needed

3.1402.1 - Crawl Spaces—Sealing Floor Penetrations

Desired Outcome:

Air leakage prevented and indoor air quality protected

Note:

3.1402.1a - Backing and infill

Desired Outcome:

Air leakage prevented and indoor air quality protected

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

The backing or infill will not bend, sag, or move once installed

Objective(s):

Ensure resulting closure is permanent and supports any load (e.g., insulation)

Ensure sealant does not fall out



🖷 Before

Gaps around floor penetrations, such as plumbing, HVAC, and electrical

Tools:

1. Headlamp



Gaps should be sealed to maintain air barrier

Materials:

- 1. Backer rod
- 2. Sealant





Prepare work space by removing any insulation

Infill with backer rod

Apply appropriate caulking to ensure backing/infill does not move



Visually inspect to verify no gaps remain

3.1402.1 - Crawl Spaces—Sealing Floor Penetrations

Desired Outcome:

Air leakage prevented and indoor air quality protected

Note:

3.1402.1b - Sealant selection

Desired Outcome:

Air leakage prevented and indoor air quality protected

Specification(s):

Sealants will be used to fill holes no larger than recommended by manufacturer specifications

Sealants will be compatible with their intended surfaces

Sealants will allow for differential expansion and contraction between dissimilar materials

Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction

Objective(s):

Create a permanent seal

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials



Avoid sealants that do not allow for expansion between dissimilar materials



Best Practice

Flexible sealants compensate for differential expansion and maintain a seal

Tools:

Materials:

- 1. Caulk gun
- 2. Spray foam gun

- 1. Caulk
- 2. Spray foam

Best practice is to utilize paintable clear sealants if high temp is not required. Gaps or cracks larger than 1/4 inches may require backer.

3in

3in

3in



Caulking can be used to span gaps up to 1/4 inch

Spray foam can be used to span gaps Check manufacturer specifications to up to 3 inches

y enmasillado viejo.	Questin
Install backer rod in joints	Custon
1/4" or larger.Instale una	17:5 IS
barra de respaido en las	DO NUT
junturas de 1/4" (0.635 cm.)	KEEP
o más anchas.	CHILDE

verify spanning capabilities



Also check manufacturer specs for incompatibility with intended surfaces

3.1402.1 - Crawl Spaces—Sealing Floor Penetrations

Desired Outcome:

Air leakage prevented and indoor air quality protected

Note:

3.1402.1c - High temperature application

Desired Outcome:

Air leakage prevented and indoor air quality protected

Specification(s):

Only non-combustible materials will be used in contact with chimneys, vents, and flues in accordance with authority having jurisdiction

Objective(s):

Prevent a fire hazard



Before

Gaps around floor penetrations allow air and moisture movement

Tools:

- 1. Caulk gun
- 2. Metal snips
- 3. Drill/screwdriver



Use non-combustible materials, like 26-gauge steel and high-temp caulk

Materials:

- 1. High-temperature caulk
- 2. 26-gauge steel sheeting



Prepare work area by removing any insulation and debris



Use high-temperature caulking (600F min)



Apply first ring of caulking to match shape of opening



Apply second ring of caulking to size and shape of rigid material



Fasten rigid material (26-gauge steel) and apply additional caulking



Fasten rigid material to cover penetration and seal against flue with caulk

3.1402.3 - Closed Crawl Spaces—Air Sealing Exterior Wall

Desired Outcome:

Well-sealed exterior wall prevents leakage and pests

3.1402.3a - Seal penetrations

Desired Outcome:

Well-sealed exterior wall prevents leakage and pests

Specification(s):

Penetrations will be sealed with a durable material

A minimum expected service life of 10 years will be ensured

Objective(s):

Prevent air and moisture penetration into crawl space



🖷 Before

Light showing through penetration in exterior block wall

Tools:

- 1. Caulk gun
- 2. Sprayfoam gun
- 3. Metal snips
- 4. Drill



Sealed with durable material to prevent air and water leakage, and pests

Materials:

- 1. Caulk
- 2. Sprayfoam
- 3. Metal mesh
- 4. Fasteners

Spray foam should not be visible from conditioned space. If the penetration is greater than 1/4 inches, caulking, steel wool, or other pest-proof material will be used to fill the penetration before sealing.







Measure holes to determine the best backing and fill strategy

In holes larger than 1/4 inch, wire mesh should be used for backing

Sprayfoam or caulk seal the hole
3.1501.1 - Penetrations, Cracks, and Doors Between Garage and House

Desired Outcome:

Openings from garage sealed to prevent leakage

3.1501.1a - Penetrations

Desired Outcome:

Openings from garage sealed to prevent leakage

Specification(s):

All lighting fixtures, wiring, plumbing, venting, ducting, and gas piping penetrations will be sealed

Objective(s):

Prevent air leakage and pollutant entry



Before

Penetrations between the garage and house can leak hazardous fumes



Seal penetrations to minimize risks and air leakage

Materials:

- 1. Backer Rod
- 2. Caulk
- 3. Spray foam

Attached garage homes are to meet ASHRAE 62.2-2016 standards.

3.1601.3 - Support

Desired Outcome:

Ducts and plenums properly supported

3.1601.3a - Support (applies to all duct types)

Desired Outcome:

Ducts and plenums properly supported

Specification(s):

Flexible and duct board ducts and plenums will be supported every 4' using a minimum of 1 ¹/₂" wide material

Support materials will be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified (e.g., ceiling, framing, strapping); duct support must be installed in accordance with authority having jurisdiction

Metal ducts will be supported by 1/2 inch wide eighteen gauge metal straps or 12-gauge galvanized wire at intervals not exceeding 10 feet or other approved means

Objective(s):

Eliminate falling and sagging







Properly supported ducts minimize heat loss and and maximize duct run

Tools:

- 1. Metal snips
- 2. Utility knife
- 3. Drill
- 4. Stapler

Materials:

- 1. 18 gauge metal strap (at least 1/2" wide)
- 2. 12 gauge galvinized wire
- 3. Fabric support straps (at least 1 1/2" wide)
- 4. Staples
- 5. Fasteners

Ductwork should be a straight as possible and where bends are necessary they should be as smooth and wide as possible. Best Practice is to use transitional pieces on angles 45 degrees or greater.



BAD: Make sure supports DO NOT compress insulation or duct



Flex ducts should have supports no less than every 4 feet

Durable strap should be at least 1 1/2 inches wide



Metal ducts should be supported every 10 feet or less with straps or wire



Metal straps should be at least 18 gauge and 1/2 inch wide



Metal wire should be at least 12 gauge and galvanized

3.1602.1 - Air Sealing Duct System

Desired Outcome:

Ducts and plenums sealed to prevent leakage

3.1602.1c - Existing component to existing component

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Seams, cracks, joints, holes, and penetrations less than ¹/₄" will be sealed using UL 181 fiberembedded mastic

Seams, cracks, joints, holes, and penetrations between 1/4" and 3/4" will be sealed in two stages:

* They will be backed using temporary tape (e.g., foil tape) as a support prior to sealing* They will be sealed using fiberglass mesh and mastic

Seams, cracks, joints, holes, and penetrations larger than ³/₄" will be repaired using rigid duct material

Mastic will overlap repair joint or existing temporary tape by at least 1" on all sides

Objective(s):

Eliminate air leakage into or out of ducts and plenums

Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct

Reinforce seal

Support fiberglass mesh and mastic during curing





Unsealed joints and connections need to be sealed to prevent health risks

Sealed ductwork connections help prevent leakage

- 1. Mastic
- 2. Fiberglass mesh tape



Prepare work area by assessing any safety concerns





Apply UL 181 mastic to seal joint

3.1602.4 - Air Sealing System Components

Desired Outcome:

Ducts and plenums sealed to prevent leakage

3.1602.4a - Duct boot to interior surface

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

All gaps between boot and interior surface that defines conditioned space will be air sealed

Gypsum edge will be wetted before applying water-based sealant

Sealants will be continuous and be in accordance with IRC

Objective(s):

Prevent air leakage

Prevent a fire hazard



Gaps around duct boots allow for leakage to and from the attic

Tools:

- 1. Utility knife
- 2. Spray bottle
- 3. Putty knife



Materials:

- 1. Mastic
- 2. Mesh tape

An appropriate caulking to allow expansion may also be used. Examples may include paintable

silicon. Caulking should not be visible once the register/grill is replaced.



Remove grill to expose duct boot and gaps



Wet the edges of the drywall to ensure a good bond



Cut mesh tape to fit around duct boot and cover gaps



Apply mastic over mesh tape to create heat resistant, durable bond



Once mastic is set, grill can be replaced and mastic should not show

3.1602.4 - Air Sealing System Components

Desired Outcome:

Ducts and plenums sealed to prevent leakage

3.1602.4b - Wooden plenums and building cavities

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Accessible connections and joints will be made airtight using approved material

Objective(s):

Ensure ducts and plenums will not leak



Locate unsealed ducts constructed from building cavities

Tools:

- 1. disposable brushes
- 2. tape measure
- 3. utility knife
- 4. rubber gloves
- 5. framing square or T-square
- 6. tin snips



Return plenum lined with fiberglass duct board and sealed with mastic

Materials:

- 1. mastic
- 2. fiberglass duct board
- 3. UL 181 listed mastic tape
- 4. sheet metal
- 5. screws

Use approved materials to seal ductwork; cover organic materials with airtight, non-organic material such as mastic, metal, or duct board. No foam is allowed.

From NFPA 90B 4.2.1.3: "The interior of combustible ducts shall be lined with noncombustible material at points where there might be danger from incandescent particles dropped through the register or heater, such as directly under floor registers, the bottom of vertical ducts, or heaters having a bottom return."

From NFPA 90B 4.3.1.1: "Duct coverings, duct linings, and tapes used in duct systems shall have a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84 or ANSI/UL 723..."

New furnace installations only.



Identify building cavities used as ducts



Seal penetrations around AC lineset and wiring



Cut and Install appropriate board material to create an airtight duct



Seal all seams and joints with duct mastic

3.1602.4 - Air Sealing System Components

Desired Outcome:

Ducts and plenums sealed to prevent leakage

3.1602.4c - Air handler cabinet

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Joints will be closed and cracks and holes not needed for proper function of unit will be sealed using removable sealant (e.g., foil tape) or in accordance with the original equipment manufacturer directions (if available)

Objective(s):

Reduce air leakage while maintaining accessibility



▲ After
Use removable foil tape to seal holes

Unnecessary holes in the air handler cabinet need to be sealed

Materials:

1. Foil tape

For new installs only. Not required on existing units, unless needed to correct pressure imbalances.



Unnecessary holes in the air handler cabinet should be sealed



Removable foil tape should be used to seal



Fully cover holes with tape to seal completely

3.1602.4 - Air Sealing System Components

Desired Outcome:

Ducts and plenums sealed to prevent leakage

3.1602.4d - Filter slot

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

A pre-manufactured or site manufactured durable filter slot cover will be installed

Objective(s):

Reduce air leakage while maintaining accessibility



Uncovered filter slots are a point of leakage

Filter slots should be covered

A readily accessible and easy to use filter slot shall be installed when a unit is being newly installed. Best Practice is to include this on existing furnaces. Magnetic filter slot covers are a best practice for existing furnaces.

3.1602.5 - Return—Framed Platform

Desired Outcome:

The return duct installed to prevent air leakage

3.1602.5a - Preparation

Desired Outcome:

The return duct installed to prevent air leakage

Specification(s):

Debris and dirt will be cleaned out of the return platform

Objective(s):

Allow for the application of rigid materials and sealants



Refore

Dirty, unsealed return platform needs to be cleaned out before sealing



In Progress

Vacuum out debris and dirt from the return to prepare work area

Tools:

1. Shop vacuum

3.1602.5 - Return—Framed Platform

Desired Outcome:

The return duct installed to prevent air leakage

3.1602.5b - Infill and backing

Desired Outcome:

The return duct installed to prevent air leakage

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the open space

Backing or infill will not bend, sag, or move once installed

Material will be rated for use in return duct systems

Objective(s):

Minimize hole size to ensure successful use of sealant

Ensure closure is permanent and supports any load (e.g., return air pressure)

Ensure sealant does not fall out



Leakage from air return into wall cavities

should be eliminated



Only materials rated for use in higher temperature areas should be used

Tools:

- 1. Tape measure
- 2. Utility knife
- 3. Drill
- 4. Caulk gun



Materials:

- 1. Drywall
- 2. Fire-resistant caulk
- 3. Fasteners

Do NOT use EPS or XPS in air returns due to proximity to combustion appliances

3.1602.5 - Return—Framed Platform

Desired Outcome:

The return duct installed to prevent air leakage

3.1602.5c - Sealant selection

Desired Outcome:

The return duct installed to prevent air leakage

Specification(s):

Sealants will be continuous and be in accordance with IRC

Objective(s):

Select permanent sealant

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials



Best Practice

Sealants, like mesh and UL 181 mastic, meet IRC, ASTM, and UL specs

Tools:

- 1. Caulk gun
- 2. Utility knife
- 3. Taping knife



Caulk sealants will be continuous

Materials:

- 1. Fiberglass mesh
- 2. Siliconized caulk
- 3. UL 181 mastic

Paraphrased from 2012 IRC R302.9: Wall and ceiling finishes will have a flame spread index of 200 or less and a smoke-developed index of 450 or less

Desired Outcome:

Ensure safety from fire and prevent air leakage

4.1001.1a - Air barrier system

Desired Outcome:

Ensure safety from fire and prevent air leakage

Specification(s):

A fire-rated air barrier system (i.e., equivalent to 5/8 fire code gypsum wallboard) will be used to separate non- IC rated recessed lights from insulation, using one of the methods below:

A fire-rated airtight closure taller than surrounding attic insulation will be placed over non- IC rated recessed lights

OR

The non- IC rated light fixture will be replaced with an airtight IC - rated fixture or insert

OR

The fixture(s) may be replaced with surface mounted fixture and opening sealed

ORAir sealing measures as approved by the authority having jurisdiction

Objective(s): Prevent a fire hazard

Prevent air leakage through fixture



Refore

Non-IC rated recessed light fixtures should be dammed from insulation



Sealed box around non-IC light should be taller than surrounding insulation

Tools:

- 1. Utility knife
- 2. Tape measure

Materials:

- 1. 5/8" fire-rated drywall
- 2. Fire-rated caulk sealant

For recessed or can ligths see specifications 4.1001.1a, 4.1001.1b, 4.1001.1c, and 4.1001.1d.Commercially available fire-rated air barrier systems may also be used. A full metal enclosure that is airsealed, provides the required clearances, and is not insulated on top, meets the specifications.



Box should be constructed with clearances in mind



Sealed box should be constructed of fire-rated drywall



OR non-IC can light can be replaced with IC-rated recessed light

Desired Outcome:

Ensure safety from fire and prevent air leakage

4.1001.1b - Enclosure top

Desired Outcome:

Ensure safety from fire and prevent air leakage

Specification(s):

The top-fire rated enclosure material will have an R-value of 0.56 or less

The top of the enclosure will be left free of insulation

Objective(s):

Prevent heat build up



Non-IC rated recessed lights create excess



Once dammed from insulation, it should still not have insulation on top

Tools:

1. Utility knife

heat and are a fire risk

2. Caulk gun

Materials:

1. Drywall

For recessed or can ligths see specifications 4.1001.1a, 4.1001.1b, 4.1001.1c, and 4.1001.1d.Commercially available fire-rated air barrier systems may also be used. A full metal enclosure that is airsealed, provides the required clearances, and is not insulated on top, meets the specifications.

Desired Outcome:

Ensure safety from fire and prevent air leakage

4.1001.1c - Clearance

Desired Outcome:

Ensure safety from fire and prevent air leakage

Specification(s):

The entire closure will maintain a 3" clearance between the closure and the fixture including wiring, box, and ballast

Objective(s):

Keep an air space around the fixture



Non-IC rated recessed lights produce excess heat and can be a fire risk



- 1. Utility knife
- 2. Tape measure
- 3. Caulk gun



A 3 inch clearance should be kept from boxing materials

Materials:

- 1. Fire-rated sealant
- 2. Drywall

For recessed or can lights see specifications 4.1001.1a, 4.1001.1b, 4.1001.1c, and 4.1001.1d. Commercially available fire-rated air barrier systems may also be used. A full metal enclosure that is airsealed, provides the required clearances, and is not insulated on top, meets the specifications.

Desired Outcome:

Ensure safety from fire and prevent air leakage

4.1001.1d - Sealants and weather stripping

Desired Outcome:

Ensure safety from fire and prevent air leakage

Specification(s):

Caulk, mastic, or foam will be used on all edges, gaps, cracks, holes, and penetrations of closure material only

Objective(s):

To prevent air leakage, completely adhere the sealant to all surfaces to be sealed



Non-IC recessed light fixtures produce excess heat and can be a fire risk

Tools:

- 1. Caulk gun
- 2. Spray foam gun
- 3. Putty knife



Entire box should be sealed, but none should come in contact with light

Materials:

- 1. Fire-rated silicone caulk
- 2. UL-181 mastic
- 3. Spray foam

For recessed or can ligths see specifications 4.1001.1a, 4.1001.1b, 4.1001.1c, and 4.1001.1d.Commercially available fire-rated air barrier systems may also be used. A full metal enclosure that is airsealed, provides the required clearances, and is not insulated on top, meets the specifications.

4.1001.3 - Fireplace Chimney and Combustion Flue Vents

Desired Outcome:

Combustible materials kept away from combustion sources

4.1001.3a - Verify attic prep

Desired Outcome:

Combustible materials kept away from combustion sources

Specification(s):

Holes, penetrations, and bypasses will be sealed

Dams will be fixed in places that maintain required clearance

Objective(s):

Prevent air leakage

Ensure insulation dams maintain clearance



🖷 Before

Gaps and penetrations in attic need to be sealed to maintain air barrier

Tools:

- 1. Metal snips
- 2. Caulk gun
- 3. Fasteners



Chimneys, flues, and light fixtures should be dammed to prevent fire

- 1. 26-gauge steel sheeting
- 2. High temperature caulk
- 3. Caulk
- 4. Backer rod
- 5. Spray foam



Gaps around flues and penetrations need to be sealed before insulating



High temperature caulk should be used for flues and chimneys



26-gauge steel should be used to construct seals and dams on flues



Only construct dam after sealing has been completed properly



Dammed chimneys, flues and light fixtures prevent fires

4.1001.3 - Fireplace Chimney and Combustion Flue Vents

Desired Outcome:

Combustible materials kept away from combustion sources

4.1001.3b - Required clearance

Desired Outcome:

Combustible materials kept away from combustion sources

Specification(s):

A rigid dam having a height to ensure a 3" clearance area free of insulation or combustibles between combustion flue vent and dam, unless the flue vent is listed for a lesser clearance

Objective(s):

Ensure dam material does not bend, move, or sag

Prevent a fire hazard



To prevent fire hazards, flues, chimneys, and light fixtures require dams

Tools:

1. Metal snips



Observe a 3 inch minimum clearance for dams around flues and chimneys

- 1. 26-gauge steel sheeting
- 2. Fasteners

4.1001.4 - Vented Eave or Soffit Baffles

Desired Outcome:

Attic ventilation meets code requirements and insulation is protected from wind washing

Note:

4.1001.4a - Installation

Desired Outcome:

Attic ventilation meets code requirements and insulation is protected from wind washing

Specification(s):

If soffit venting or eave venting is present, baffles will be mechanically fastened to block wind entry into insulation or to prevent insulation from blowing back into the attic

If soffit venting or eave venting is present, baffles will be installed to maintain clearance between the roof deck and baffle in accordance with manufacturer specifications

Installation will allow for the highest possible R-value above the top plate of the exterior wall

Objective(s):

Ensure insulation R-value is not reduced

Maintain attic ventilation



Before Insulation should not block vented eaves

Tools:

1. Stapler



Baffles installed in vented attics to allow air flow past insulation

- 1. Baffles
- 2. Staples

Soffit baffles are to be installed in conjuction with attic insulation only if soffit venting is existing.



Allow a standard two inch gap for air flow through eave



Baffles should be securely fastened to Once baffles are properly installed, prevent movement over time



insulation can be placed against them



Baffles also hold insulation from falling into eave

4.1004.1 - Preparation for Dense Packing

Desired Outcome:

Airtight cavity and insulated knee wall

4.1004.1a - Backing

Desired Outcome:

Airtight cavity and insulated knee wall

Specification(s):

All knee walls will have top and bottom plate or blockers installed using rigid materials

When knee wall floor and walls are being insulated, the floor joist running under the knee wall will be air sealed

If fabric is used before dense packing, it will be secured, according to manufacturers specifications or with furring strips every wall stud

If rigid material is used, material will be installed to cover 100% of the surface of the accessible knee wall area

If foam sheathing is used, sheathing will be listed for uncovered use in an attic or covered with a fire barrier

Objective(s):

Eliminate bending, sagging, or movement that may result in air leakage

Prevent air leakage through the top or bottom of the knee wall

Ensure material will not tear under stress from wind loads or insulation



Knee walls often need sealing and insulation



Knee wall is prepped for dense pack insulation

Tools:

- 1. Tape measure, Utility Knife
- 2. Caulk gun/Spray foam gun
- 3. Drill
- 4. Stapler

- 1. Drywall, XPS
- 2. Caulk/ Spray foam
- 3. Fasteners
- 4. Staples



Knee walls missing top plates need one created from rigid material



Top plate holds dense pack insulation New top plate should be sealed to in cavity



surrounding joists and studs



Bottom plates also need to be installed. Measure for size



Cut to size and attempt to install in line with air barrier above



Seal to surrounding joist



If using house-wrap or fabric, tack in place with furring strips or staples



Drywall is also a good barrier for dense packing knee walls

4.1004.1 - Preparation for Dense Packing

Desired Outcome:

Airtight cavity and insulated knee wall

4.1004.1b - Installation

Desired Outcome:

Airtight cavity and insulated knee wall

Specification(s):

All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates

Insulation that is blown behind fabric or air barrier material will be blown dense to a minimum specification of 3.5 pounds per cubic foot for cellulose

Follow manufacturer's requirements for fiberglass dense pack applications

Objective(s):

Eliminate misalignment of existing insulation

Prevent insulation from settling or moving





Existing batt insulation should be adjusted to fit properly

If properly dense-packed, insulation should hold in place when finished

Batt insulation adjustment must be audit approved based on insulation grade differences. Bag and blow kneewalls is another option and also requires audit approval.



Attach furring strips to create pockets for dense-pack insulation



Insulation should meet manufacturer specifications for density.

4.1004.2 - Preparation for Batt Insulation

Desired Outcome:

Airtight cavity and properly insulated knee wall

4.1004.2a - Knee wall prep for batts

Desired Outcome:

Airtight cavity and properly insulated knee wall

Specification(s):

All knee walls will have a top and bottom plate or blockers installed using a Rigid material

All joints, cracks, and penetrations will be sealed in finished material, including interior surface to framing connections

When knee wall floor and walls are being insulated, the floor joist running under the knee wall will be air sealed.

Objective(s):

Eliminate bending, sagging, or movement that may result in air leakage

Prevent air leakage through the top or bottom of the knee wall

Create an air barrier



Top plate is missing from knee wall



After New top plate is sealed to adjacent framing

Tools:

- 1. Spray foam gun
- 2. Caulk gun
- 3. Tape measure
- 4. Utility knife
- 5. Drill
- 6. Saw

Materials:

- 1. XPS
- 2. Lumber
- 3. Caulk
- 4. Spray foam
- 5. Fasteners



Top plate has been cut and fit to size



Top plate has been sealed to adjacent framing



Bottom plate is also missing. Space is measured so XPS can be cut



Bottom plate is cut to size



Bottom plate is placed in line with interior air barrier



Bottom plate is also sealed to surrounding joist and framing

4.1004.2 - Preparation for Batt Insulation

Desired Outcome:

Airtight cavity and properly insulated knee wall

4.1004.2b - Installation

Desired Outcome:

Airtight cavity and properly insulated knee wall

Specification(s):

Insulation will be installed using one of the following methods:

- · New batts will be installed in accordance with manufacture specifications
- All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates

Objective(s):

Eliminate misalignment of existing insulation



Knee wall with batts improperly installed and missing from stud bays

Tools:

- 1. Utility knife
- 2. Tape measure



Properly fit insulation filling full volume of stud bay

Materials:

1. Fiberglass batts

Batt insulation adjustment must be audit approved based on insulation grade differences.



Where existing insulation is improperly installed, fix it



Kraft-face should go to "warm in winter" side and batt should fill bay



Batts should fill entire volume of knee wall stud bays

4.1005.5 - Enclosed Bonus Room Floor Over Unconditioned Space—Dense Pack Installation

Desired Outcome:

A consistent thermal boundary between conditioned and unconditioned space controls the heat flow

4.1005.5a - Air barrier

Desired Outcome:

A consistent thermal boundary between conditioned and unconditioned space controls the heat flow

Specification(s):

Existence of air barrier material in line with the knee walls will be installed or verified when dense packing

Air barrier material will not bend, sag, or move once dense packed

Objective(s):

Hold dense pack in place



his finished garage below

This finished garage below a bonus room is an unconditioned space

Tools:

- 1. Drywall saw
- 2. Utility knife
- 3. Tape measure
- 4. Straight edge



Rigid material forms an air barrier located under the bonus room stem wall

Materials:

1. XPS or other rigid material


Snap chalk lines to keep access cuts clean and easy to repair



Cut through garage ceiling to access joist cavities below bonus room



The rigid block should be placed in line with the stem wall above



Measure joist cavity depth



Measure joist cavity width



Cut XPS, or other rigid material, to measured size of joist cavity



Rigid block should fit snugly into joist cavity to prevent insulation leaks



Rigid block will hold the insulation in place under the bonus room above

4.1005.5 - Enclosed Bonus Room Floor Over Unconditioned Space—Dense Pack Installation

Desired Outcome:

A consistent thermal boundary between conditioned and unconditioned space controls the heat flow

4.1005.5b - Fill floors

Desired Outcome:

A consistent thermal boundary between conditioned and unconditioned space controls the heat flow

Specification(s):

Each cavity will be 100% filled to consistent density:

- Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot or to a maximum density structurally allowable
- Loose fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density per the manufacturer's recommendations

The number of bags installed will be confirmed and will match the number required on the coverage chart

Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke or other approved verification method by the authority having jurisdiction

Objective(s):

Eliminate voids and settling

Minimize framing cavity air flows

Insulation will be verified with acceptable applicable methods other than chemical smoke and a blower door.

Dense pack insulation will be verified by bag count, core sampling, or with diagnostic methods such as infrared camera, or chemical smoke with a blower door at 50 pascals.

4.1006.1 - Pull-Down Stairs

Desired Outcome:

Pull-down attic stair properly sealed and insulated

4.1006.1a - Installation

Desired Outcome:

Pull-down attic stair properly sealed and insulated

Specification(s):

Top-side of the attic enclosure will be insulated to the maximum R-value structurally allowable up to the R-value of the adjoining insulated assembly

Pull-down stair rough opening will be surrounded with a durable, rigid dam that is higher than the level of the attic floor insulation

Counter-weights should be considered to ease accessibility for excessively heavy hatches

Objective(s):

Achieve uniform R-value

Prevent loose insulation from entering the living area



Before Insulation needs to be dammed to keep from falling through during operation



Pull down stairs has air tight and insulated box or "coffin" built above it.

Tools:

- 1. Tape measure
- 2. Drill
- 3. Saw
- 4. Caulk gun



Stairs and hatch should both be insulated to match r-value of attic

Materials:

- 1. Caulk sealant
- 2. Lumber
- 3. XPS
- 4. Pre-fabricated stairwell cover

4.1006.1 - Pull-Down Stairs

Desired Outcome:

Pull-down attic stair properly sealed and insulated

4.1006.1b - Sealing

Desired Outcome:

Pull-down attic stair properly sealed and insulated

Specification(s):

Entire pull-down stair assembly will be covered with an airtight and removable/openable enclosure inside the attic space

Pull-down stair frame will be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier material, suitable film, frictionally engaging components or solid material that allows attic door operation

Objective(s):

Prevent air leakage



Before

Unsealed pull-down stairs leads to air leakage to and from the attic

Tools:

1. Caulk gun



To preserve thermal envelope, an airtight seal needs to be created

Materials:

- 1. Weatherstripping
- 2. Spray foam
- 3. Caulk



Seal around frame of pull-down stairs with appropriate sealant

4.1006.2 - Access Doors and Hatches

Desired Outcome:

Attic access door properly sealed and insulated

4.1006.2a - Installation

Desired Outcome:

Attic access door properly sealed and insulated

Specification(s):

Hatches will be insulated to the maximum R-value structurally allowable up to the R-value of the adjoining insulated assembly

Attic hatches rough opening will be surrounded with a durable, rigid protective baffle that is higher than the level of the surrounding attic floor insulation

Objective(s):

Achieve uniform R-value on the attic door or hatch

Achieve uniform R-value on the attic floor

Prevent loose attic floor insulation from entering the living area



Before
Uninsulated attic hatches and access panels weaken the thermal envelope



Hatch cover or panel access door should match r-value of attic insulation

Materials:

- 1. XPS
- 2. Lumber
- 3. Weatherstripping
- 4. Fasteners

Attic hatches will be dammed around with a strong and durable material that is higher than the level of the surrounding attic insulation. Weather stripping should be appropriate for the hatch material to ensure durability and appropriate seal. See SWS 4.1006.2a, 4.1006.2b, and 4.1006.2c. Modifications and deviations can be made to ensure accessibility, i.e. low clearances may require a shorter or flexible dam. New hatches must be finished to match surrounding ceiling. i.e painted or stained.



Create hatch cover that matches rvalue of surrounding insulation



and hold cover in place tightly



Build dam to hold back attic insulation Weatherstrip underside of hatch cover to create tight seal



Alternate installation for vertical access panel to attic

4.1006.2 - Access Doors and Hatches

Desired Outcome:

Attic access door properly sealed and insulated

4.1006.2b - Sealing

Desired Outcome:

Attic access door properly sealed and insulated

Specification(s):

Access hatch frames will be sealed using caulk, gasket, weather-strip, or otherwise sealed with an air barrier material, suitable film, or solid material

Options will include installing a latch or lock or frictionally engaged components that do not require a latch

The measure must include a protective baffle or insulation barrier

Objective(s):

Prevent air leakage



🖷 Before

Unsealed attic hatches and panel doors allow air leakage to and from attic



Once sealed, air leakage at attic hatch or door should be minimized

Materials:

- 1. Weatherstripping
- 2. 3/4" Lumber
- 3. Caulk

See SWS 4.1006.2a, 4.1006.2b, and 4.1006.2c.



Remember to seal around finish details and framing on interior



Build insulation dam from 3/4 inch lumber and seal around base



Weatherstrip around bottom edge of hatch cover to create air tight seal

4.1006.2 - Access Doors and Hatches

Desired Outcome:

Attic access door properly sealed and insulated

4.1006.2c - Attachment

Desired Outcome:

Attic access door properly sealed and insulated

Specification(s):

Insulation will be permanently attached and in complete contact with the air barrier

Objective(s):

Insulate to prescribed R-value



Part Before

Unsealed and uninsulated attic hatches and access doors allow leakage



Rigid insulation on back of new hatch cover attached firmly and squarely to allow for air-

Tools:

- 1. Caulk gun
- 2. Utility knife

Materials:

tight fit

- 1. XPS
- 2. Adhesive

See SWS 4.1006.2a, 4.1006.2b, and 4.1006.2c.



Apply foam tape to "warm side" face of Ensure an air tight seal by making attic hatch



sure foam tape has no gaps



Apply strong adhesive to "cold-side" of hatch



Adhesive should ring perimeter as well Affix XPS insulation to "cold-side" of as criss-crossing hatch to ensure complete attachment of insulation



hatch with adhesive, ensuring XPS is tight and square to hatch



Repeat adhesive and XPS layers to reach maximum R-value without making hatch excessively heavy or awkward



All XPS layers should be attached firmly to one another and square to hatch

4.1006.3 - Whole-House Fan

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value of an adjoining insulated assemb

Note:

4.1006.3a - Installation

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value of an adjoining insulated assemb

Specification(s):

Sides of fan insulation box assembly will be insulated to the same R-value as adjoining insulated assembly

Objective(s):

Insulate to prescribed R-value

Operational Fans: If whole house fans are left operational, a dam must be built in the attic to allow attic insulation to be installed up to the fan. Where operational fan louvers do not form an adequate air barrier, a seasonally removable air sealing cover should be applied to the conditioned side of the fan.

Inoperation Fans: If the whole house fan is not operational, airseal and insulate the assembly like a pull down stair by building a 'box/coffin' over it.

Desired Outcome:

Properly restored vents minimize moisture and ice dams

4.1088.1a - Air barrier and thermal boundary

Desired Outcome:

Properly restored vents minimize moisture and ice dams

Specification(s):

Attic ventilation will be recommended or installed if local code requires attic ventilation during weatherization or retrofits

The presence of an effective air barrier and thermal boundary between the attic and the living space must be verified and appropriate attic sealing and proper insulation is specified as part of the scope of work

Objective(s):

Ensure presence of continuous air barrier and thermal boundary

Desired Outcome:

Properly restored vents minimize moisture and ice dams

4.1088.1b - Vent type

Desired Outcome:

Properly restored vents minimize moisture and ice dams

Specification(s):

Attic vent types will be made of corrosion-resistant material for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof)

Attic-powered ventilators will not be used

Objective(s):

Ensure vent meets proper performance characteristics for location and roofing type

Desired Outcome:

Properly restored vents minimize moisture and ice dams

4.1088.1c - Vent location

Desired Outcome:

Properly restored vents minimize moisture and ice dams

Specification(s):

Placement of attic vents will be considered for proper air flow and prevention of entry of wind driven rain or snow

Objective(s):

Encourage proper air flow

Minimize entry of wind driven rain or snow

Vents shall be installed in accordance with manufacturers specifications and sealed with an appropriate sealant. Vents shall be installed under shingles to allow proper drainage to the fullest extent possible.

Desired Outcome:

Properly restored vents minimize moisture and ice dams

4.1088.1d - Ventilation baffling

Desired Outcome:

Properly restored vents minimize moisture and ice dams

Specification(s):

Baffling for attic soffit vents will be installed to:

- Ensure proper air flow
- Prevent wind washing of insulation
- Allow maximum insulation coverage
- Ensure baffle terminates above insulation

Objective(s):

Ensure vent allows proper air flow without compromising insulation performance

Desired Outcome:

Properly restored vents minimize moisture and ice dams

4.1088.1e - Ventilation screens

Desired Outcome:

Properly restored vents minimize moisture and ice dams

Specification(s):

All attic ventilation will have screens with non-corroding wire mesh with openings of 1/16" to 1/4" to prevent pest entry (e.g., birds, bats, bees)

Existing vents that are not screened will be covered with non-corroding wire mesh with openings of 1/16" to 1/4"

Ensure net free area requirements are met

Additional vents or larger vents can be added if screen size is smaller than designated

Objective(s):

Prevent pest entry

4.1088.3 - Skylights

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

4.1088.3a - Sealing

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

Specification(s): Holes and penetrations will be sealed

Bypasses will be blocked and sealed

Objective(s): Prevent air leakage

4.1088.3 - Skylights

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

4.1088.3b - Installation

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

Specification(s):

Insulation will be installed in accordance with manufacturer specifications and will be in full contact with all sides of existing cavity without gaps, voids, compressions, misalignments, or wind intrusions

Insulation will be installed to prescribed R-value

Objective(s):

Insulate to prescribed R-value



Uninsulated, unsealed skylight well



Insulated, air sealed skylight well

Tools:

- 1. stapler
- 2. tape measure
- 3. utility knife
- 4. caulking gun
- 5. foam gun

Materials:

- 1. caulk
- 2. one-part foam sealant

3. insulation (fiberglass, cellulose, spray polyurethane foam, polyisocyanurate board, extruded polystyrene board, or other as needed to achieve specified Rvalue)

4. air barrier material (drywall, foam board, paneling, hardboard, etc.)

Air-permeable insulation such as fiberglass or cellulose should be covered with a sealed attic-side air barrier.



Skylight well



Carefully seal all seams and joints



Install insulation in complete contact with all sides of the cavity.



Install an attic-side air barrier.



The air barrier may be constructed from rigid insulation board. Seal the attic side air barrier

4.1101.1 - Exterior Wall Dense Packing

Desired Outcome:

Walls properly prepared to receive dense pack insulation

4.1101.1a - Preparation

Desired Outcome:

Walls properly prepared to receive dense pack insulation

Specification(s):

Lead and asbestos safety procedures will be followed

Cavities will be free of hazards, intact, and able to support dense pack pressures

Drilling hazards (e.g., wiring, venting, fuel piping) will be located

Blocking will be installed around:

- All openings to inside crawl space and basement for fibrous material
- High temperature fire-rated materials
- · Wiring and electrical hazards
- Heat sources

Access to exterior wall cavities will be gained, sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers

Interior will be masked and dust controlled during drilling when accessing from interior

Electricity supply will be confirmed and will support blowing machine power demand

Blowing machine pressure test will be performed with air on full, feed off, agitator running, and gate closed

Hose outlet pressure will be at least 80 IWC or 2.9 psi for cellulose insulation; for other types of dense pack insulation, check manufacturer specification for blowing machine set up

Objective(s):

Prevent damage to house

Provide a clean work space

Provide thorough access to allow 100% coverage

Ensure proper equipment and process results in consistent density

Prevent settling and retard air flow through cavities

Protect worker and occupant health

4.1101.1 - Exterior Wall Dense Packing

Desired Outcome:

Walls properly prepared to receive dense pack insulation

4.1101.1b - Exterior dense pack

Desired Outcome:

Walls properly prepared to receive dense pack insulation

Specification(s):

Using fill tube, 100% of each cavity will be filled to a consistent density:

- Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot
- Loose fiber glass material will be installed and will be specifically approved for air flow resistance per manufacturer's specifications

The number of bags installed will be confirmed and will match the number required on the coverage chart

Insulation density will be verified by bag count, core sampling, or infrared camera with the blower door at 50 pascals to prevent visible air movement using chemical smoke at 50 pascals of pressure difference

Objective(s):

Eliminate voids and settling

Minimize framing cavity air flows

Also see 4.1103.1a

4.1102.1 - Open-Cavity Wall Insulation—General

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

4.1102.1a - Sealing

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

Specification(s): Holes and penetrations will be sealed

Bypasses will be blocked and sealed

Objective(s):

Prevent air leakage



🖷 Before

Penetrations and bypasses create places where blown in insulation can leak

Tools:

1. Caulk gun



Sealed penetrations offer leakage protection and keep insulation in place

Materials:

- 1. Backer rod
- 2. Spray foam
- 3. Caulk



Open walls to be insulated and drywalled need air sealing



Penetrations and bypasses should be sealed to keep insulation in cavities



Use backer rod or other infill for larger penetrations



Seal penetration with caulk or fireblock, as appropriate

4.1102.1 - Open-Cavity Wall Insulation—General

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

4.1102.1b - Installation

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

Specification(s):

Insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions

Insulation will be installed to prescribed R-value

Objective(s):

Insulate to prescribed R-value



Open walls should be insulated

Tools:

- 1. Insulation machine
- 2. Staple gun



Well-insulated rooms are significantly more comfortable in all seasons

Materials:

- 1. Loose fillable insulation
- 2. Netting
- 3. Staples
- 4. Fiberglass batts



Wall should be netted and insulation blow in to prescribed r-value



OR: Wall can be insulated using batts installed without gaps

4.1102.1 - Open-Cavity Wall Insulation—General

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

4.1102.1c - Pre-drywall verification

Desired Outcome:

Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

Specification(s):

Verification of complete installation without gaps, voids, compressions, misalignments, or wind intrusions will be provided

Objective(s):

Install insulation correctly



🖷 Before

Verify insulation is properly installed before drywalling

Tools:

- 1. Hands
- 2. Eyes



Once proper installation is verified, begin drywalling to finish wall



Take a visual and physical inspection of insulation installation

4.1103.1 - Dense Pack Exterior Walls

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1103.1a - Exterior dense pack

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Using fill tube or an alternative method as approved by the authority having jurisdiction, 100% of each cavity will be filled to a consistent density:

- Cellulose insulation used in an enclosed cavity will be installed at 3.5 pounds per cubic foot or greater density
- Blown fiberglass, mineral fiber, or rock and slag wool used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cfm /sq. ft. at 50 pascals, as measured using ASTM C 522, E 283, or E 2178; the number of bags installed will be confirmed and will match the number required on the coverage chart
- All holes and penetrations will be plugged and/or sealed

Insulation will be verified to prevent visible air movement using chemical smoke at 50 pascals of pressure difference

Objective(s):

Eliminate voids and settling

Minimize framing cavity air flows



Make accurate count of insulation bags to be installed



- 1. insulation blowing machine
- 2. pressure gauge
- 3. blower door
- 4. chemical smoke dispenser
- 5. drill
- 6. tape measure
- 7. ladder
- 8. utility flag bent into a "Z" shape



Install insulation to correct density (at least 3.5 pounds per cubic foot for cellulose, or 1.5 pounds for fiberglass)

Materials:

 cellulose or fiberglass insulation (any fiberglass material used must be specifically approved for air flow resistance by the manufacturer)
 wooden, plastic, or foam plugs to fill installation holes
 piece of fiberglass batt or towel to stop insulation from blowing out around the

Also see: 4.1101.1a and 4.1101.1b

Insulation will be verified with acceptable applicable methods other than chemical smoke and a blower door. Dense pack insulation will be verified by bag count, core sampling, or with diagnostic methods such as infrared camera, or chemical smoke with a blower door at 50 pascals.

hose



Calculate the number of bags needed



Check that the static pressure at the



Adjust the pressure with the blower

and verify the number you actually install.



Adjust the feed gate to fill an 8-foot wall cavity in 2 to 4 minutes.

blowing machine and at the hose end controls. is at least 2.9 PSI.



With a rag or fiberglass batt to prevent insulation blowing out, fill all cavities in exterior walls with insulation.



Check to make sure all cavities are properly filled. One of these is empty, and another is not filled to proper density



Check that cavities are filled and are the proper density.

Insert a bent utility flag into insulation. If it is possible to turn, the cavity needs more insulation.

4.1103.2 - Additional Exterior Wall Cavities

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

4.1103.2b - Sealing

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

Specification(s):

Backing will be provided and all newly uncovered openings will be sealed with air barriers, foam, or mastic, maintaining all required clearances

Objective(s):

Ensure the air barrier is connected across all accessible house elements



Unsealed penetrations should be sealed to ensure insulation stays in place

Tools:

1. Caulk gun



Once air barrier has been preserved by sealing, insulation can begin

Materials:

- 1. Caulk
- 2. Backer rod
- 3. Fire-block, when necessary

Spray foam should not be visible from conditioned space.

4.1103.2 - Additional Exterior Wall Cavities

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

4.1103.2d - Quality assurance

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

Specification(s):

Completed wall sections will be verified to be appropriately filled.

Any voids or low density areas will be drilled and re-packed

Objective(s):

Establish air barrier and thermal boundary

Confirm no voids or hidden air flows remain



Unisulated exterior wall cavities to be insulated

Tools:

1. Infrared camera

insulated wall cavities

4.1103.2d - Quality assurance



Depressurize house (if safe) to -50pa wrt outside



Inspect for voids and low density areas



Reduced temperature difference indicating insulated wall cavities
4.1103.2 - Additional Exterior Wall Cavities

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

4.1103.2e - Close holes

Desired Outcome:

Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

Specification(s):

SEE BELOW FOR KS STANDARDS

Installation holes will be plugged as follows:

- · Exterior holes will be weather barrier patched
- · Interior holes will be coated and patched to match original interior surface

All construction debris and dust will be collected and removed

Objective(s):

Ensure house is returned to watertight and clean condition



In Progress

With insulation complete, wall needs to be patched to better-than-found



Patches /plugs will be weather tight.

Tools:

- 1. Taping knife
- 2. Caulk gun
- 3. Drill
- 4. Paint brush

Materials:

- 1. Spackle
- 2. House wrap
- 3. Lath
- 4. Stucco
- 5. Fasteners
- 6. Adhesive
- 7. Primer
- 8. Drywall
- 9. XPS

Follow all applicable KDHE Lead Regulations and SHPO Guidelines.

Exterior:Exterior sidewall work should not result in any visible work areas or plugs. The first priority is for exterior siding to be removed and insulation installed behind. When removal is not possible, the agency/inspector may approve drilling. Where exterior holes are drilled, holes must be finished to match original surface. Patches will be weather tight and finished.

Interior: Interior sidewall work should strive for the hightest quality of finished product. Clients shall be informed and agree to the type of sidewall patching performed. Sheetrock and lath and plaster holes should be finished to provide a smooth, nearly paint ready surface. Minimal to zero sanding is the desire. The use of painted or stained chair rail to cover holes is acceptable. Chair rail will be installed around the full perimeter of the room where appropriate.

The use of plastic plugs will be allowed in garage walls and ceiling, CAZ closets, and other unfinished areas. The use of plugs will also be allowed in manufactured home ceiling and in wood paneling where permission is documented by the client.



For interior access, locate access holes at studs for easier patching



Drywall patches are to be paint ready. For exterior access, use a drop cloth



For exterior access, use a drop cloth or gutter to help with clean up



Plug holes with rigid material that will not move or sag over time



For stucco and plaster patches, lath will need to be used to hold weight



If possible, maintain house wrap, or replace it after holes are plugged



Put siding back in place, or return exterior finish to match remaining wall

4.1301.1 - Standard Floor System—Batt Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.1b - Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Insulation will be installed in contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions

If kraft-faced batts are used, they will be installed with kraft facing to subfloor

Insulation will be installed to prescribed R-value

Objective(s):

Insulate to prescribed R-value



Uninsulated floors above unconditioned spaces are an energy drain

Tools:

- 1. Utility knife
- 2. Tape measure



Batts should fill most of joist bay and be in full contact with subfloor

Materials:

1. Kraft-faced fiberglass batts to work order specifications

KHRC Kansas Housing Resources Corporation and the Kansas Weatherization Network

Floor insulation shall be R-19 unless specified otherwise.

Measure 8 Floor Ins. R-11			Components F1				
Comment			Estimated				
# Material / Labor	Description /Comment	Units	Qty	Unit Cost	Total	G	
1 Insulation	Floor Insulation - Kraft- faced Batts - R-11	SqFt	1180	\$0.22	\$259.60	ļ	
2 Labor	Floor Insulation - Kraft- faced Batts - R-11	SqFt	1180	\$0.35	\$413.00	-	
3 Miscellaneous Su	Floor Insulation - Kraft- faced Batts - R-11	Each	1	\$100.00	\$100.00		

Order and install insulation as called for in Work Order



If precise r-value cannot be purchased, choose option with greater r-value



Install kraft-faced batts with paper against subfloor



Ensure batts are in full contact with subfloor and remain uncompressed

4.1301.1 - Standard Floor System—Batt Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.1c - Securing batts

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Batts will be secured with physical fasteners

Objective(s):

Ensure insulation remains in contact with subfloor



🖷 Before

Fiberglass batts should not be hanging away from subfloor

Tools:

- 1. Utility knife
- 2. Drill
- 3. Staple gun



"Lightning rods" or twine can be used to hold batts in contact

Materials:

- 1. Lightning rods
- 2. Twine
- 3. Fasteners

Best practice is to install supports every 2-3 feet with fasteners within 6 inches of batt ends.



Batt should be in contact with subfloor without being compressed



Twine fastened across bays in a zig-zag pattern can also be used

4.1301.2 - Standard Floor System—Loose Fill with Netting

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.2b - Netting, fabric

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

When using netting or fabric, staples will be placed according to manufacturer specifications

Netting or fabric will meet local fire codes

Objective(s):

Secure insulation



🖷 Before

Uninsulated floors above unconditioned spaces are an energy drain

Tools:

- 1. Utility knife
- 2. Scissors
- 3. Stapler

In Progress

Netting is secured to joists and sills to create cavities for insulation

Materials:

- 1. Fabric netting
- 2. Staples

All penetrations and air sealing locations must be addressed before installing netting.



Secure netting across each joist to create separate cavities



Secure netting across sills to prevent leakage of insulation



Keep netting taut while stapling to prevent wrinkles and leakage



Staples should be kept tightly together, placed no more than 1 1/2" apart

4.1301.2 - Standard Floor System—Loose Fill with Netting

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.2c - Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Insulation in netted or fabric cavities will be dense packed with loose fill insulation in accordance with manufacturer specifications

Insulation will be installed to prescribed R-value

Insulation will be in continuous contact with air barrier

Objective(s):

Insulate to prescribed R-value

Ensure a continuous thermal boundary between conditioned and unconditioned space



In Progress With netting in place, insulation can begin



Cavities filled to manufacturer specs to achieve prescribed r-value

Tools:

1. Utility knife

- Materials:
- 1. Loose fill fiberglass or cellulose
- 2. Insulation machine

The insulated cavity will be completely filled. Holes must be patched or repaired to prevent fill insulation from falling out.

Measure 7 Floor Ins. R-30			Components F1			
Comment			Estimated			
# Material / Labor	Description /Comment	Units	Qty	Unit Cost	Total	
1 Insulation	Floor Insulation - Net & Fill - R-30	SqFt	1180	\$0.59	\$696.20	
2 Labor	Floor Insulation - Net & Fill - R-30	SqFt	1180	\$0.35	\$413.00	
3 Mucellaneous Su	Floor Insulation - Net & Fill - R-30	Each	1	\$100.00	\$100.00	

Order and install insulation based on specifications in work order



Always wear proper PPE when blowing in insulation



Cut holes in each individual cavity to insert insulation machine nozzle



Ensure that hole is large enough for nozzle without allowing for outflow



Consult manufacturer specs on insulation packaging for proper installation



Blow in insulation to prescribed r-value

4.1301.5 - Cantilevered Floor—Batt Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.5a - Air barrier

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Air barrier will be installed between joists and sealed

Air barrier will be placed to the most interior edge of the top plate of the wall below

Objective(s):

Separate cantilevered floor from conditioned floor space

Allow for insulation



Cavities are open allowing unconditioned air to communicate within the space between floors.



Cavity has been blocked, sealed, and insulated. Rigid air barrier is hidden behind insulation in this photo

Tools:

- 1. tape measure
- 2. utility knife
- 3. flashlight
- 4. caulking gun
- 5. foam gun

Materials:

- 1. rigid air barrier (plywood, OSB,
- drywall, rigid foam board)
- 2. caulk or foam sealant
- 3. dense-pack cellulose or fiberglass insulation
- 4. batt insulation
- 5. two-part spray polyurethane foam
- (optional)

Install insulation at the required R-value in permanent contact with the subfloor under the cantilevered section.

Use finished plywood for exposed cantilevered floor areas such as under an elevated back porch.

4.1301.5 - Cantilevered Floor—Batt Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed Rvalue of an adjoining insulated assembly

4.1301.5b - Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Air barrier will be insulated between joist from top plate of the wall below to subfloor above

Cantilevered subfloor will be insulated in complete contact with the floor without gaps, voids, compressions, misalignments, or wind intrusions

If kraft-faced batts are used, they will be installed with kraft facing to the air barrier

Insulation will be installed to prescribed R-value

Objective(s):

Insulate to prescribed R-value



Cavities are open and subfloor of conditioned space above is uninsulated.



Batt insulation is installed to either fill the cavity or be properly supported to maintain contact with the subfloor.

Tools:

- 1. drill
- 2. mechanical fastners
- 3. claw hammer or pry bar

Dense pack insulation is also an acceptible alternative. Also see 4.1301.5a.



Cavities are open and subfloor of conditioned space above is uninsulated.



Materials:

2. insulation supports

1. batt insulation - kraft-faced or unfaced

Insulation R-value to be installed matches the work order.



Here the worker is removing the kraft facing, which may be needed in some areas.



Ensure the batt is positioned correctly.



Batt insulation is installed to either fill the cavity or be properly supported to maintain contact with the subfloor.

4.1301.5 - Cantilevered Floor—Batt Installation

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

4.1301.5c - Attachment

Desired Outcome:

Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):

Batts will be secured with physical fasteners

Objective(s):

Ensure insulation remains in contact with subfloor and air barrier



🖷 Before

Insulation should be secured to prevent drooping or movement

Tools:

- 1. Utility knife
- 2. Drill
- 3. Staple gun



"Lightning rods" or twine should keep full contact with the subfloor

Materials:

- 1. Lightning rods
- 2. Twine
- 3. Fasteners

Cantilevered Floors should be inspected for insulation and treated just like a framed floor. Batt or dense pack insulation are acceptable.



Batts should have full contact with subfloor without being compressed



Twine fastened across bays in a zig-zag pattern can also be used

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

4.1401.1a - Preparation

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

Specification(s):

All band/rim joist areas will be open and accessible for SPF application

All surfaces where SPF is applied will be clean, dry, and free of contamination and degradation

Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt

Grease and oil will be removed using appropriate cleaners or solvents

Moisture content of all wood substrate materials will be checked to ensure it is below 20%

Objective(s):

Prepare all substrate surfaces for the application of SPF

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

4.1401.1b - Installation

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

Specification(s):

SPF will be applied to desired thickness, using pass thickness maximum in accordance with manufacturer specifications, onto subfloor between floor joists and all rim/band joists

When applied to first floor,SPF will be continuous from subfloor surface, over band/rim joist and sill plate, and in contact with foundation below, except as stipulated by classification 4.1402.1c

When applied to second story floor or above,SPF will be continuous from subfloor surface, over band/rim joist, and in contact with top plate below

Objective(s): Insulate and seal floors

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

4.1401.1c - Fire protection

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

Specification(s):

If SPF exceeds a thickness of 3", all SPF will be separated from the occupied interior space of the building with an approved thermal barrier material (typically $\frac{1}{2}$ " or thicker gypsum wallboard or an approved thermal barrier coating)

Application to rim/band joist up to 3" can be left exposed if the foam is Class I, unless the space is a habitable space and then cover it with drywall or another thermal barrier

Local codes will be confirmed and followed for fire protection requirements

Objective(s):

Provide necessary fire protection for combustible SPF insulation

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

4.1401.1d - Onsite documentation

Desired Outcome:

Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1401.2 - Band/Rim Joists – Insulation other than Spray Polyurethane Foam

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

4.1401.2a - Preparation

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

Specification(s):

The rim joist, sill plate and adjacent surfaces will be sufficiently clean and free of debris to allow for the proper adhesion of any caulks, adhesives or spray foam used during installation.

Objective(s):

Prepare all surfaces for the installation of insulation

4.1401.2 - Band/Rim Joists – Insulation other than Spray Polyurethane Foam

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

4.1401.2b - Insulation installation

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

Specification(s):

A foam-based insulation will be installed so as to create a continuous thermal and pressure boundary or vinyl faced fiberglass batt insulation, installed tightly to the wood and sealed at all edges. If rigid insulation is used, all edges will be sealed and the insulation will be installed tightly to the wood to prevent the movement of moisture throughout the assembly. Insulation will be installed in accordance with local/national code requirements and/or manufacturer's instructions regarding flame spread

Objective(s):

Improve thermal performance Prevent moisture condensation on the inside of the band joist

4.1402.1 - Closed Crawl Spaces—Wall Insulation

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

4.1402.1a - Insulation selection

Desired Outcome:

Closed crawl spaces insulated to achieve best thermal performance possible

Specification(s):

A fire-rated insulation (25 or less flame spread or Class I or Class A) will be used with a minimum life expectancy of 10 years

Objective(s):

Provide fire-safe, durable insulation that will not exacerbate moisture issues in the crawl space



Crawlspace Wall, clean,dry, ground moisture barrier installed and sealed

Tools:

- 1. tape measure
- 2. knife
- 3. straight edge
- 4. stapler/mechanical fasteners



Batt insulation installed smooth, without gaps or voids, stapled in place

Materials:

- 1. Batt Insulation
- 2. Mechanical Fasteners/staples

R-19 fiberglass batt insulation may also be used. R-19 vinyl-faced, metal building insulation or wall batt insulation may be used. Insulation should be attached to the entire wall surface with appropriate fasteners. Install insulation with no significant voids or edge gaps. Foundation insulation will only be used in conjuction with a ground moisture barrier. Draped insulation shall extend down the wall and

extend 1 foot from the wall along the ground.



Ensure Crawlspace is dry. Install and seal ground moisture barrier.



Cutt Batts to fit around joists. Extend insulation 1 foot from wall.



Corners are lapped to provide full coverage

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

4.1601.2a - Selection of duct insulation material

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Duct insulation on all ducts located in unconditioned spaces will be a minimum of R-8, in accordance with local code, or buried under attic insulation, whichever is greater, and have an attached vapor retarder

Hot humid and warm coastal regions will not bury ducts

Objective(s):

Decrease heat loss and condensation problems



🖷 Before

Uninsulated ducts in unconditioned spaces are an energy drain



Properly insulated ducts operate at much higher rates of efficiency

Ductwork will be sealed (see SWS 4.1601.2b) before being insulated. Sealing and insulating ductwork is considered a general heat waste measure and should be performed whenever the ductwork is outside of the conditioned volume of the home. Ductwork is generally, not insulated inside the conditioned volume.



Ducts in unconditioned areas should have r-8 insulation with vapor barrier



OR ducts can be buried in loose fill in attic spaces in drier climates

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

4.1601.2b - Duct sealing

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

All joints, seams, and connections in ductwork shall be securely fastened and sealed with UL 181 B-M mastics (adhesives) or mastic- plus-embedded-fabric systems installed in accordance with the manufacturer's instructions before insulation is applied

Objective(s):

Minimize duct leakage



- Belole

Unsealed joints and connections need to be sealed to prevent health risks

Tools:

1. Putty knife



Sealed ductwork connections help prevent leakage

Materials:

- 1. Mesh tape
- 2. Mastic

Ductwork will be sealed before being insulated. Ductwork will also be sealed inside the conditioned volume of the home where excessive leakage or pressure differences are a concern.







Prepare work area by assessing any safety concerns

Wrap joint with fiberglass mesh tape

Apply UL 181 mastic to seal joint

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

4.1601.2c - Attachment of duct insulation

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Duct insulation will be secured to the duct system using metal wire or rot-proof nylon twine

Pattern of the wire or twine will be sufficient to securely hold the duct insulation tight to the duct

Objective(s):

Ensure a secure connection between the duct system and the duct insulation



After

Durable materials can be attached without

Materials holding insulation in place should not compress or kink duct

Tools:

- 1. Scissors
- 2. Metal snips

Materials:

- 1. Nylon twine
- 2. Wire

compressing insulation

3. Tie bands

Plastic cable ties are allowed. Ensure insulation is not compressed.

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

4.1601.2d - Taping of the duct insulation

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Using a tape approved by the manufacturer, all seams and connection of the duct insulation will be taped

No gaps will exist between pieces of duct insulation

Objective(s):

Prevent gaps in the vapor barrier of the insulation



Unsecured and sealed insulation around ducts is useless

Tools:

1. Utility knife



All seams should be sealed with UL-181 duct tape to preserve vapor barrier

Materials:

- 1. UL-181 tape
- 2. R-8 duct insulation with vapor barrier

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10a - Connection

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Connections in condensate drain system will be watertight

Objective(s):

Ensure condensate drain connections do not leak



Refore

HVAC equipment needs condensate drainage to prevent water damage

Tools:

- 1. Hacksaw
- 2. Crimper



Drainage pipes should be sealed to be watertight

Materials:

- 1. Pex piping and angles
- 2. PVC piping and angles
- 3. Purple primer and PVC Cement

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10b - Insulation

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Condensate drainlines will be insulated with a minimum 1" of insulation with a vapor retarder when there is potential for condensation or freezing on the drainline

Objective(s):

Ensure condensate drain connections do not leak



Before

Once drainage pipes cross into unconditioned space, they can freeze

Tools:

- 1. Tape measure
- 2. Utility knife



After

Pipes in unconditioned spaces should be insulated with 1" pipe insulation

Materials:

- 1. 1" thick pipe insulation
- 2. Zip ties

Heat tape is recommended as best practice and required by some manufacturers for warranty compliance when installed outside the conditioned space.

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10c - Overflow protection: upflow

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Secondary drain pan and float switch will be installed when overflow could damage finished surfaces

OR

Float switch in the primary condensate drain for upflow systems will be installed when overflow could damage finished surfaces

Objective(s):

Ensure condensate drain connections do not leak



A float switch should be installed to prevent overflow and damage

This speficiation will only apply when installing new units. Typically a requirement of units installed in attics over living spaces. Install per manufacturer installation specifications.

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10d - Pumps

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Condensate drain pumps will be installed when condensate cannot be drained by gravity

Power source for pump will be installed

Operation and drainage of pump will be verified

Objective(s):

Ensure condensate drain connections do not leak





HVAC equipment that drains upward through a roof cannot drain naturally

For non-gravity draining systems, a pump is necessary

Install per manufacturer installation specifications and local codes where applicable.


HVAC unit is mounted to "historic" adobe wall which cannot be penetrated



Instead, unit is drained by utilizing a pipe and pump in the next room



The pump is connected directly into the sewage system

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10e - Vents and traps

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Vents and traps will be installed on condensate drainlines

Trap supplied with the equipment will be used and manufacturer specifications will be followed

Objective(s):

Ensure condensate drain operates as designed

Ensure condensate drain does not leak air

This will apply to new installations only, not retrofiting exisiting units.

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10f - Drain pan

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Condensate from all cooling coils or evaporators shall be conveyed from the drain pan outlet to an approved place of disposal

Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1% slope)

Condensate shall not discharge into a street, alley, or other areas where it would cause a nuisance

Objective(s):

Prevent water damage from drain system malfunction

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10g - Float switch

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

All secondary drain pans will have a float switch and be drained away through a drainline

Objective(s):

Prevent water overflowing the pan and draining onto the ceiling below



Float switches should be installed in drainage pans to prevent overflow

This specification will only apply when installing new units. Install per manufacturer installation specifications. See 5.3003.10c.

Desired Outcome:

Equipment and condensate drain operate as designed

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

5.3003.10h - Termination

Desired Outcome:

Equipment and condensate drain operate as designed

Specification(s):

Condensate drain will be terminated in accordance with local codes

Objective(s):

Ensure condensate does not leak to the house

Ensure condensate drain does not freeze

5.3003.14 - Combustion Analysis of Gas-Fired Appliances (LP and Natural Gas)

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

5.3003.14b - Place appliance in operation

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

Heating equipment will be placed in operation in accordance with applicable <u>NFPA</u> standards and manufacturer specifications when available

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable



Best Practice

Only place appliances in operation that are installed to manufacturer specification and have passed combustion testing

6.6002.1 - Ducts

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

6.6002.1a - Duct design and configuration

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Ventilation ducts will be as short, straight, and smooth as possible

Ventilation ducts will not be smaller than the connections to which they are attached

Objective(s):

Effectively move the required volume of air



Duct work for exhaust fans should be short, smooth, and not pinch down

<image><image>

Duct is the same size as the outlet and makes shortest run possible

Tools:

- 1. Metal snips
- 2. Drill

- Materials:
- 1. Metal duct piping
- 2. Fasteners

See ASHRAE 62.2-2016 regulations. All ductwork requirements about air sealing, being as straight as possible, being supported, and being insulated will apply to exhaust fans. When applicable, pitch duct to remove condensation to outdoors. Duct diameter will be equal to or greater than the exhaust fan outlet.

6.6002.1 - Ducts

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

6.6002.1e - Duct materials

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Flexible materials will be UL 181 listed or Air Diffusion Council approved

The metal gauge of rigid kitchen fan ducting shall meet code requirements or the approval of the authority having jurisdiction.

Objective(s):

Effectively move the required volume of air

Preserve the integrity of the duct system



Bad Practice

Existing duct is installed incorrectly and is not UL listed



Best Practice

This flexible duct conforms to UL 181

Materials:

- 1. All materials should be UL 181 Listed
- 2. 30-gauge minimum Rigid Duct







Look for the Air Diffusion Council seal.

Flex installed should meet or exceed UL181.

When rigid duct is being used, its wall thickness should be 30 gauge minimum.

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2b - Termination fitting

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

A termination fitting with an integrated collar will be used

Collar will be at least the same diameter as the exhaust fan outlet; if collar is larger than exhaust fan outlet, a rigid metal transition will be used

Fitting will be appropriate for regional weather conditions and installation location on house so as not to be rendered inoperable

Objective(s):

Effectively move the required volume of air to the outside

Preserve integrity of the building envelope

Ensure durable installation



Termination fittings with no collars are not allowed

Tools:

1. Drill

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Use a termination fitting with integrated collar

Materials:

1. Fasteners

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Gable venting locations are ideal where a standard dryer type termination can be applied. Where venting through the roof is required, a collared fitting specifically for exhaust fans shall be used. A hole no greater than a 1/4 inch larger than the fitting will be cut to accommodate termination fittings. All new and existing exhaust fans will be vented to the exterior.

Use a termination fitting with integrated collar such as Broan's roof cap 636 and additional duct collar (or kit RVK1A) or similiar style.



BAD: Termination fittings without collars should be avoided



Termination fittings with collars should Collared fittings extend through the be used for exhaust ventilation



roof to fasten securely with duct



BAD/REWORK: Do not attach ducting to roof decking without a collar. A integrated collar must be used.

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2c - Duct to termination connection

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

Duct will be connected and sealed to termination fitting as follows:

- Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws
- Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes
- Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool
- · PVC-to-PVC materials will be fastened with approved PVC cement
- Other specialized duct fittings will be fastened in accordance with manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

Fasteners will not inhibit damper operation

Objective(s):

Effectively move the required volume of air to the outside

Preserve integrity of the building envelope

Ensure durable installation



Refore

Termination is not mechanically fastened, or sealed appropriately.

Tools:

- 1. wire cutter
- 2. chip brush
- 3. zip tie tension tool
- 4. utility knife



After

Termination fitting is secure, and duct is sealed to termination.

Materials:

- 1. insulated flex duct with liner
- 2. UL 181 sealant
- 3. zip tie straps
- 4. PVC primer
- 5. PVC cement



With other end of the duct connected to the fan, cut duct to desired length.



Apply mastic to termination fitting.



Fit duct liner on to termination fitting.



With duct liner in place, use the zip tie



With liner secured and zip tie



Ensure termination damper functions

tension tool to secure the liner to the fitting.

trimmed, you are ready to pull the insulation to cover the fitting.

as intended.



Round metal-to-metal connections require fiberglass mesh tape and 3 mechanical fasteners minimum.



PVC-to-PVC connections should use PVC primer and cement.



Sealants should be UL181-M or UL181B-M listed.

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2d - Weatherproof installation

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

Exterior termination fitting will be flashed or weather sealed

Water will be directed away from penetration

Installation will not inhibit damper operation

Manufacturer specifications will be followed

Objective(s):

Preserve integrity of the building envelope

Ensure a weather tight and durable termination installation

Ensure unrestricted air flow



Holes for termination fitting need to be sealed to weatherproof



Termination installation should follow shingling to deter water penetration

Tools:

- 1. Hole saw
- 2. Caulk gun
- 3. Drill



Termination fitting is installed to repel water and sealed

Materials:

- 1. Fasteners
- 2. Caulk

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2e - Pest exclusion

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

Screen material with no less than 1/4" and no greater than 1/2" hole size in any direction will be used

Installation will not inhibit damper operation or restrict air flow

Objective(s):

Prevent pest entry

Ensure proper air flow



Exhaust terminations without screens are an invitation to pest intrusion



Screen mesh should be between 1/4" and 1/ 2" in either direction

Screen material required on new installations. Recommended installation on existing terminations but not required.

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2f - Termination location

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

Terminations will be ducted to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors.

Terminations will be installed:

- · A minimum of 3' away from any property line
- · A minimum of 3' away from operable opening to houses
- A minimum of 10' away from mechanical intake
- · As required by authority having jurisdiction

Objective(s):

Prevent exhaust from reentering house



Exhaust vent has been improperly mounted too close to mechanical vent



Exhaust vent was properly mounted over 3ft from door, window, and deed line

Tools:

- 1. Measuring tape
- 2. Hole saw
- 3. Drill

Gable venting locations are ideal where a standard dryer type termination can be applied. Where venting through the roof is required, a collared fitting specifically for exhaust fans shall be used. If proper clearance can't achieved, document reasons why in the client file.

6.6002.2 - Terminations

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

6.6002.2g - Kitchen exhaust

Desired Outcome:

Securely installed termination fittings with unrestricted air flow

Specification(s):

Galvanized steel, stainless steel, or copper will be used for termination fitting for kitchen exhaust

Objective(s):

Prevent a fire hazard



Kitchen exhaust vents should not be made from highly combustible materials



This roof-mounted kitchen exhaust fan is galvanized steel--heat resistant

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3a - Hole in building shell

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

A hole no greater than a 1/4 inch greater than the assembly will be cut to accommodate fan assembly

Objective(s):

Allow for ease of weatherproofing



🖷 Before

Determine size to cut hole by measuring fan assembly and ducting



A snug fit should be ensured to minimize weatherproofing required

Tools:

- 1. Tape measure
- 2. Saw



Measure the termination fitting to determine proper hole diameter (in this larger than assembly diameter case, 4")



Hole should be no more than 1/4"



Clear wall surface and mark hole size 1/4" larger than termination fitting



Since opening is larger than most hole saws, precision cutting is important

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3b - Wiring

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Objective(s):

Prevent an electrical hazard



Incorrect: disconnected ground, no wire nuts on splices, no clamp on wires passing

through junction box



Fan junction box with cover installed

Tools:

- 1. Wire strippers
- 2. Utility knife or cable ripper
- 3. Screwdriver
- 4. Non-contact voltage tester
- 5. Lineman's pliers

Materials:

- 1. Ground wire crimp sleeves
- 2. Non-metallic sheathed wire (Type NM-
- B) e.g., Romex ®
- 3. Plastic junction box and cover plate
- 4. Wire nuts
- 5. Cable staples
- 6. Clamp-type cable connectors

Follow manufacturer's specifications and applicable codes when wiring newly installed equipment.



Inspect for: proper ground, wire nuts on splices, clamps on wiring where it enters junction box, cover installed on box



Install clamp on wiring into junction box



Install wire nuts on splices



Use crimp sleeves to connect ground wires



Tuck wiring into place



Reinstall cover on junction box

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3e - Backdraft damper

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

A backdraft damper will be installed between the outlet side of the fan and the exterior

Objective(s):

Prevent reverse air flow when the fan is off



Damper should be installed to maintain exterior air barrier

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3g - Fan to interior surface seal

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

Sealants will be compatible with their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Objective(s):

Prevent air leakage around intake housing

Prevent a fire hazard



Sealant should be waterproof and adhere to desired surfaces.



Sealant should be applied to the fan housing where it comes in contact with the exterior wall.

Seal the inlet and the outlet to make weathertight and to reduce unintended infiltration.

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3h - Insulation

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

All components outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local code

Exception: If system operates continuously, fan housing need not be insulated

Objective(s):

Preserve integrity of the duct system

Best practice is bury the fan and components under insulation.

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3i - Air flow

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

Air flows in CFM will be measured and adjusted to meet the design requirements

Objective(s):

Exhaust sufficient air from desired locations to outside





Using a digital manometer, exhaust flow Air flow should be within acceptable limits for the location of the fan. flow.

Tools:

- 1. exhaust fan flow meter
- 2. manometer

Materials:

1. a fabricated cover for fans larger than the flow meter



The exhaust fan flow meter won't fit most range hoods. A fabricated cover is needed.



A fabricated cover can be used so long as the opening is smaller than the meter itself and larger than the E1 opening.



Attach a pressure hose to the exhaust fan flow meter.



Attach a the hose to a T connection on With manometer properly set up, channels A & B with the manometer set to measure exhaust fan flow.



prepare to test air flow



Fans must pull the required CFM according to ASHRAE.

Desired Outcome:

Through the wall fans installed to specification

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

6.6003.3k - Combustion safety

Desired Outcome:

Through the wall fans installed to specification

Specification(s):

Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Make-up air will be provided in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction.

Objective(s):

Ensure safe operation of combustion appliances



Before

Installing new ventilation can cause imbalances within the house

Tools:

1. Manometer



Test that depressurization limit is not being exceeded by new ventilation



Run depressurization testing on house to ensure new ventilation isn't causing unsafe conditions



If depressurization limit is exceeded, mitigate to eliminate safety risk



Mitigate safety risk with make-up air or other pressure relief



After mitigation, verify that depressurization limits are not being exceeded

6.6005.1 - Clothes Dryer

Desired Outcome:

Dryer air exhausted efficiently and safely

6.6005.1a - Clothes dryer ducting

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Clothes dryers will be ducted to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

As short a run as practical of rigid sheet metal or semi-rigid sheet metal venting material will be used in accordance with manufacturer specifications

Dryer ducts exceeding 35' in duct equivalent length will have a dryer booster fan installed

Plastic venting material will not be used

Uninsulated clothes dryer duct will not pass through unconditioned spaces such as attics and crawl

spaces, except where allowed by the authority having jurisdiction-Variance approved

Ducts will be connected and sealed as follows:

- UL listed foil type or semi-rigid sheet metal to rigid metal will be fastened with clamp
- Other specialized duct fittings will be fastened in accordance with manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

In addition:

- · Sheet metal screws or other fasteners that will obstruct the exhaust flow will not be used
- Condensing dryers will be plumbed to a drain

Objective(s):

Preserve integrity of building envelope

Effectively move air from clothes dryer to outside



Pefore

Dryer is vented outside, but with the incorrect material.



Dryer is vented outdoors, with correct material. Run is as short and straight as possible ensuring maximum flow.

Tools:

- 1. metal trimmers
- 2. drill

Materials:

- 1. metal flex duct
- 2. dryer vent kit
- 3. hose clamps



Disconnect existing vent pipe from termination. If hose clamp is installed, save for reuse.



Disconnect existing vent pipe from dryer.



Attach approved vent material to termination vent. Termination vent may need to be trimmed.





Trim metal vent to ensure the run is as Connect vent pipe to dryer. short and straight as possible.



Dryer vents to outdoors, and exhaust damper is functional.



For vent runs >35 feet, a booster fan is required.

6.6005.1 - Clothes Dryer

Desired Outcome:

Dryer air exhausted efficiently and safely

6.6005.1b - Termination fitting

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Termination fitting manufactured for use with dryers will be installed

A backdraft damper will be included, as described in termination fitting detail

Objective(s):

Preserve integrity of building envelope

Effectively move air from clothes dryer to outside

6.6201.2 - Primary Ventilation Air Flow between Rooms

Desired Outcome:

Air circulates freely between rooms

6.6201.2a - Balancing pressure

Desired Outcome:

Air circulates freely between rooms

Specification(s):

An appropriate means of pressure balancing will be installed (e.g., transfer grilles, jumper ducts, individual room returns)

No room will exceed +/- 3 pascals with reference to the common area with all interior doors closed and ventilation systems running

Objective(s):

Ensure free flow of air between rooms

Preserve integrity of the building envelope





If reading is >+/-3pa, interior ventilation needs to be installed

Passive door vents and individual room returns are two possibilities

This specification only applies when installing new whole-house ventilation systems.

Best practices dictates testing rooms with ventilation systems first, then proceed as necessary.




With interior doors open, put reference Take baseline reading hose to exterior



Turn on exhaust fans and close interior doors



With hose under door, check pressure again. Readings >+/-3pa are no good and require interior ventilation

7.8001.1 - Refrigerator and Freezer Replacement

Desired Outcome:

A more energy efficient appliance installed

7.8001.1a - Selection

Desired Outcome:

A more energy efficient appliance installed

Specification(s):

Appliance shall be ENERGY STAR® qualified or at least as energy efficient

Appliance will fit in the available space without blocking access to light switches, cabinets, etc.

Appliance will carry a minimum one-year warranty that will provide a replacement appliance if repeated issues relating to health, safety, or performance occur

Objective(s):

Ensure occupant satisfaction with appliance

7.8003.1 - Lighting Upgrade

Desired Outcome:

Energy used for lighting reduced while maintaining adequate and safe lighting levels

7.8003.1b - Selection

Desired Outcome:

Energy used for lighting reduced while maintaining adequate and safe lighting levels

Specification(s):

All bulbs, fixtures, and controls will be appropriate for the intended application (e.g., enclosed, orientation, dimmable, potential for breakage, indoor, and outdoor)

All bulbs, fixtures, and controls will be selected to provide the brightness and light quality required in that application (e.g., task lighting, trip-and- fall hazards, nightlights)

Selected equipment should have the highest level of efficiency within a technology [e.g., compact fluorescent lamp (CFL), LED]

All bulbs, fixtures, and controls will be ENERGY STAR® rated where applicable

When possible, bulbs, fixtures, and controls will be selected that will facilitate the use of future lighting technologies (e.g., LEDs)

When incandescent bulbs cannot be replaced or when occupant chooses not to replace, a dimmer will be selected

Light/lamp wattage should not exceed rated wattage of fixture

Bulb replacements will be chosen based on expected durability, light quality, and lifetime energy use of the bulb

Controls to turn off lights when not needed (e.g., no one in room) will be provided

All bulbs, fixtures, and controls will be UL-approved and installed in accordance with local code(s) and NFPA 70 National Electric Code

Fluorescent light ballasts containing polychlorinated biphenyls (PCBs) will be replaced in accordance with the EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades

Objective(s):

Provide improved lighting quality at lower energy use

Select equipment that will not be an unnecessary barrier to future technologies

Avoid inferior products and unsatisfied occupants

CFL or LED bulbs may replace incandescent bulbs. Replacement bulbs should closely match the lumen output and color spectrum. Generally, a 800 lumen, omni-directional bulb with 3,000 Kelvin color temperature is the appropriate replacement for a 60 watt incandescent.

7.8101.1 - Shower Head and Faucet Aerator

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8101.1b - Selection

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Specification(s):

The rated flow of new shower heads will be 2.5 gallons per minute (GPM) or less

If multiple heads are provided, the total flow rate will not exceed 2.5 GPM

Aerator flow rate will be 2.2 GPM or less

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Reduce water and energy consumption

Ensure occupant satisfaction

Low flow showerheads shall be 2.0 gpm and shall not be a mister style. Kitchen aerators will be 1.5 gpm and shall not be a needle style. Bath aerators may be 1.0 to 1.5 gpm and shall not be a needle style.

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2b - Equipment removal

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Accepted industry procedures and practices will be followed to:

- Remove old water heater and associated components in accordance with IRC or authority having jurisdiction
- Seal any unused chimney openings and penetrations in accordance with IRC or authority having jurisdiction
- Remove unused oil tank, lines, valves, and associated equipment in accordance with IRC or authority having jurisdiction

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2c - New equipment installation

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

New water heater and associated components will be installed to accepted industry standards, in accordance with the IRC and manufacturer specifications

The system will be installed to be freeze resistant

Any existing water leaks will be repaired before installation begins

Any penetrations to the exterior of the home created by the installation of the equipment will be sealed

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2d - Emergency drain pan

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

An emergency drain pan and drain line shall be installed in accordance with the IRC

Objective(s):

Collect and safely dispose of water escaping from the storage tank

Emergency drain pans will be installed with newly installed water heaters only.

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2e - Expansion tank

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Expansion tanks will be installed on weatherization installed water heaters where required and in accordance with the AHJ

Objective(s):

Protect the storage tank from expansion



Expansion tank installed on the cold inlet side.

Expansion tanks will be installed with newly installed water heaters only.

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2f - Temperature and pressure relief valve

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Correct temperature and pressure relief valve will be installed in compliance with IRC and according to manufacturer specifications

Temperature and pressure relief valve discharge tube will be installed in accordance with IRC

Objective(s):

Discharge excessive energy (pressure or temperature) from storage tank to safe location



Part Before

Water heaters should be not capped off at t&p valve

Tools:

- 1. Pipe wrench
- 2. Hacksaw

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T&P discharge should be piped to a safe and observable location

Materials:

- 1. PVC
- 2. Plumber's epoxy
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Check local jurisdictional codes. Paraphrased from 2012 IRC P2803.6.1: Temperature and pressure relief valve discharge pipes should not be connected to drainage system. T&P discharge pipes should be a clean line without valve or tee, flowing with gravity to an observable and safe location that cannot cause personal injury or structural damage -- the floor, an existing drain pan, a waste receptor, or to the outdoors. Pipe should not terminate more than 6" from floor, pan or waste receptor.

Temperature and pressure relief valves will be installed with newly installed water heaters only.



GOOD: T&P discharge should be piped within 6" of the floor or to outdoors



BAD: T&P discharge should flow with gravity and be observable



BAD: T&P discharge should not be piped into drainage system

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2i - Thermal efficiency

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

If additional tank insulation is installed, it will be rated a minimum of R-11 and will be installed to manufacturer specifications

If additional insulation is installed, it will be installed based on fuel type, making sure not to obstruct draft diverter, pressure relief valve, thermostats, hi-limit switch, plumbing pipes or elements, and thermostat access plates

The first 6' of inlet and outlet piping will be insulated in accordance with manufacturer specifications

Combustible pipe insulation must maintain a minimum clearance of 6" from gas water heater draft hood and/or single wall metal pipe. Clearance from vent such as "B" vent should be maintained per vent manufacturer's specifications

Heat traps will be installed on the inlet and outlet piping where not provided by manufacturer

Objective(s):

Reduce standby loss from near tank piping and storage tank

Ensure insulation does not make contact with flue gas venting

Heat traps will be installed on newly installed water heaters only. Water heater blankets should be installed where allowed by the manufacturer and by policy. Blankets should be smooth and permanently secured to ensure insulation does not come loose. A piece of string or cable tie near the top and the bottom is best practice to support any tape.

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note:

The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

7.8102.2k - Discharge temperature

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Discharge temperature will be set not to exceed 120° or as prescribed by local code

Objective(s):

Ensure safe hot water supply temperature to fixtures



Water heaters producing water over 120 degrees raise heating costs



Water heaters should produce water under 120 degrees to prevent scalding

Tools:

1. Thermometer



Test temperature of hot water at faucets in house



Hot water temperatures should not exceed 120 degrees Fahrenheit

Adjust water heater settings and insulate as needed



After adjustment and insulation, retest to verify temp is under 120 degrees

3.1101.1c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

All holes and penetrations on exterior surface of exterior walls will be sealed to ensure resistance to outdoor elements

Intentionally ventilated walls will not be sealed at vent locations (e.g., weep holes)

All holes and penetrations on the interior surface of exterior walls will be repaired

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected load

Ensure sealant is effective and durable

NOTE: Bypasses are holes and gaps in the air barrier. The approach to sealing these holes depends on the size, location, and surrounding material. Cracks and gaps can be sealed with appropriate sealants and materials. Large holes may need to be covered with strong patching materials. Patching material should be selected based on the surrounding material. These materials should be attached with mechanical and/or adhesive bongs and sealed. Paintable sealants and materials and materials should be used where appropriate.

4.1005.8a

Desired Outcome:

Insulation controls heat transfer through ceiling

Specification(s):

New insulation will not be added until all air sealing has been completed

Existing insulation will be inspected to confirm that it is not concealing air barrier weaknesses and is in full contact and alignment with the air barrier

Where the insulation is disturbed or found not to be in contact with the air barrier, it will be reinstalled to be in contact with the air barrier; if it cannot be reinstalled or if its condition compromises its effectiveness, the insulation will be removed

Insulation will be adequately marked for depth a minimum of every 300 square feet of attic area with measurement beginning at the air barrier

All electrical junctions will be flagged to be seen above the level of the insulation

Open electrical junction boxes will have covers installed

Insulation dams and enclosures will be installed as required

Blocking will be installed to maintain existing vented attic functionality

Objective(s):

Ensure proper performance of insulation

Verify uniformity of insulation material

Provide location of electrical junctions for future servicing

Prevent an electrical hazard



Accessible attic floors should be air sealed and insulated



Depth markers and insulation dams aid in

Tools:

- 1. Pry Bar
- 2. Hammer
- 3. Caulk gun
- 4. Utility knife
- 5. Staple gun
- 6. Spray foam gun
- 7. Tape measure

Materials:

proper insulation of attic spaces

- 1. Flags
- 2. Depth markers
- 3. Staples
- 4. XPS
- 5. Caulk
- 6. Spray foam
- 7. Junction box covers

NOTE: Blown depth most result in settled depth and density to achieve appropriate R-Value.

4.1005.8a - Preparation







Seal and penetrations





Non-IC can lights should be covered with a damn and have no insulation on top

Install depth markers and insulation dams above height of insulation

4.1005.8b

Desired Outcome:

Insulation controls heat transfer through ceiling

Specification(s):

The correct depth and number of bags will be blown in accordance with manufacturer specifications

Insulation will be installed to prescribed R-value

Final R-value will account for the compression of existing insulation

Objective(s):

Insulate to prescribed R-value



Check chart on product to ensure proper insulation depth to achieve R-value

Tools:

1. Insulation machine



Use depth markers to ensure insulation has reached prescribed R-value

Materials:

- 1. Loose fill insulation
- 2. Insulation Depth Sticks

Final product must achieve uniform R-value throughout area. Insulation R-sticks are to be used to ensure a level product and allow for visual inspection. Allow for plenty of extra material to ensure settled depth is adequate.

4.1005.8d

Desired Outcome:

Insulation controls heat transfer through ceiling

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
- · Installed thickness and minimum settled thickness
- Number of bags installed in accordance with manufacturer specifications
 Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area completed

Comply with 16 CFR 460.17



Best Practice

Information on insulation installed should be posted nearby



Posted info includes insulation type, r-value, settled depth, coverage area, etc

NOTE: An Insulation Certificate must be placed in the attic in a visible location. This documentation is required for all applications of additional insulation

Paraphrased from 16 CFR 460.17: If you are an installer, you must give your customers a contract or receipt for the insulation you install. For loose-fill, the receipt must show the coverage area, initial installed thickness, minimum settled thickness, R-value, and the number of bags used. To figure out the R-value of the insulation, use the data that the manufacturer gives you. The receipt must be dated and signed by the installer.