



TRADES & CRAFTS

Professional tips for fast and easy installation

On the following pages you will find step-by-step, easy-to-follow illustrated instructions for implementing key energy efficiency technologies.

These *Building Tips* are designed to be easily duplicated and distributed.

- Slab
- Housewrap
- Window Flashing
- Air Sealing - Plumbing
- Air Sealing - Electrical
- Air Sealing - Drywall
- Air Sealing - Glossary
- Fiberglass Insulation
- Masonry Construction
- Radiant Barriers
- Duct Sealing

INTRODUCTION

Taking action in your community



HOMEOWNERS

Shopping for value, comfort, and quality



MANAGERS

Putting building science to work for your bottom line



MARKETERS

Energy efficiency delivers the value that customers demand



SITE PLANNERS & DEVELOPERS

Properly situated houses pay big dividends



DESIGNERS

Well-crafted designs capture benefits for builders, buyers, and business



SITE SUPERVISORS

Tools to help with project management



TRADES & CRAFTS

Professional tips for fast and easy installation

CASE STUDIES

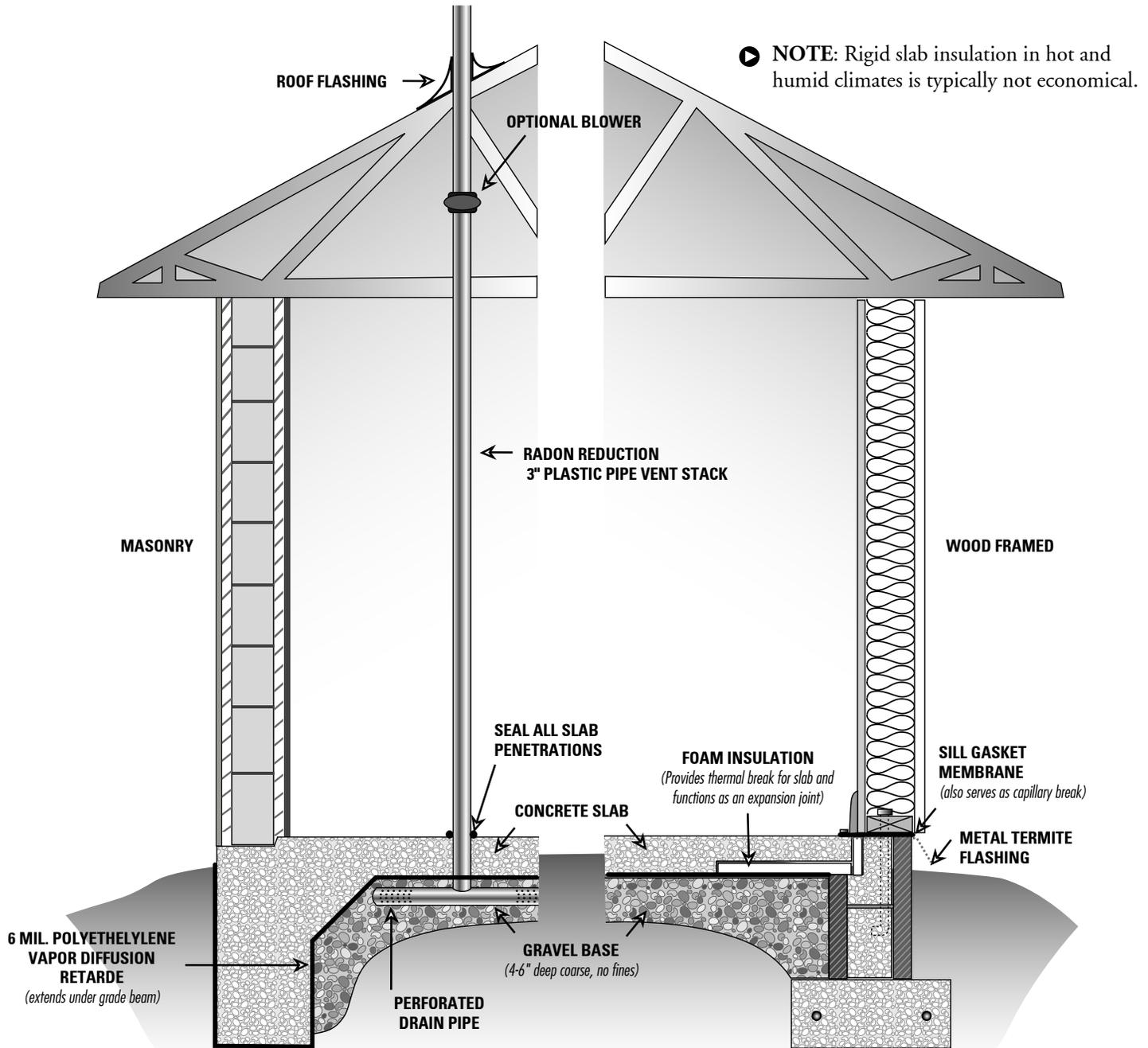
Bringing it all together





SLABS

Building Tips

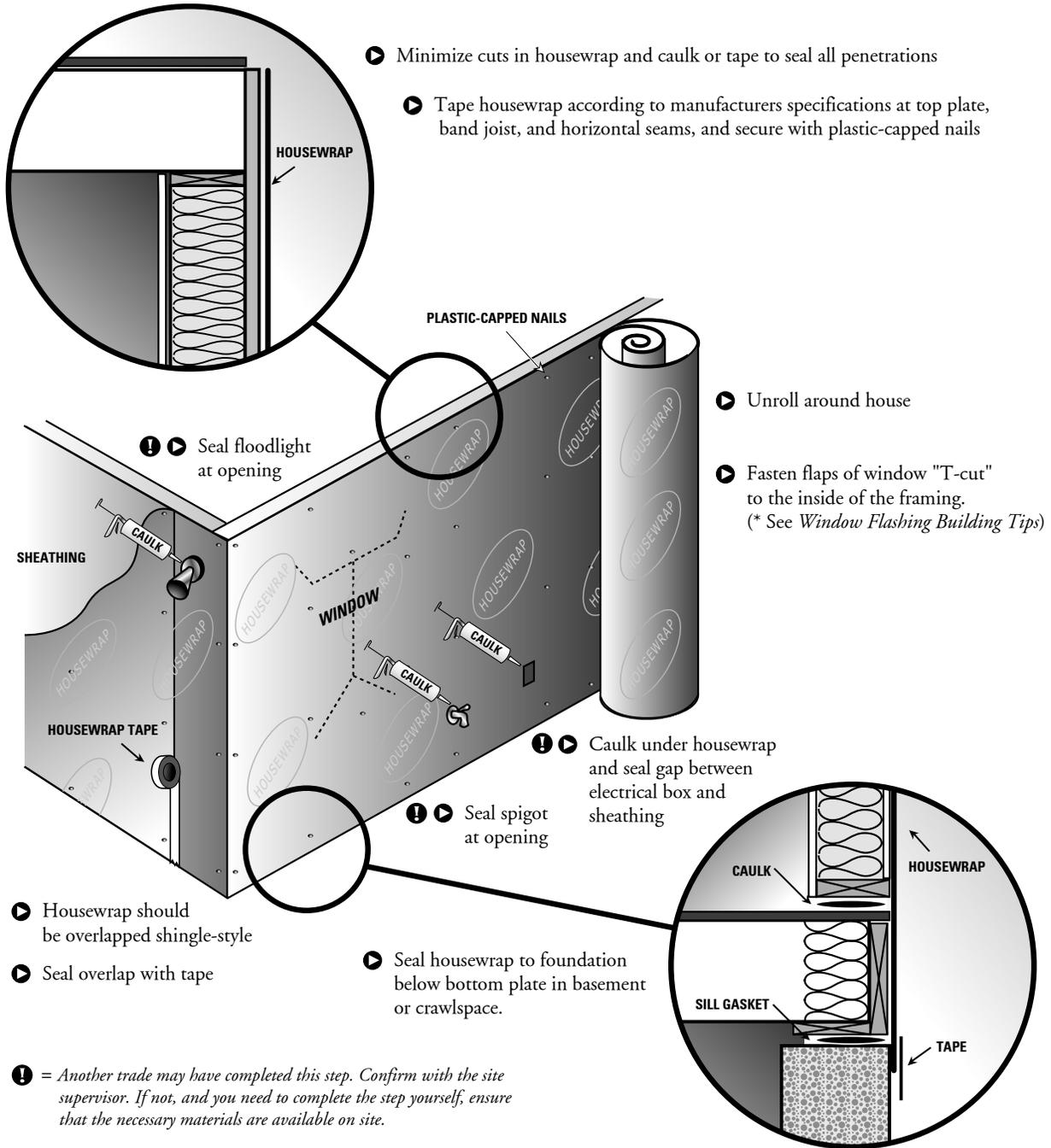


Sources & Additional Information

- U.S. DOE *Technology Fact Sheet on Slab Insulation* (www.eere.energy.gov/buildings/documents/pdfs/29237.pdf).
- Southface Energy Institute *Fact Sheets #29: Insulating Foundation and Doors* (www.southface.org/home/sfpubs/techshts/29_insulatefloors4PDF.pdf).
- Southface Energy Institute *Fact Sheets #30: Radon-Resistant Construction for Builders* (www.southface.org/home/sfpubs/techshts/30_radonresistantconst.pdf).
- Building Science Corporation: www.buildingscience.com/housethatwork/hothumid/wood/default.htm



Building Tips



Sources & Additional Information

- Southface Energy Institute *Fact Sheets #8 Air Sealing* (www.southface.org/home/sfpubs/techshts/8_airsealing.pdf)
- U.S. DOE *Technology Fact Sheet on Air Sealing* (www.eere.energy.gov/buildings/documents/pdfs/26448.pdf).
- See also the Building Tips on *Air Sealing* and *Window Flashing*
- See: <http://construction.tyvek.com/en/productServices/HomeWrap/index.shtml>
- Straube, John. 2001. *Canadian Architect*. "Wrapping it Up". May, 2001. www.cdnarchitect.com.

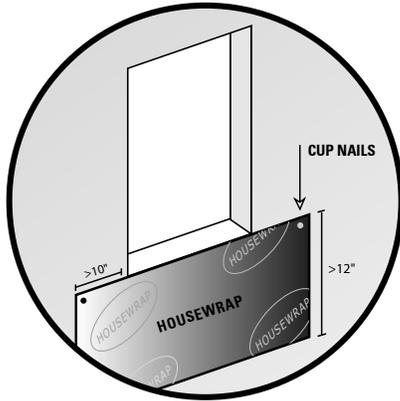


WINDOW FLASHING

Building Tips

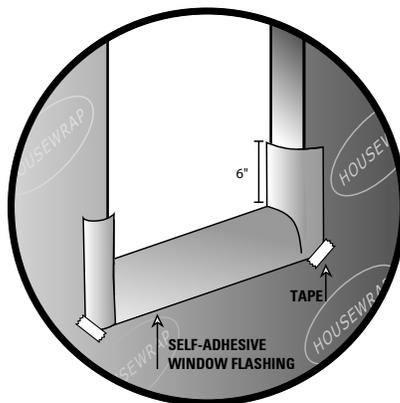
Example of window flashing details for home with housewrap and plywood or OSB wall sheathing.

STEP 1 - IF HOUSEWRAP HAS **Not** BEEN INSTALLED



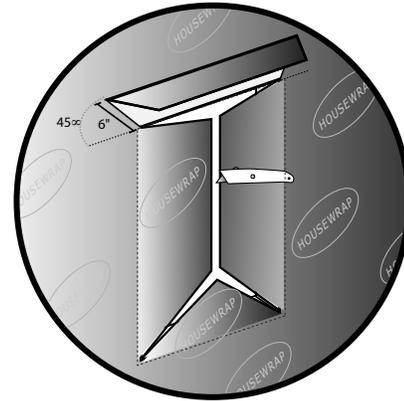
- ▶ Apply at least a 12" flap, or apron, of building paper or housewrap just below the windows sill.
- ▶ If the window sill is close to the sill plate, the apron can extend all the way to the sill plate.
- ▶ The apron should extend at least 10" past the sides of the window opening, or to the first stud in open wall construction.
- ▶ Attach only the apron's top edge with cup nails.

STEP 2 - SILL FLASHING



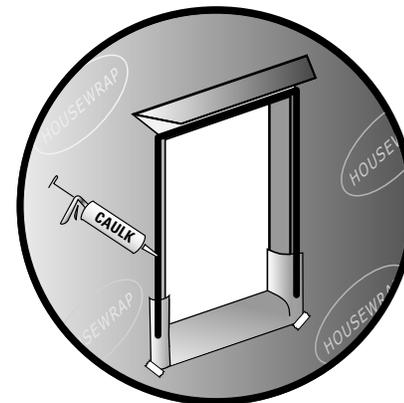
- ▶ Install self-adhesive flashing to the sill, ensuring that flashing extends up jambs at least 6".
- ▶ One commercial product comes with two removable strips over the adhesive. Remove the first strip to expose half the adhesive and apply this area to the sill. Begin pressing in the middle of the sill and work towards the sides. Remove the second strip to expose the adhesive that will be used to apply the flashing below the window to the outside wall.
- ▶ Tape down the bottom corners of the flashing

STEP 1 - IF HOUSEWRAP HAS BEEN INSTALLED



- ▶ Cut the housewrap covering the rough opening in the shape of a modified "Y".
- ▶ Fold the side and bottom flaps into the window opening and secure.
- ▶ Above the window opening, cut a head flap and flip up to expose sheathing, and loosely tape in place out of the way.

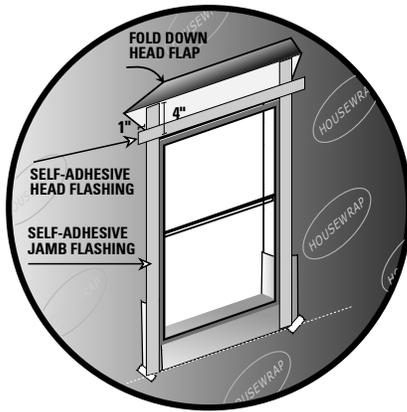
STEP 3 - JAMB CAULKING



- ▶ Caulk the outside edges of the head and side jambs
- ▶ Do not caulk across the sill
- ▶ Install the window using corrosion resistant nails and following manufacturer's specifications.

BUILDING TIPS: WINDOW FLASHING

STEP 4 - JAMB AND HEAD FLASHING



- ▶ Install self-adhesive jamb flashing extending 4" above the top of the head flange and even with the bottom of the sill flashing.
- ▶ Install self-adhesive head flashing extending 1" beyond the jamb flashing.
- ▶ If housewrap has been installed, be sure that the head flap, when it is folded down, will cover the top of the flashing.

STEP 5 - SEAL ROUGH OPENING GAP



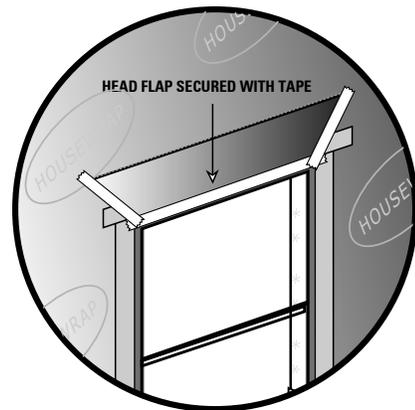
- ▶ On the interior side of the window, seal gap between the window and the rough opening with appropriate sealant.

STEP 6 - IF APRON WAS INSTALLED



- ▶ If an apron was installed under the window, slip the housewrap or building paper under the apron.
- ▶ Tape the edges where the housewrap meets the window flange if housewrap is installed after flashing.
- ▶ If building paper is used, embed the edges in a bead of sealant where the paper meets the window flange.

STEP 6 - IF HEAD FLAP WAS CREATED



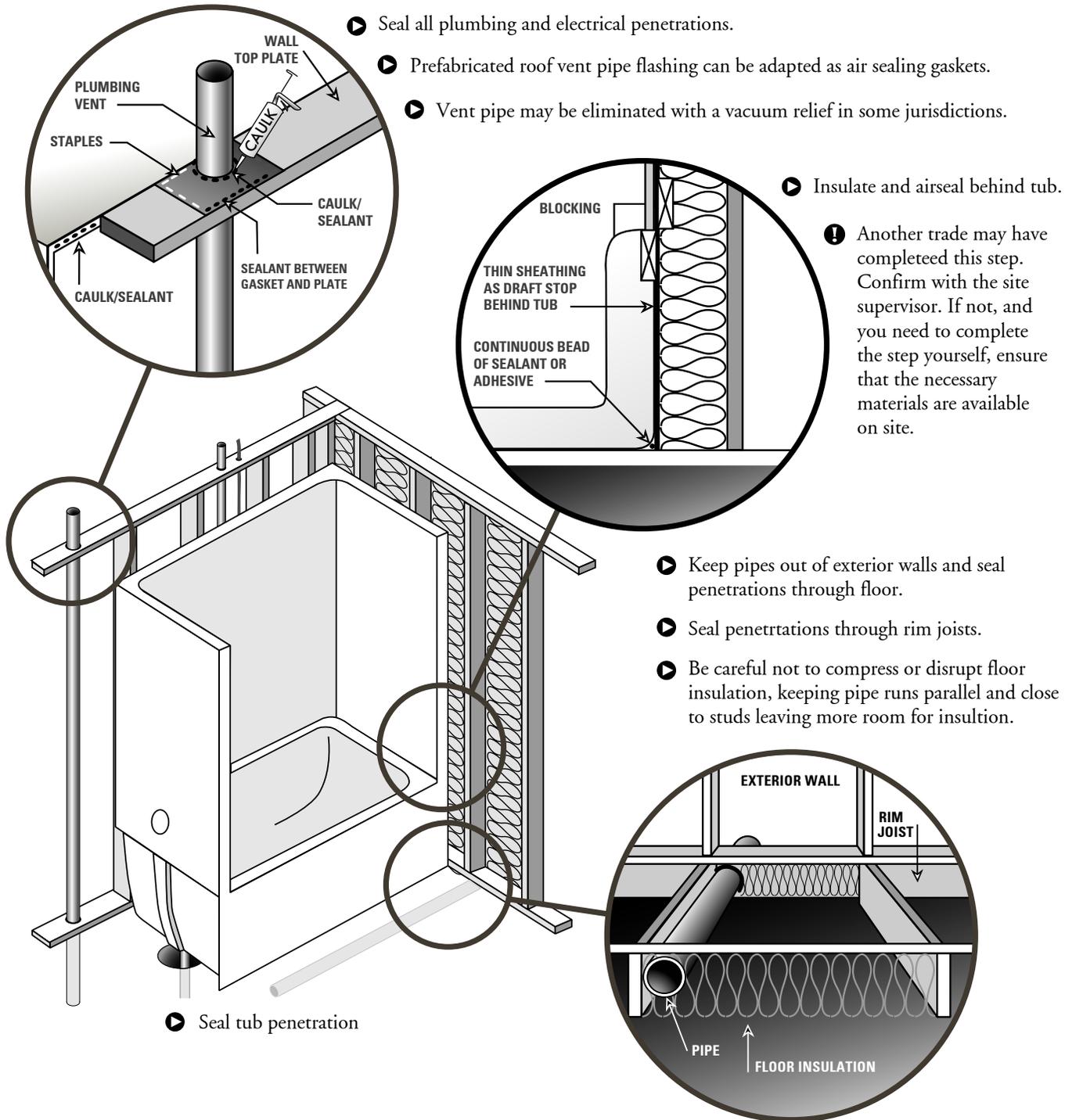
- ▶ If headflap was created, fold it over the head flashing and tape across the top window flange and the 45° angle seams.

Sources & Additional Information

- Lstiburek, J.W. (2002). *Water Management Guide*. Minneapolis, MN: Energy and Environmental Building Association (www.eeba.org).
- U.S. DOE *Technology Fact Sheet on Weather-Resistive Barriers* (www.eere.energy.gov/buildings/documents/pdfs/28600.pdf).
- *Standard Practice for Installation of Exterior Windows, Doors, and Skylights*. ASTM E2112-01, September 2002. West Conshohocken, PA.



Building Tips



Sources & Additional Information

- Lstiburek, J.W. (2000). *Builder Guide Hot-Humid Climates*. Minneapolis, MN: Energy and Environmental Building Association (www.eeba.org).
- U.S. DOE *Technology Fact Sheet on Air Sealing* (www.eere.energy.gov/buildings/documents/pdfs/26448.pdf).



Building Tips

- ▶ Recessed light fixtures should be rated for Insulated Ceiling Air Tight (ICAT).
- ▶ Ceiling fans should be wired to a wall switch.
- ▶ Seal light fixture boxes to drywall with caulk or foam.
- ▶ Seal bath fan box to drywall with caulk or foam.
- ▶ Seal all exterior penetrations, such as porch light fixtures, phone, security, cable and electric service holes, with caulk, spray foam, or gaskets - note that foam degrades in sunlight.
- ▶ Use air tight outlet boxes or seal standard boxes.
- ▶ Run wiring along side of stud at exterior wall and along plates
- ▶ Run wiring along bottom plate at exterior wall.
NOTE: Some codes require wires to be held up from bottom plates 6"-8" to protect from future drilling through plates.
- ▶ Caulk/seal/foam all electrical wires penetrating top and bottom plates of exterior walls.
- ▶ Seal standard plastic electrical box at face to drywall with joint compound or cover the plate gasket with caulked foam.

Sources & Additional Information

- Lstiburek, J.W. (2000). *Builder Guide Hot-Humid Climates*. Minneapolis, MN: Energy and Environmental Building Association (www.eeba.org).
- U.S. DOE *Technology Fact Sheet on Air Sealing* (www.eere.energy.gov/buildings/documents/pdfs/26448.pdf).
- See also *Air Sealing Building Tips*



AIR SEALING DRYWALL

Building Tips

MEASURE

**Actual assignments to be made by site supervisor. The supervisor may choose to work with a sealing specialist instead.*

	FRAMER	ELECTRICIAN	DRYWALLER	PLUMBER	WINDOW INSTALLER
EXTERIOR WALLS					
Install gaskets or caulk at top and bottom plates of exterior walls.	●				
Seal between the bottom plate and subflooring.	●				
Install gaskets behind coverplates.			●		
Seal large holes behind bath tubs or stairs with sheathing.		●			
PARTITION WALLS					
Seal the drywall at the intersection with the top or bottom plate.			●		
Seal penetrations through the top and bottom plates for plumbing, wiring, and ducts using fire resistant sealants.		●		●	
Knee walls can be insulated and sealed at either the roofline or along the line formed by the roof, wall, and floor. Rigid foam insulation, taped at the seams with housewrap tape, can be used to seal the backside of the knee wall and the underside of the roof. Sealing along the roofline is preferred in new construction.	●		●		
WINDOWS & DOORS					
Caulk or glue drywall edges to either framing or jambs.			●		
Fill rough opening with foam backer rod and caulk (preferred) or low-expanding foam sealant.			●		
Caulk window and door trim to drywall with clear or paintable sealant.			●		●
CEILING					
Seal the junction between the ceiling and walls.			●		
Whenever possible, use continuous drywall sheets for the ceiling and walls to minimize joints to be sealed.			●		
Seal all penetrations in the ceiling for wiring, plumbing, ducts, and attic access openings.		●	●	●	



Building Tips

Caulk

Seals gaps of less than 1/2". Select grade (interior, exterior, high temperature) based on application.

Expanding Spray Foam

Fills large cracks and small holes. Expanding foams are messy but useful for filling large holes or cracks. The material expands 2- to 3-times in volume after application. It comes in one-part cans that require no mixing or in two-part systems for larger jobs. It degrades in sunlight and users should be careful not to get the foam on their skin. **DO NOT USE** near flammable applications (e.g., flue vents). **DO NOT USE** on windows and doors. In large applications, a two-part system is used which involves mixing the sealant on site. For small jobs, one-part spray cans are used.

Low-Expanding/Non-Expanding Spray Foam

These latex-based spray foams come in one-part spray cans. They expand very little or not at all and will not pinch jambs or void window treatments.

Backer Rod

Closed-cell foam or rope caulk. Press into crack or gap with screwdriver or putty knife. Often used with caulk around window and door rough openings.

Gaskets

Apply under the bottom plate before an exterior wall is raised or use to seal drywall to framing instead of caulk or adhesive.

Housewrap

Installed over exterior sheathing. Must be sealed with housewrap tape or caulk to act as an air retarder. Resists water, but is **NOT** a vapor barrier.

Sheet Goods

(Plywood, Drywall, Rigid Foam Insulation) These materials form an air retarder. Air leaks only at unsealed seams or penetrations.

Sheet Metal

Used with high-temperature caulk for sealing high-temperature components, such as flues, chimneys, and framing.

Polyethylene Plastic

This inexpensive material for air sealing also stops vapor diffusion. All edges and penetrations must be completely sealed for an effective air retarder. Poly is fragile, and proper placement is climate specific.

Weatherstripping

Used to seal moveable components, such as doors, windows, and attic accesses.

Mastic

A thick paste which can be used on all duct materials and provides a permanent seal. Seals air handlers and all duct connections and joints. UL-181-approved water bars mastic is best.

UL-181 or Foil-Faced Tape

Temporarily seals the air handler.

Sources & Additional Information

- U.S. DOE *Technology Fact Sheet on Air Sealing* (www.eere.energy.gov/buildings/documents/pdfs/26448.pdf).



Building Tips

INSTALLING FIBERGLASS BATT INSULATION

ALWAYS:

- Avoid gaps, tight turns, and compression
 - Cut insulation to fit snugly in non-standard spaces
 - Slit batts to fit around wiring and plumbing
 - Notch out around electrical boxes and use scraps to fill in behind
- Install long runs first – then use scraps to fill in smaller spaces and gaps
- Use unfaced batts in hot and humid climates
- Even if blown in insulation is to be generally applied, use fiberglass batts to insulate areas that will be inaccessible to the blown in insulation, such as behind bath enclosures.

Walls:

- Friction fit the batts in place until covered by drywall or sheathing
- Insulate before installing stairs and tubs and other features that will block access

Knee Walls:

- Seal knee wall to create a continuous air barrier. Knee walls can be sealed following the wall itself and attic floor or along the sloping edge of the attic roof. Rigid foam insulation, taped at the seams with housewrap tape, can be used to seal the backside of the kneewall and the underside of the roof. Sealing along the roofline is preferred in new construction.
- Insulate and air seal the rafter space along the sloping ceiling of the knee wall attic space or insulate and air seal the roofline wall and floor.
- Rafters should receive [R-19 or R-30] insulation
- Cover rafters with a sealed air barrier (such as drywall or foil-faced hardboard)
- Caulk the barrier to the top plate of the wall below the attic space and to the top plate of the knee wall itself
- Seal all other cracks and holes

Ceilings:

- Insulate and seal the attic access door
- Install insulation over IC, AT rated recessed cans
- Ventilation pathways?
- Install insulation baffles

Band Joists:

- Place insulation in the cavities between joists and subfloor
- Caulk bottom plate to subfloor
- Caulk band joist to subfloor and plates and insulate
- Caulk bottom plate to subfloor

Under Floor Insulation:

- Metal stays, lathe, or stainless steel wire support insulation in joist cavities.
- In new construction it is preferred that crawlspace walls are insulated. If underfloor insulation is to be used it can be held in place with metal staves, lathe, stainless steel wire, or twine.
- If truss systems are used under floors, an approach better than batt insulation is to install netting or rigid insulation to the underside of the floor trusses and fill the joist cavity with blown-in insulation.

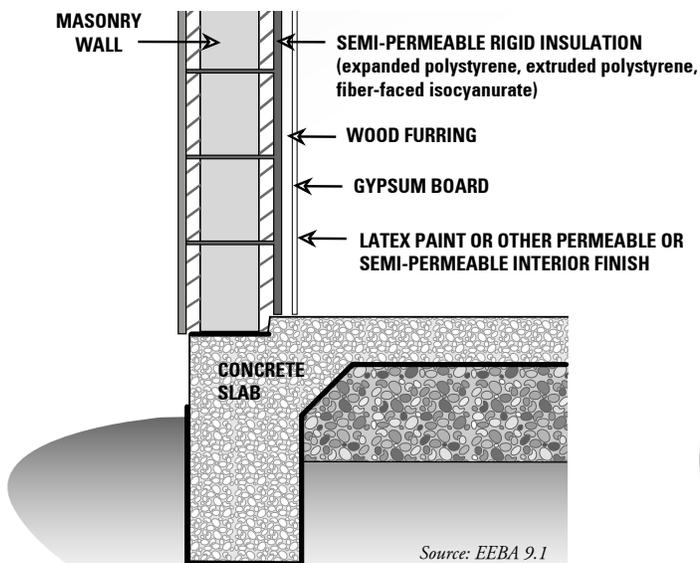
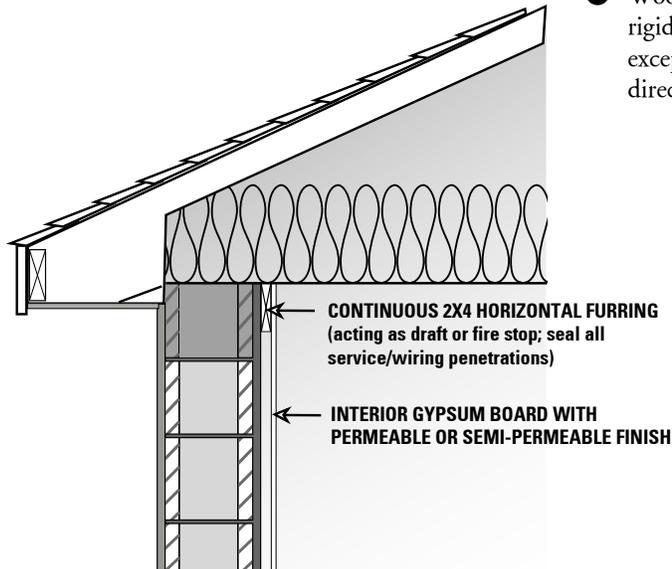
Sources & Additional Information

- Energy Efficient Building Association's *Builder's Guide Hot-Humid Climates*, 2000.
- U.S. DOE *Technology Fact Sheet on Attic Access*.
- U.S. DOE *Technology Fact Sheet on Crawlspace Insulation*.
- * Refer to the *Air Sealing Building Tips*



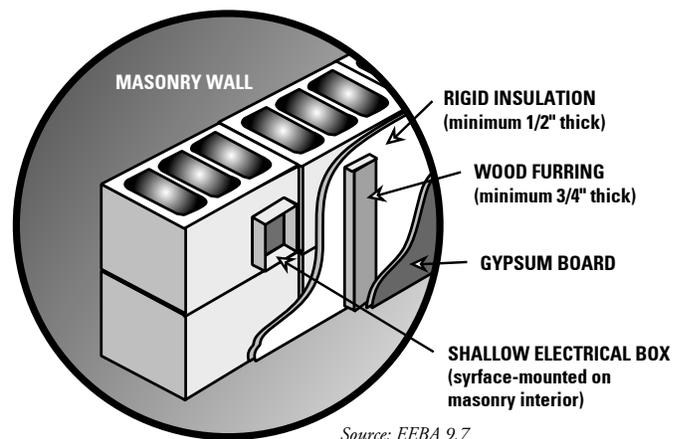
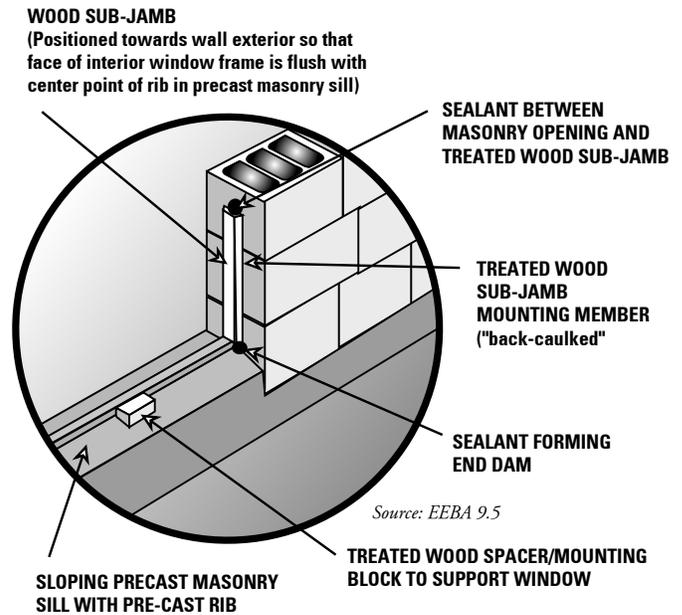
Building Tips

- ▶ Semi-vapor permeable rigid insulations used on the interior of wall assemblies should be unfaced or faced with permeable skins. Foil facings and polypropylene skins should be avoided.
- ▶ Wood furring should be installed over rigid insulation; the rigid insulation should be continuous over the surface of the wall, except for the 2x4 furring near the ceiling. This blocking attaches directly to the masonry block and is above the insulation, not behind it.



- ▶ Electrical boxes can be surface-mounted eliminating chiseling/chipping masonry

WINDOW SILL DRAINAGE



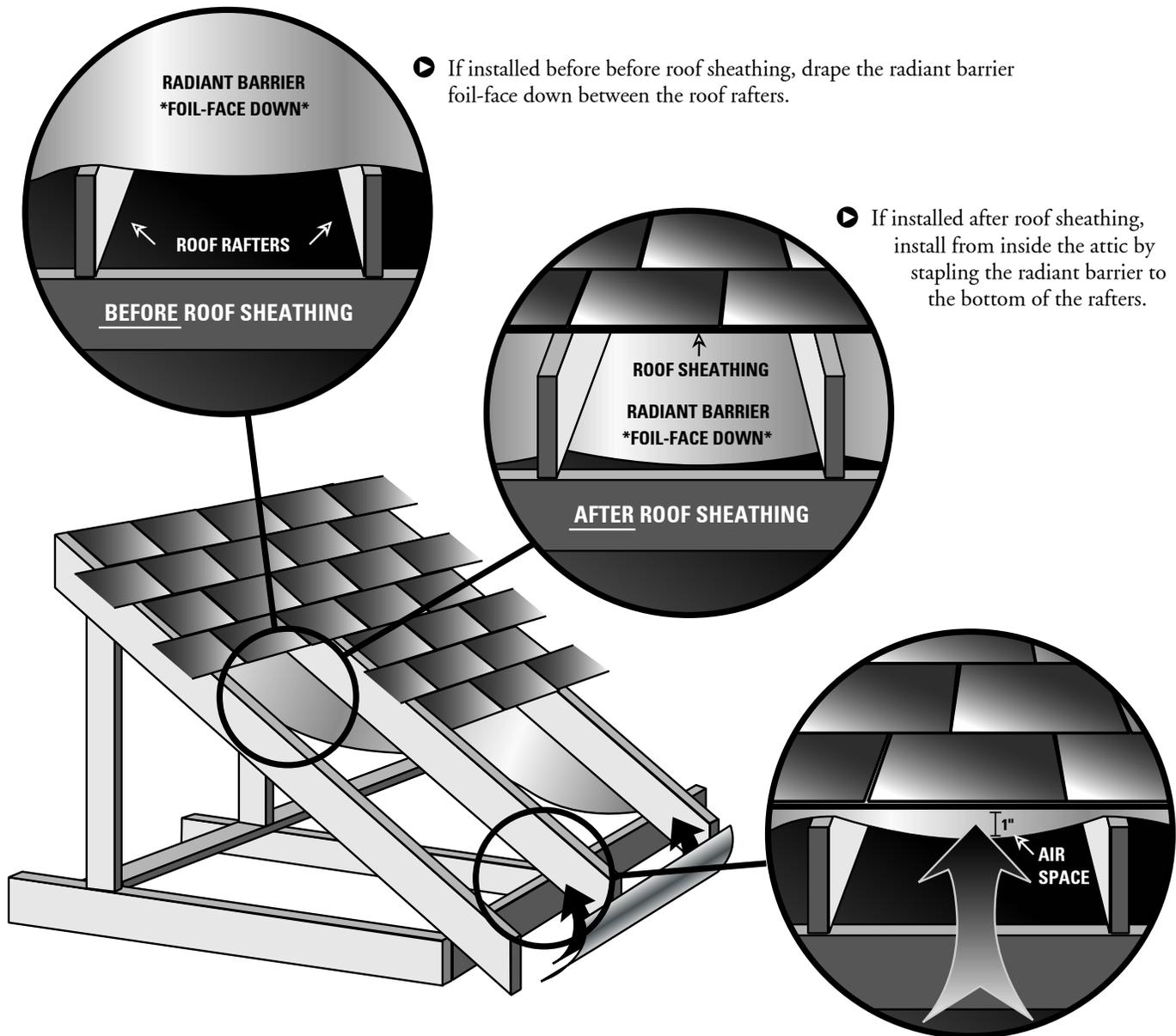
ELECTRICAL BOX

Sources & Additional Information

- *Builders Guide to Hot and Humid Climates*. 2000. Energy and Environmental Building Association (ww.eeba.org).



Building Tips



▶ If installed before roof sheathing, drape the radiant barrier foil-face down between the roof rafters.

▶ If installed after roof sheathing, install from inside the attic by stapling the radiant barrier to the bottom of the rafters.

▶ NOTE: Some roof sheathing products have a radiant barrier preinstalled; in this case, ensure the shiny side faces the attic.

▶ Allow the material to droop between attachment points to make at least a 1 inch air space between the radiant barrier and the bottom of the roof.

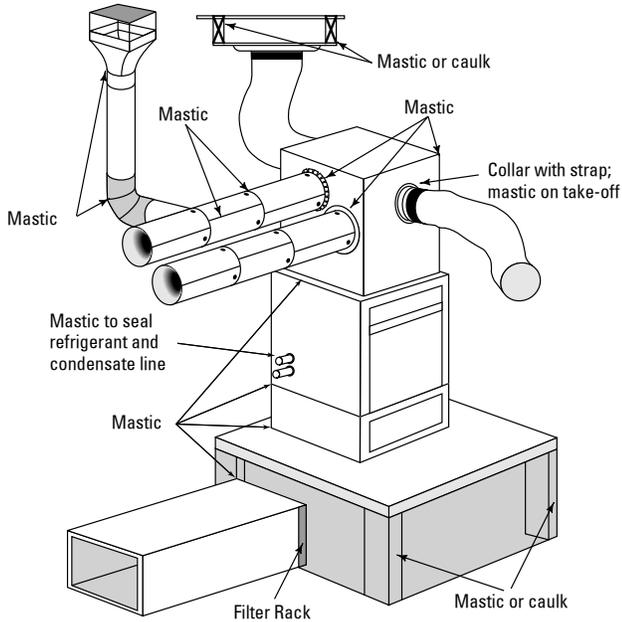
Sources & Additional Information

- U.S. DOE EREC Brief on Radiant Barriers (www.eere.energy.gov/consumerinfo/refbriefs/bc7.html).
- Southface Energy Institute Fact Sheet #14 Radiant Barriers (www.southface.org/home/sfpubs/techshts/14radiantbarriers.pdf).
- Southface Energy Institute Fact Sheet #25 Ceiling and Attic Insulation and Ventilation (www.southface.org/home/sfpubs/techshts/25_insulateceilings_4pdf.pdf).

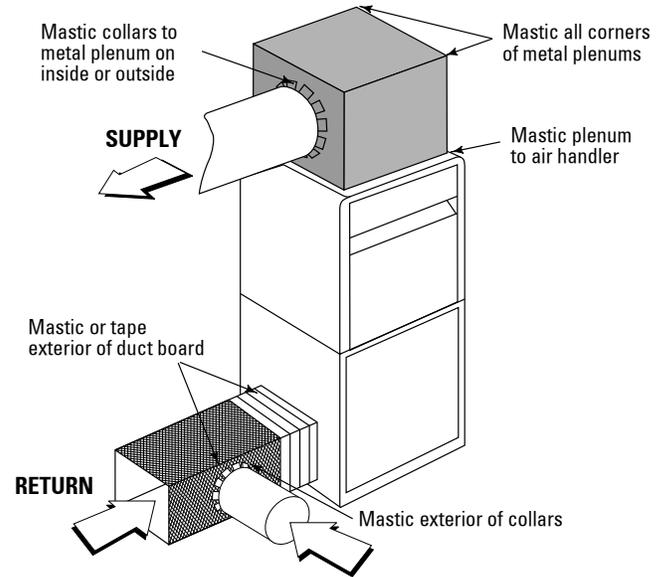


Building Tips

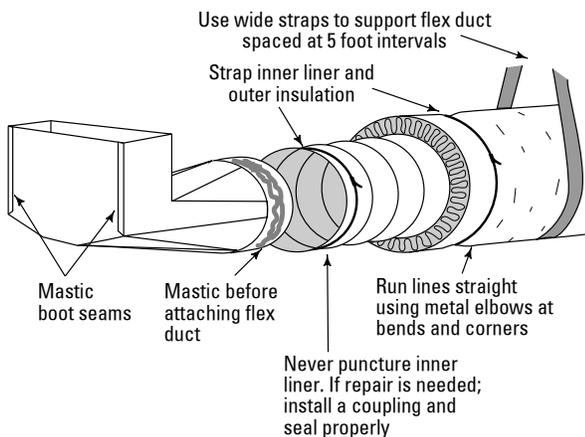
AIR HANDLER



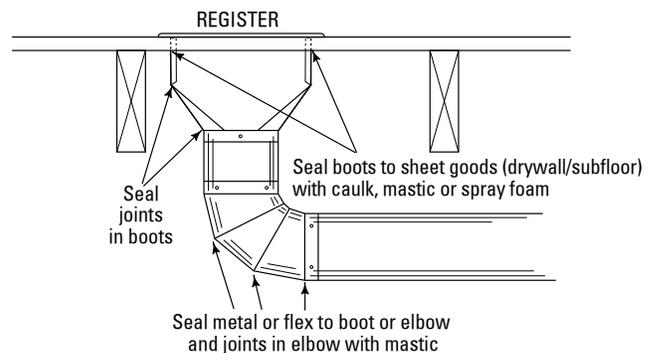
SUPPLY & RETURN PLENUMS



FLEX DUCT



BOOTS



- ▶ Mastic is a gooey adhesive that is applied wet. It fills gaps and dries to a soft solid. Mastics may or may not contain reinforcing fibers, and they may be used with reinforcing mesh tape.

Sources & Additional Information

- *Energy Efficient Building Association Builder's Guide Hot and Humid Climates*, 2000.
- Southface Energy Institute *Fact Sheet #2 Ductwork Questions & Answers* (www.southface.org/home/sfpubs/techshts/2duct_q&a.pdf).
- Southface Energy Institute *Fact Sheet #18 Energy Checklist* (www.southface.org/home/sfpubs/techshts/checklist.pdf).
- * All graphics diagrams courtesy of Southface Energy Institute Fact Sheet #2 Ductwork Questions & Answers.