

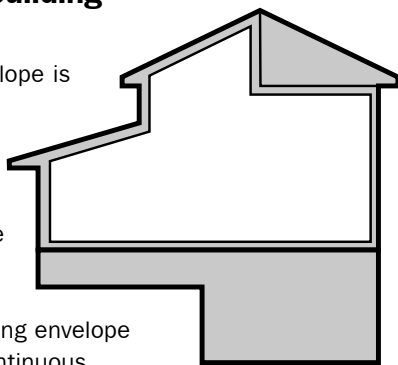
## Seal air leaks and save energy!

### What is Air Leakage?

Air leakage, or *infiltration*, is a major problem in both new and older homes. Besides wasting hundreds of dollars on energy bills, air leakage paths can cause building durability problems, increase the risk of fire spread, permit insect and rodent entry, and create unhealthy indoor air quality. Reducing air leakage usually adds little to the materials cost of a house and does not require specialized labor.

### What is the building envelope?

The building envelope is the floor, exterior walls and ceiling that separate the inside conditioned space from the outside or unconditioned space. The building envelope should form a continuous insulated barrier and a continuous air barrier. The two barriers are usually formed by different materials.



Standard insulation products, such as batt or loose fill products, do not seal against air leakage. For most affordable homes, the sheet goods that form the decking, sheathing, and finish materials are the primary air barrier. Seal holes in the materials with durable caulks, gaskets, and foam sealants.

### How does airsealing affect HVAC?

Reducing infiltration can significantly cut heating and cooling costs. Because infiltration can account for up to 50% of heating and a significant part of cooling loads, by tightening the building we can often decrease the size and first cost of the HVAC system.

Annual Energy Costs for 1300 sq. ft. house			
	Infiltration rate		Savings
Atlanta, GA	High*	Low**	
Heating	\$311	\$244	\$67
Cooling	\$196	\$178	\$18

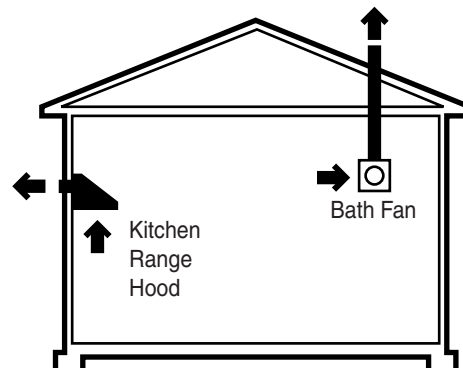
\* Estimated 12 air changes at 50 Pascal pressure difference

\*\* Estimated 6 air changes at 50 Pascal pressure difference

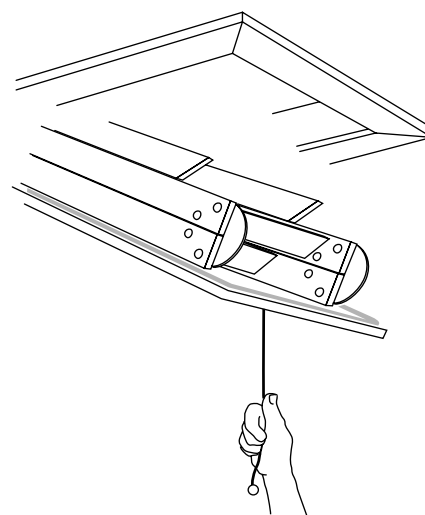
### Can a house be too tight?

A leaky house that breathes in moldy, humid crawlspace air, or dusty attic air is not healthy. It is unwise to rely on the weather for ventilation. During cold or windy weather the house may have too much air leakage, and during warm or calm weather, too little.

All houses need controlled ventilation. For simple designs, effective spot ventilation, such as kitchen and bath fans that exhaust to the outside, may be adequate. For complex designs or harsh climates, whole house ventilation may be appropriate. These systems may incorporate heat recovery, moisture control, and air filtration.



*Kitchen and bath vents provide spot ventilation*



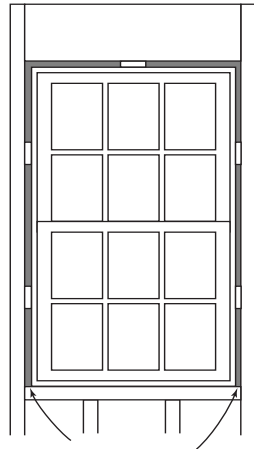
*An attic access is one of the biggest "intentional" holes between living space and non-conditioned space. Add weatherstripping and an insulated cover.*

## What are the priorities for airsealing?

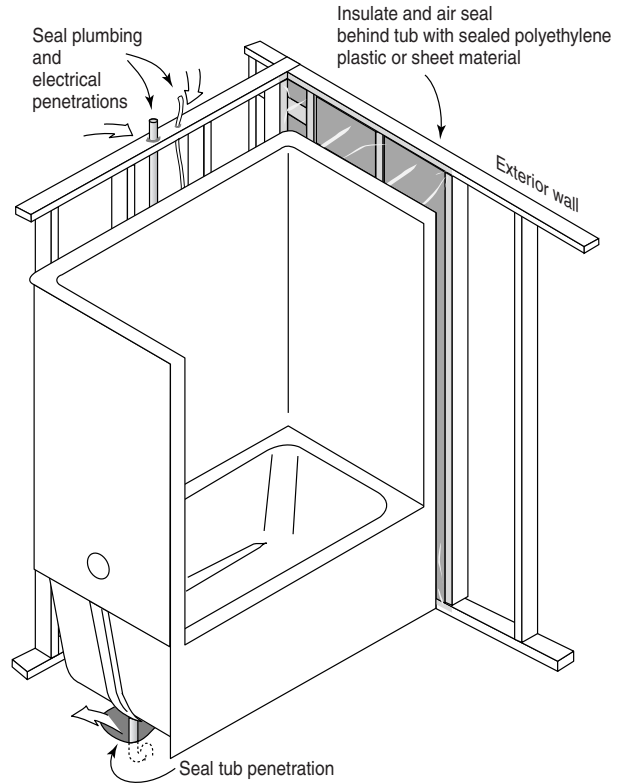
It just makes sense to first seal all the big holes, then the large cracks and penetrations, and finally the smaller cracks and seams. Many times unseen holes or pathways, called bypasses, occur at key junctures in the framing (such as an attic to kneewall transition) and permit large quantities of air to leak in and out of a home.

## Where are these leakage sites?

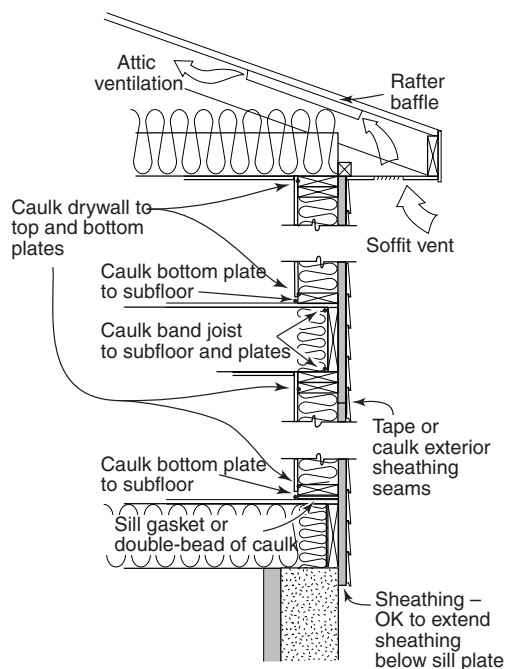
Focus efforts on sealing the attic and floors first, as the walls represent a less serious problem. Dropped soffit ceilings, ductwork and plumbing chases, leaky recessed light fixtures, wire penetrations, and pull-down stairs represent connections between the attic and the conditioned space. Major leakage sites in the floor can be found under the tub drain and at the numerous plumbing, HVAC, and wiring penetrations. In walls, the bottom and top plates, fireplaces with chimney inserts, the band joist (for two story houses), and the window and door rough openings are the primary culprits.



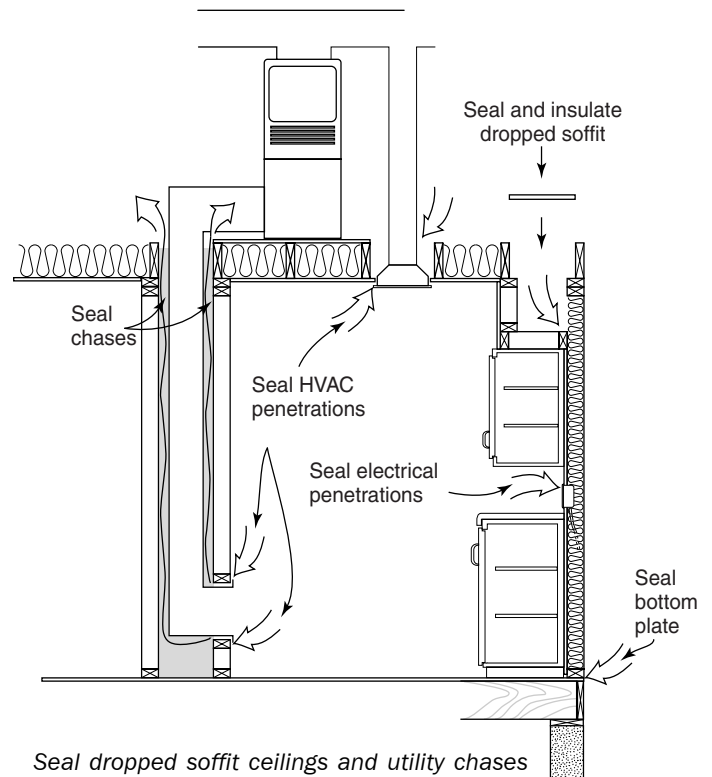
Use backer rod to fill gaps between window and rough opening



Seal and insulate before installing bath tubs.



Seal the band joist

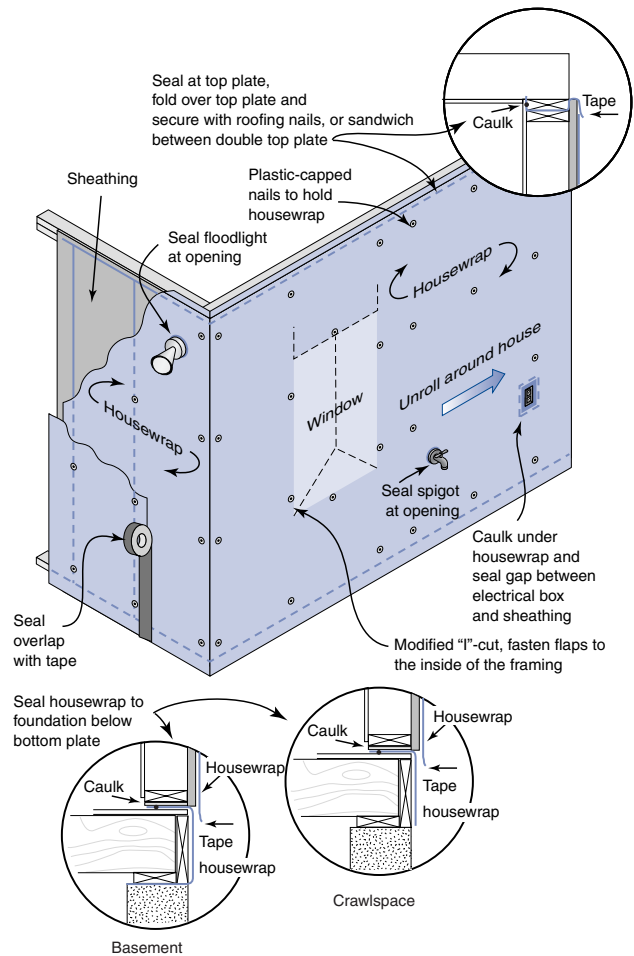


Seal dropped soffit ceilings and utility chases

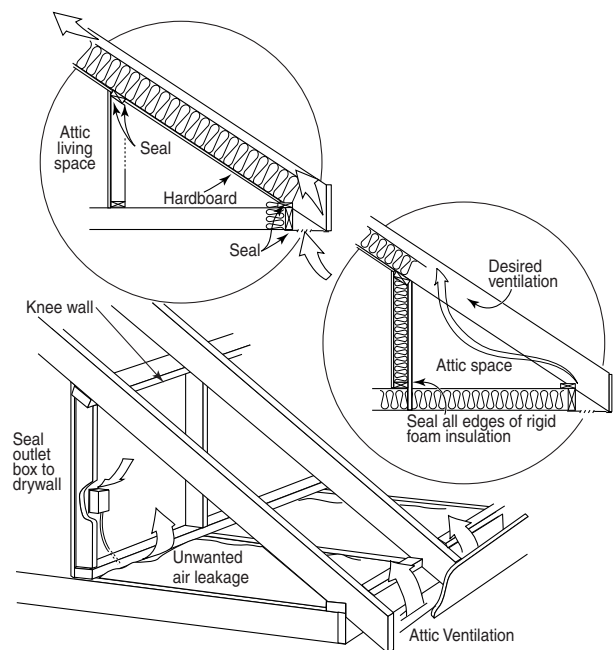
## Airsealing materials

Use a combination of these different airsealing materials.

- ❑ **Caulk:** Use to seal gaps less than 1/2". Select grade (interior, exterior, high temperature) based on application.
- ❑ **Spray foam:** Expands to fill large cracks and small holes. It can be messy; consider new, water-based foams. NOT recommended near flammable applications (flue vents, etc.).
- ❑ **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:** Can be applied under the bottom plate before an exterior wall is raised, or used to seal drywall to framing.
- ❑ **Housewrap:** Installed over exterior sheathing. Must be sealed with tape or caulk to form an airtight seal. Resists liquid water but is *not* a vapor barrier.
- ❑ **Sheet goods** (plywood, drywall, rigid foam insulation): These are the solid materials which form the building envelope. Air will only leak at the seams or through unsealed penetrations.
- ❑ **Sheet metal:** Used with high temperature caulk for sealing high temperature components, such as flues, to framing.
- ❑ **Polyethylene plastic:** Inexpensive material for airsealing that also stops vapor diffusion. Must have all edges and penetrations sealed to be effective air barrier.
- ❑ **Weatherstripping:** Used to seal moveable components, such as doors and windows.
- ❑ **Don't rely on the insulation:** The most common insulation, fiberglass, does *not* stop air leakage. In older houses, dirty fiberglass is a telltale sign of air movement (it simply acts as a filter). Certain types of insulation, such as dense-packed cellulose and urethane foams, can be effective at reducing air flow.



*Housewraps must be sealed to framing to reduce air leaking into exterior walls.*



*Seal the entire kneewall for continuity in the building envelope.*

## Air sealing checklist

### Before drywall

- Seal **bottom plate** of exterior walls with caulk or sill seal; seal inside edge with caulk after walls are up.
- Seal **band joist** area with caulk, spray foam, or gasketing between top plate and band joist, and between band joist and subfloor.
- For **bath tubs** on outside walls, insulate the exterior wall and air-seal behind tub with sheet goods before tub is installed. After the drain is installed, seal the **tub drain** penetration with rigid foam insulation and spray foam.
- For **dropped soffit** cabinets and showers, use sheet material and sealant to stop air leakage from attic into soffit and then insulate. Alternately, frame and install drywall for the soffit area *after* the taped ceiling drywall is installed.
- Seal **windows** and exterior **doors** with backer rod and caulk or spray foam. Be cautious using spray foam as it can expand and pinch jambs and may void some window warranties.
- Seal all **electrical wire, plumbing, and HVAC** penetrations between any conditioned and unconditioned spaces.

### After drywall

- Seal electrical **switch** and **outlet boxes** to drywall with caulk.
- Seal light **fixture boxes** to drywall with caulk or foam.
- Seal bath and kitchen ventilation **fans** to drywall with caulk or foam.
- Seal all **duct boots** to floor or drywall with caulk, foam, or mastic.
- Seal any **plumbing** penetration through drywall with caulk or foam.
- If not done before drywall, seal **tub drain** penetration (from crawlspace side) with plywood or rigid board insulation and caulk or foam.
- Seal **gaps at whole house fan** with spray foam or housewrap tape (ensure louvers function properly).
- Fabricate **whole house fan cover** from rigid foam insulation and contact paper; attach with Velcro® or wood frame bolted to ceiling. Or, if attic access is easy, build a cover from rigid foam or duct board which is placed over the fan from the attic side.

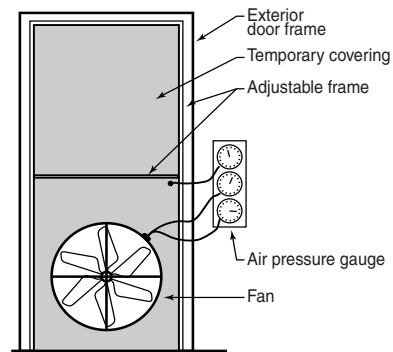
- For **attic hatches**, insulate top of board with at least two inches of rigid foam insulation or fiberglass batt; seal with weatherstripping. Use these same steps for short and full-size attic **kneewall** access doors and include a tight latch.
- For **attic pull down stairs**, use rigid foam cover kit; make stairs airtight using latch bolts and weatherstripping.

### Airseal exterior

- Seal all **exterior** penetrations, such as porch light fixtures, phone, security, cable and electric service holes, with caulk or spray foam.
- Repair or replace any **missing sheathing**.

### If installing housewrap:

- Seal **top** and **bottom** edges past the plates with housewrap tape or caulk.
- Seal housewrap at windows and doors.
- Minimize cuts in housewrap and caulk or tape to seal all **penetrations**.
- Overlap** seams and seal with caulk or housewrap tape.
- If not using housewrap, seal all **sheathing seams** with housewrap tape or caulk.



### Diagnostic tools

A blower door is a variable speed fan used to measure how tight a house is and locate air leakage sites. Often, an energy efficiency incentive program, such as the DOE/EPA Energy Star Program requires a blower door test to confirm the tightness of the house.