



Air Sealing

The most effective and cheapest energy conservation measure a homeowner can apply to their home is to assure that the home is adequately sealed. Air sealing includes tightening- the building envelope by using caulk, foam, weatherstripping and other materials to prevent cold winter air from coming into the heated space and preventing warm heated air from escaping. Based on a U.S. Department of Energy study, homeowners can expect air sealing to lower their space heating consumption around 18 to 30 percent.

Infiltration (Air Leakage Control)

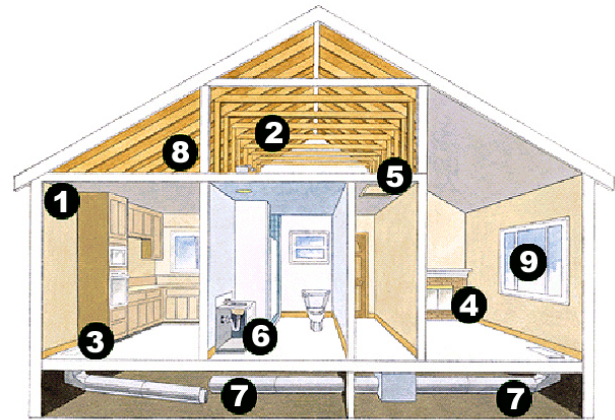
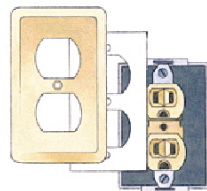
Air leakage, or **infiltration**, is outside air that enters a house uncontrollably through cracks and openings. During cold or windy weather air may penetrate the building envelope enter the house. The recommended strategy in both new and old homes is to reduce air leakage as much as possible and, if need be, provide controlled ventilation.

Priorities

Although windows, doors, and outside walls contribute to air leakage, the biggest holes are usually hidden from view. Most homeowners are aware that air leaks into their houses through what seem to be small openings around doors and window frames and through fireplaces and chimneys. Air also enters the living space from other unheated parts of the house, such as attics, basements, or crawl spaces. These holes and pathways (sometimes called bypasses) connect the house to the attic, crawlspace, or basement. To effectively reduce infiltration, seal the big holes first, then the large cracks and penetrations, and finally the smaller cracks and seams.

Where to look for air leaks

Air travels through openings in walls, floors, or ceilings, such as cracks where two walls meet (1) and where the wall meets the ceiling, or near interior door frames. Other openings too look for are gaps around and through electrical outlets and switch boxes, recessed lighting fixtures, recessed cabinets (2), pull-down stairs, false ceilings such as kitchen or bathroom soffits (3), behind bath tubs and shower stall units, floor cavities of finished attics adjacent to unconditioned attic spaces, and plumbing connections. These often-over looked leaks between the living space and other parts of the house are often much greater than the obvious leaks around



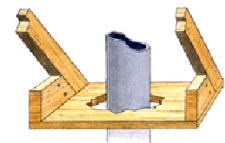
windows and doors. Since many of these leakage paths are driven by the tendency for warm air to rise, the attic is often the easiest and best place to stop the leaks. It's important to stop these leaks before adding attic insulation because the insulation may hide them and make them less accessible. Some types of insulation, by themselves, will not stop these leaks and you won't save as much as you expect because of the air flowing through the insulation.



Sometimes leak locations are visible because the existing insulation has been stained by dust carried by the airflow. Some of the openings to look for include: Top openings of interior partition wall cavities, around the chimney (4), around the attic trap door or entry door (5), areas above staircase ceilings and dropped ceilings, around pipes (look under your sinks and behind your toilets) (6) and ducts penetrating a wall or attic floor.



Other places to look for leaks are in ductwork, (7) plumbing chases, wiring penetrations through the top plates of walls, and between the attic and conditioned space (8). Bypasses occur at key junctures in the framing (such as at attic-to-kneewall transitions) and permit large quantities of air to leak in and out of the home. In walls, the bandjoist (for two-story homes), window and door rough openings (9), and penetrations



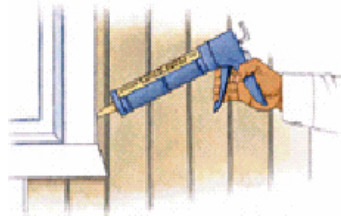
through the drywall and exterior sheathing are primary leakage sites.

After you have found the air leaks, it is time to seal them using the proper materials.

What materials to use

There are numerous materials available from local hardware stores or home improvement stores for sealing air leaks. Use a combination of these different air-sealing materials for your application. The following list provides a description and guidelines for using these materials.

- **Caulk:** Seals gaps of less than ½". Select grade (interior, exterior, high temperature) based on application and note application and cleanup information on product.



- **Spray foam:** Fills large cracks and small holes. It can be messy; consider new latex-based foams. **DO NOT USE** near flammable applications (e.g., flue vents). **DO NOT USE** high expansion types on windows and doors.

- **Backer rod:** Closed-cell foam or rope caulk. Press into crack or gap with screwdriver or putty knife. Backer rod is 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. Apply behind electric outlet covers and switch plates.

- **Housewrap:** Installed over exterior sheathing. It must be sealed with housewrap tape or caulk to form an airtight seal. Resists water but is *not* a vapor barrier.

- **Insulation:** various types of insulation can be used to stuff large holes or bypasses only when used in conjunction with other air sealing materials.

- **Sheet goods:** (plywood, drywall, rigid foam insulation): These materials form the air barrier. Air leaks only at unsealed seams or penetrations.

- **Sheet metal:** Used with high-temperature caulk for sealing high-temperature components, such as flues and chimneys, to 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 barrier. Poly tears easily and should be placed to prevent warm inside air from penetrating the wall or ceiling.

- **Plastic storm window kits:** These kits are available at any home improvement or hardware store. These kits are

easily applied over leaky windows to stop drafts and provide for seasonal removal.

- **Weatherstripping:** Used to seal moveable components, such as doors, windows, and attic accesses.

- **Mastic or foil-faced tape:** Seals air handlers and all duct connections and joints. Apply foil tape to clean surfaces only.

Here are some areas to treat with suggested air sealing materials:

- Top openings of interior partition wall cavities: staple a plastic sheet over the opening and seal it around the edges with a high quality caulking material.

- Around the chimney: pack gaps around an insulated chimney with **unfaced** rock wool or **unfaced** fiber glass insulation. Do not insulate bare, hot flue pipes. **Do not seal with combustible products.**

- Around the attic trap door or entry door: weatherstrip the edges. Place rigid foam insulation on attic side of door.

- Areas above staircase ceilings and dropped ceilings: staple a plastic sheet over the opening and seal it around the edges with a high quality caulking material.

- Around pipes (look under your sinks and behind your toilets) and ducts penetrating a wall or attic floor: pack insulation tightly into the gap. You can also fill the area around them with spray low-expansion polyurethane foam.

- Sometimes joints between walls and floors allow open passage of air between the heated part of the house and the attic area or outdoors. Look for such joints in your attic or in the space over a porch ceiling. This air leakage path is commonly found in Cape Cod type houses, or if attic space has been converted to living space. A similar arrangement occurs when the second floor of a two-story house is larger than the ground floor and has an overhang over the outdoors.

- Another major source of air leakage can be the joint between a porch roof and a sidewall. If you can reach these areas, you can stop the leaks by carefully covering the openings with plywood. If the areas are more difficult to reach, you can greatly reduce the air leakage by blowing high-density insulation or injecting spray foam insulation into these joints, thus reducing these energy-gobbling air paths.

- If windows leak excessively, consider installing a plastic storm window kit. These kits are inexpensive and easy to install. In the end, you may have to consider installing replacement windows. Replacement windows are expensive and may not be cost effective.

- Doors may need to be adjusted to improve the seal prior to weatherstripping. Check and adjust the catch plate to ensure that the door shuts tight against the weatherstripping. Where the door meets the floor, make sure that the threshold is adjusted (if possible) to minimize infiltration. If the threshold is missing or not sealing properly, install a weather seal. Install a door sweep to improve the door seal. A storm door may be advisable, but like storm windows, storm doors may not be cost effective.
- Duct leaks reduce the amount of heated or cooled air delivered into the living space. In many older houses with forced-air furnaces, an estimated 20 percent of the heated air is wasted through leaks and not delivered to the living spaces. To compensate, homeowners turn up the thermostat to get the heat they need, raising their heating bills unnecessarily. Sealing all duct leaks can be a highly effective conservation measure. Make sure that you use proper mastic or foil tape when sealing ducts. Fabric-type duct tape is ineffective since the adhesive dries out after six months.

Conclusion

Homeowners can stop leaks from windows and doors by caulking and weatherstripping or by installing interior plastic storm window kits available from local hardware or home improvement stores. Sealing leaks requires attention to detail since even a small leak can lose a significant amount of heat.

An adequately sealed home will provide energy savings and a comfortable environment for the homeowner and their family.

Bibliography

- Energy Efficiency and Renewable Energy, U.S. Department of Energy, *Air Sealing: Seal air leaks and save energy!*, *Technology Fact Sheet*; www.eere.energy.gov/consumer
- Minnesota Department of Commerce Energy Information Center, *Techniques, Tactics & Tips, Home Energy Guide to Caulk and Weatherstripping*. Energy Information Center publications are available free.
- City of Chicago, Department of the Environment
- Grateful acknowledgement is given by the Department of Commerce and Economic Opportunity to the City of Chicago for the use of this document.