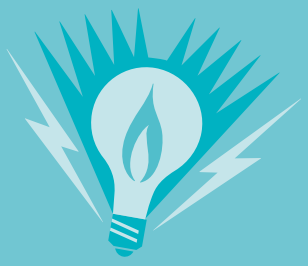
Reducing Home Air Leaks



If you live in the Northwest, you've probably experienced drafts of cold winter air leaking into your home. Air leaks could raise the cost of heating a typical home 20 percent or more. This fact sheet offers some information about air leaks and what you can do to prevent them.

The Problem: Air Leaks

What is an air leak?

Two types of air exchanges take place between a heated building and an unheated environment: ventilation and air leaks. Ventilation is a "controlled" air exchange (such as through an exhaust fan). Air leaks are uncontrolled, and occur when air exits and enters buildings through cracks, holes and other openings. ***Infiltration*** occurs when air leaks into a building from outside. In winter, infiltration carries cold air into your home; in summer, it carries hot air, dust and pollen. ***Exfiltration*** occurs when air leaks out of a building, carrying with it both heat and water vapor in that heat that can cause potential moisture problems in your insulation.

What causes air leaks?

Pressure differences between the inside and outside of a building cause air leaks. These pressure differences are caused by:

▶ *Temperature differences* — In winter, warm inside air "bubbles" up through building cracks, flues and chimneys (warm air is more buoyant than cold air). This is called the "stack effect." The taller the building and the greater the difference between indoor and outdoor temperature, the greater the stack pressure. To visualize this effect, imagine drilling holes in the bottom of a bucket, then turning it upside down and immersing it in water to see the bubbles streaming upward.

▶ *Wind pressures* — These vary and are significant when the wind is blowing, causing infiltration on the side of your home receiving the wind and exfiltration on the opposite site.

▶ *Mechanically induced pressures* — Operating bath and kitchen fans, fireplaces, dryers, etc., can push air out of your home forcefully enough to cause outdoor air to be sucked inside to replace the removed air.

These three kinds of pressure often occur simultaneously, resulting in a complex, constantly changing pattern of infiltration and exfiltration.

Where do air leaks occur?

The shell of your home serves as the dividing line between heated and unheated space. However, there are many places in that shell where air leaks can occur, including:

- Windows and doors
- Attic hatches
- Plumbing pipe entrances
- Electrical service panels
- Kitchen cabinets
- Interior partition walls (think of all the holes the electrician drilled in these to run wires to interior outlets)

Air in the soil can also come into your home through cracks, joints and penetrations in basement walls.

Air leaks are measured in "air changes per hour" (ACH). An average home leaks the equivalent of its entire internal air volume every hour (i.e., one ACH). Newer homes leak about 45 percent of their air volume every hour (.45 ACH).

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How do I find the leaks?

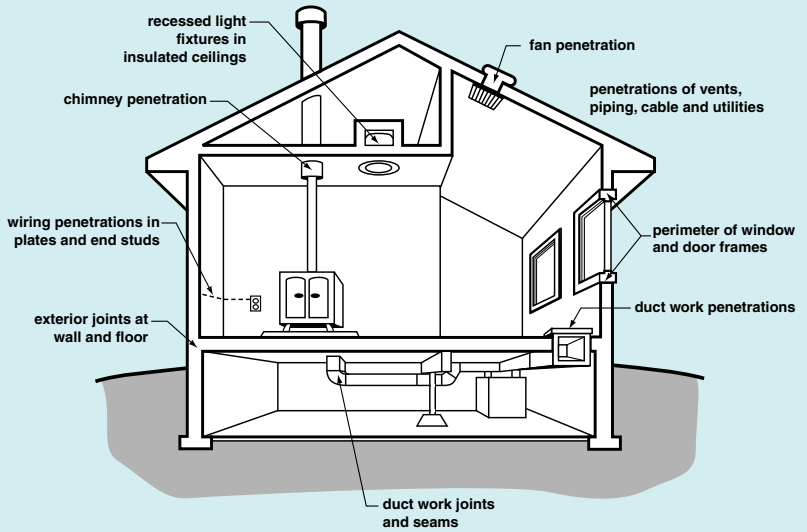
Some leaks can be found through a visual inspection, but most cannot. Sealing contractors often use a device called a blower door to measure air leakage. This fan depressurizes the home and measures the rate at which air is pulled back in.

The Solution: Air Sealing

What is air sealing?

You can't eliminate all air leaks, but you can reduce them significantly. Air sealing is a systematic approach to plugging the leaks that allow air to enter or escape your home. After you locate the leaks, apply the appropriate sealants, foams, weather stripping and other materials to seal them shut. Several kinds of sealing materials are available; the kind you use will depend on your specific situation. For example, sometimes sealants must bond to dissimilar materials, such as metal and wood, to be effective. Other considerations include the size of opening to be sealed, the amount of movement in the area due to regular building expansion and contraction, and temperature considerations. Sealing is done primarily from the inside of your home.

Critical Areas for Air Leakage Control



Remember that air sealing is just one approach you can take to improve your home's energy efficiency. Adding insulation and making heating system improvements are other options. You need to take a close look at your home's specific needs, and where you can reap the most energy savings per dollar invested.

Benefits of air sealing

Air sealing is generally an inexpensive way to reap many rewards. For example, air sealing:

▶ *Reduces or eliminates cold drafts coming into your home during the winter*

▶ *Improves the efficiency of air-cleaning devices operating in your home* — This is especially helpful to people who are sensitive to dust and pollen.

▶ *Raises your home's humidity levels* — Low humidity levels cause static electricity and create a cooling effect on your body that further chills you during the winter.

▶ *Increases ventilation effectiveness in your home*

▶ *Reduces moisture problems* — Air escaping from a warm home during the winter can lose some of its water vapor as it approaches the cold outdoor air, right about the time it's passing through the shell of your house. Over time, this accumulated moisture can discolor walls, blister exterior paint, soak insulation, create mold and mildew, and possibly weaken the building structure.

▶ *Reduces heating and cooling costs* — Many factors contribute to the cost of heating and cooling your home, and the extra costs you're paying due to air leaks vary also. For example, a very leaky house with large, easy-to-access leaks may be sealed to a .5 ACH and allow you to recoup your costs within two to three years with your energy savings. A house with many small, hard-to-find leaks may be impossible to seal to a .5 ACH level with even a seven-year payback on your costs. (Remember — the ACH level lets you know how fast air is "turning over" in your house each hour, so the lower the ACH the better.) In a typical house, you can spend between $200 and $1,200 to get a 30 percent to 40 percent air leak reduction that will save you 10 percent to 15 percent on your energy bill.

Common Caulking Materials

Generic Product	Cost	Useful Life	Joint Movement	Comments
Oil-based caulk	Low	3 – 5 years	Very poor — 1%	Poor adhesion to wet surfaces. Considerable shrinkage. Generally not recommended.
Butyl rubber caulk	Low to medium	3 – 10 years	Fair — 5-10%	Good adhesion to masonry and metal; poor to wet surfaces. May be stringy during application. Long curing time before paintable. Becomes brittle.
Acrylic latex caulk	Low to medium	3 – 10 years	Poor — 2%	Use only for interior applications on joints between similar materials. Easy to use; cleans up with water; paintable.
Siliconized acrylic latex caulk	Medium	10 – 20 years	Fair — up to 10%	Silicone greatly improves product over standard acrylic latex. Easy clean-up and painting; minimal shrinkage. Considerable variation between brands relative to silicone content.
Silicone caulk	High	20 – 50 years	Highest — 50%	Excellent flexibility. Good adhesion to metal and glass. Effective over very wide temperature range. Easy application. Most are not paintable. May not bond well to all woods, concrete or other porous materials without extensive preparation.
One-part polyurethane caulk	High	20 – 30 years	Good — 25%	Excellent adhesion to most surfaces. Very good performance. Paintable. Clean-up may be difficult. Used by professionals for years; has become widely available only recently.
Ethylene copolymer (geocel)	Medium	20 years	Good — 25%	Good adhesion to most materials; good flexibility; paintable. Good general-purpose caulk.
Polyurethane foam sealant	Medium	10 – 20 years	Poor	Good for filling large cracks but does not move well. Not recommended outdoors.
Acoustic sealant	Medium	20 – 30 years	Good	Not paintable, non-shrinking, non-hardening. For unexposed joints only. (Sound control and sealing air/vapor barrier.)
Silicon firestop	Very high	Not available	Excellent — 20-60%	Two-part sealant that expands by chemical reaction to form compression seal in crack. Fire rated for applications such as party wall sealing. Applied as liquid, so needs backer material. Relatively expensive.

Health and safety concerns

When you are air sealing, make sure you:

▶ *Maintain or improve indoor air quality* — Indoor air quality is a complex issue, but the quality of the air in your home can be compromised if any polluting substance in your home — such as dust, moisture, formaldehyde in wall cavities or furniture, chemicals in household cleansers, etc. — has a high enough concentration to become a health hazard, a source of physical discomfort or a threat to the structure of your home. Air sealing can reduce the entry of outdoor pollutants into your home, but it also can cut off the exit of indoor pollutants. Although rare, it's possible to tighten a house too much, which would reduce the air exchange to a point that's too low to maintain good indoor air quality. If that occurs, you need to either reduce sources of internal air pollution, or increase ventilation.

▶ *Ensure there's an adequate air supply for any combustion appliances in your home* — Combustion furnaces and water heaters, fireplaces and wood stoves typically consume indoor air when they're operating, and they need air to help exhaust the combustion byproducts (smoke, fumes, etc.). If you tighten a home too much, those pollutants can be pulled back into your home.

▶ *Avoid fire and other safety hazards when installing material* — Proper sealing around chimneys, furnace flues and electrical outlets/fixtures requires specific materials and attention to local building codes. You should wear a respirator if you're working in a crawl space, attic or other dusty area, and especially if there is the possibility of encountering asbestos. Take extra care in sealing around electrical outlets, fixtures and service panels to avoid electrical shocks. When caulking, be sure the area you're working in is well ventilated.

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QUESTIONS?

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