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Building envelope solutions and simple tips



AIR SEALING

Is your house leaking money?

If your home is like most, the greatest amount of heat loss is from air leakage; heated air escaping to the colder outdoors through hundreds of tiny holes and cracks around your home.

In fact, up to 40 percent of your home's heating bill is spent on heating cold air that has leaked into your home, because warm air has leaked out. The movement of air in and out of your home is increased by the wind, the difference between inside and outside temperatures, and the operation of mechanical systems in your home, such as dryers, exhaust fans and furnaces. It is not unusual for your home to undergo minor expansion and contraction as it adjusts to climate changes, thereby creating air leaks as your home ages and weathers.

But there's good news! Preventing cold air from entering and exiting your home is easy to do.

Of all the energy-saving jobs that need to be done around the house, caulking and weatherstripping are perfect candidates for do-it-yourself projects.

A thorough and effective air sealing job can save you money on your heating bill. Of course, the first step is to figure out where the cold drafts are entering and where the warm, moist air is leaving. Statistically, air leakage in a house is broken down as illustrated on the right.

Playing detective for drafts

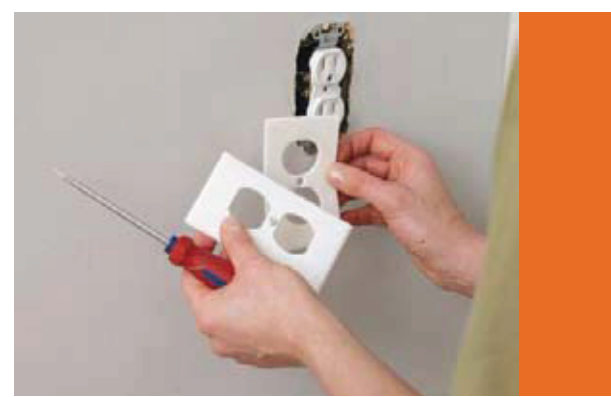
You won't need any fancy tools to find the leaks. With the help of the illustration on the right and your eyes and hands, you can identify areas in need of air sealing. The best time to feel for drafts is on a cold or windy

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In an unfinished basement, you don't have to wait for a cold or windy day to detect drafts – just look for spider webs! Generally, where there's a web, there's a draft.

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day by feeling for the cold air that's entering in through the cracks. But, if you see a crack and don't feel a cold draft, the heated air is probably exiting the house and the crack needs to be sealed.

Ceiling leaks can be a little more difficult to find; try looking for dirty insulation in the attic, as this indicates indoor air is being cleaned by the insulation as it exits your home. You can pinpoint the location of light fixtures and ceiling fans under the insulation by measuring their distance from the walls in the room below. Then, it's easy to locate them in the attic by using a tape measure and the wall-to-fixture measurements. Even though locating and then air sealing the ceiling penetrations may be difficult or awkward, it is the most important step in reducing your home's air leakage and minimizing moisture damage in the attic. If you choose to have a home audit, your air leaks will be easy to find when the certified auditor turns on the blower door. This equipment depressurizes your home forcing outside air to come in through all cracks.

Percentage of air leakage* in a typical house

Wood-burning
fireplace **11%**

Ceiling penetrations
(i.e. interior wall penetrations, light fixtures, ceiling fans, plumbing stack, chimneys) **23%**

Exterior doors
(including the trim around the doors) **8%**

Pipes and wire entrances (for heating fuel, cable television, telephone, electrical services, etc.) **6%**, **Attic hatch 5%**



Exhaust fans (through poor fitting dampers when not in use, and through the cracks around the fan when installed in ceilings or walls) **4%**

Electrical outlets and switches **4%**

Windows (including the trim around the windows) **12%**

Sill plates (i.e. the first piece of wood at the top of the foundation wall and at each floor assembly at the baseboard) **27%**

*All percentages are approximate and may vary from home to home depending on its age and condition. Source: R2000 Training Manual

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Caulking

Caulking is a putty-like substance that is applied to non-moveable joints around the home, such as the edges of windows and door trim. You must caulk on the inside of the house to provide both a draft seal and a moisture block. Blocking the moisture is most important since it prevents the moist air inside your house from penetrating into the walls and attic, and possibly accumulating and causing moisture damage to the insulation and wood framing. Although caulking is usually only done on the inside of the home, a bead of caulking is also applied around outside window and door frames to prevent rain from getting into the walls.

Exterior brick, siding, and storm windows all have built-in vent holes that must not be caulked. These holes provide an exit point for moisture.

Some key points to keep in mind when purchasing and applying caulking:

- Make sure that the caulking material you are using is suitable for the job and is properly applied to ensure a better, longer-lasting job. Some characteristic variations include: flexibility, ability to paint over, ability to adhere to various surfaces, temperature conditions for application, ease of preparation and clean up, expected lifetime, and cost
- Purchase a good quality, durable caulking gun. A good caulking gun is easier to use and the finished result will be neater
- Before applying the caulking, clean the surfaces to remove dirt and grime. Follow the manufacturer's directions on the container. If improperly installed, even the best caulking available will do little to prevent air leakage
- To minimize the problem of too much caulking for the crack, cut the caulking tube nozzle to suit the size of gap to fill. Caulk the smaller cracks first and increase the nozzle hole size for the wider gaps

- Practice on scrap wood before you attempt the baseboards. When practicing, try cutting the nozzle flat and pushing the caulking into the crack while holding the caulking gun at a 90 degree angle. This is often more effective than cutting the nozzle on a slant and pulling the caulking tube and gun, which only lays a bead of caulking on top of the crack

Weatherstripping

Weatherstripping is used around doors, the opening parts of windows, and attic hatches. You can choose from many different types of weatherstripping; from materials such as foam, vinyl, rubber, and metal. There are also different means of attaching them, such as tape and screws.

When properly applied, weatherstripping makes the moveable joint airtight and still allows the door, window, or attic hatch to be easily opened or closed.

Some key points to keep in mind when you purchase and apply weatherstripping:

- Before heading to the building supply store, be sure to note how your doors and windows operate, the size of gap, and colour

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- Good weatherstripping will be easy to install, aesthetically pleasing, and provide a long-lasting, effective seal
- Use effective products that can perform in cold weather and in high-traffic areas
- Clean surfaces before attaching adhesive-backed weatherstripping

For more information on where and how to air seal, see chapter seven.

INSULATING YOUR HOME

How to stop the great escape!

From the very moment heat is generated inside your home, it tries to escape to the colder outdoors. Over and above air leakage, heat is also lost through the ceiling, basement, windows and doors, and walls by conduction, convection, and radiation.

The rate of heat loss depends on the difference between inside and outside temperatures and the insulation resistance met by escaping heat. Increasing the insulation in these areas reduces the heat loss.

Does your home need extra insulation?

If snow is melting on your roof on a cold, dull winter day, you likely don't have enough insulation in the attic. If snow is disappearing from around the sides of your house, you probably need more insulation on the basement walls.

Sometimes it may be obvious where you need insulation; other times it may be difficult to determine the best locations to add insulation.

To determine payback on your investment you must consider the ease of doing the job and the cost of materials. However, if comfort is your priority, upgrade insulation in your home in any order – as long as air sealing is done first. Air sealing will achieve the fastest payback and will help to protect the wood framing and insulation from moisture damage.

Refer to chapter seven to request more information when considering adding insulation.

R-value: The measure of insulation

Insulation is measured based on its heat loss resistance: R-value for short (RSI-value in metric). A higher R-value number indicates a more effective level of insulation.

As insulation is made from different materials, there are varying R-values for the same thickness of insulation. To check the insulation levels of exterior walls, turn the power off and remove the cover of an electrical outlet. If there is a gap, you may be able to see the insulation. Push a thin wooden stick between the electrical box and the drywall or plaster to the back of the wall and measure the depth. In the attic, slide a ruler down the side of a floor joist and measure the depth of insulation.

The recommended R-value of insulation may vary depending on where you live. Check with your local building department for current required levels. The amount of insulation you can add may also depend on how much physical space is available in the walls or attic.

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Protecting the insulation with air and vapour barriers

To be effective and to minimize moisture damage, you must protect insulation with both an air and vapour barrier. In the winter, the air that leaves your home is warm and moisture-laden. When this moisture meets cold surfaces in the walls and attic, it will condense and can then be absorbed by the wood framing and insulation. If insulation becomes wet, its ability to resist heat loss is diminished. There are numerous ways to create effective air/vapour barriers.

Air barriers

Air barriers prevent indoor air, which is carrying moisture, from exiting through cracks. Air barriers also prevent wind from whistling through the insulation. Some insulation, such as glass fiber, rock wool, and cellulose, resist heat loss by trapping small pockets of air. The greater the number of undisturbed air pockets, the higher the R-value. If wind can blow through this insulation, its ability to resist heat loss is greatly reduced.

To be effective an air barrier must be resistant to air movement, continuous, and durable. There are several ways to create an air barrier. The simplest method is to apply caulking or foam and install weatherstripping on the indoor cracks and leaks to prevent air and moisture from entering or exiting the house. In new construction, including additions to your home and new siding, especially designed housewrap materials are wrapped around the outside of the house behind the siding or brick. This material resists wind, but still allows any moisture that gets in the wall to diffuse through.

Air barriers are very important. In fact, studies indicate that an air barrier is 100 times more effective than a vapour barrier at stopping moisture from getting into a wall or attic.

Vapour barriers

Vapour barriers stop moisture travelling directly through a material, like drywall, by diffusion. They are usually constructed of six millimetre polyethylene and installed on the warm side of insulation (normally right behind the drywall).

Vapour barriers improve as a house gets older because each coat of paint and some wallpapers help resist moisture travelling through the drywall or plaster. To make the vapour barrier most effective, the six millimetre polyethylene needs to be sealed at every seam with acoustical caulking (a tar-like caulking). Together, the polyethylene and the caulking form an air/vapour barrier.





Reducing window heat loss

Here are some tips to improve your window's insulating value:

- Heavy drapes or energy-efficient window coverings can be used to reduce heat loss, especially at night. During the winter, be sure to open your drapes to allow heat and air to get to the glass to help minimize condensation problems and to allow the winter sun into your home for some free heat. In the summer, block the hot sun by closing your drapes during the day, installing awnings or reflective window film
- Improve the thermal resistance of the existing window glazing by installing additional layers of glazing. This can be done by adding either a loose fitting exterior storm window or an airtight 'interior storm window', such as shrink wrap plastic that is attached to your interior window frame with double sided tape and 'shrunk' drum tight with a hair dryer

Some tips for purchasing new windows:

To identify energy-efficient windows and sliding glass doors look for the ENERGY STAR® label. The label indicates that the product has met the government's requirements for efficiency and for which climate zone(s) the product has been designed. Four climate zones have been designated across Canada, the more zones a product qualifies for, the more energy efficient it is. ENERGY STAR information is printed in the product literature for each model. ENERGY STAR qualified windows and sliding glass doors will have many of the following features:

- double or triple glazing with sealed insulating glass unit
- low-emissivity (low-e) glass
- inert gas, such as argon or krypton, in the sealed unit
- low conductivity or 'warm edge' spacer bars
- insulated frames and sashes
- superior air-tightness

To determine the approximate R-value of batt or loose fill insulation, multiply the depth (in inches) by 3. For example, 4 inches x 3 = R-12. Approximate R-value = Depth of insulation in inches x 3

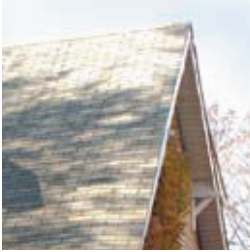
To minimize heat loss, windows must be insulated and air sealed at the frame-to-wall joint when installed. You need to confirm this procedure with the contractor prior to and during the installation.

To ensure a quality installation of your new windows, choose a contractor who has been trained and certified by Window Wise. Window Wise is a quality assurance program that independently audits and certifies contractors and window manufacturers, and conducts comprehensive window installation training for installers. Look for the Window Wise logo and be protected by an industry-backed guarantee. For more information on Window Wise and to find certified companies, visit windowwise.com



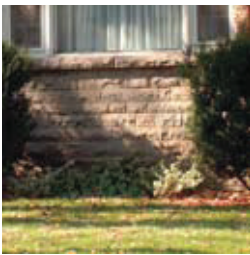
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THE FOLLOWING PRIORITY LIST WILL ASSIST YOU IN DETERMINING WHERE YOUR ENERGY DOLLARS AND EFFORTS ARE BEST SPENT:



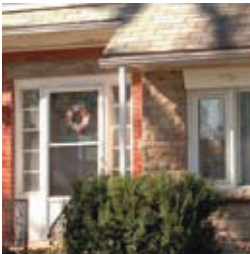
1 Attic

Though it has a relatively low heat loss, 10 to 15 percent, the attic is the first place to consider adding more insulation. It is generally the easiest and least expensive area to insulate. If there is room, attic insulation should be 13 to 16 inches deep (R-40 to R-50) and evenly distributed. Insulation can be kept away from the soffit vents with the use of foam, plastic or cardboard baffles. Caulk or foam all attic floor cracks prior to adding more insulation.



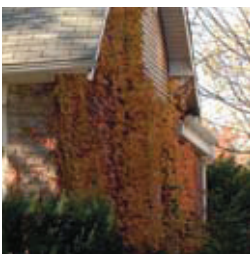
2 Basement

Since an unfinished basement has a high heat loss, 20 to 25 percent, adding exterior or interior insulation is a major opportunity to improve your home's thermal efficiency. Basement insulation is most cost-effective when done in conjunction with finishing the basement as living space, or when digging up the exterior to repair foundation wall drainage. Basement walls should be air sealed and insulated with at least R-10 to R-20 including the header space between the floor joists and all the way to the basement floor.



3 Windows and doors

Windows and doors represent about 15 to 20 percent of your home's heat loss. Remember, this is the heat loss through the glass, wood, and framing materials; not heat loss from air leakage (heat loss from air leakage is included in the air leakage statistic of 30 to 40 percent). Depending on the age, operation, and design of your windows and doors, you may want to consider replacing them. Consider replacing windows and doors if they do not operate easily, are in poor condition, or are difficult to weatherstrip.



4 Walls

Adding insulation to walls is cost effective if done in coordination with renovating the interior walls or re-siding. Don't miss the opportunity to add a continuous air barrier over top of the insulation before installing the siding.