Caulking and Weatherstripping

CO_2RE Home$avers

Take Action on Climate Change

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About CO_2RE

Created *by* Edmontonians *for* Edmontonians...

Carbon Dioxide Reduction Edmonton (CO_2RE) is the City of Edmonton's community-based strategy to permanently reduce local greenhouse gas (GHG) emissions.

The CO_2RE strategy was developed by representatives from the residential, business, industrial, institutional sectors and not-for-profit organizations that worked with the City to develop a single, coordinated plan. The group, known as the CO_2RE Team, consulted extensively with many local groups and organizations to develop a consensus on the best approach and strategies. CO_2RE was launched to the public in 2004.

The CO_2RE mission is to work with Edmonton residents, businesses, institutions, non-profits and industry to provide services, programs and initiatives to assist in reducing energy use, thereby reducing the levels of the GHG emissions that are responsible for climate change.

The original CO_2RE goals include:

- up to a 6% reduction in GHG emissions (from 1990 levels) by the year 2010 and
- a 20% reduction in GHG emissions (from 1990 levels) by the year 2020.

Current Status

Edmonton's GHG emissions increased from 13.9 million tonnes in 1990, to 18.2 million tonnes in 2008 (the most recent year of data), an increase of approximately 38%. Much of this increase is attributable to Edmonton's 24.3% population growth, as well as significant economic growth during this period.

On a per capita basis, GHG emissions appeared to have peaked in 2001 at 29 tonnes of CO_2 per person per year. Since then, per capita emissions have continued to fall.

Do your part...

We can do many things to reduce our emissions – and that includes making our homes and lifestyles more energy-efficient. The publications in this series are a first step, providing Edmonton with specific how-to guides on improving home energy efficiency, saving money and reducing GHG emissions.

For more ideas on how to become more energy-efficient, log onto our website at www.edmonton.ca/co2re.

Free Membership

Why get a membership? Becoming a CO_2RE member is free and the more people who join us in taking action on climate change, the faster we will achieve our goals.

CO_2RE is working with local companies to offer incentives on energy-efficient products and programs to further assist residents. You'll also receive a regular newsletter with new ideas and updates. Sign up today at www.edmonton.ca/co2re.

Organizations or individuals in the industrial, commercial and institutional sectors can contact our commercial coordinator by calling 311.

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Introduction

Houses are built of a number of different materials. Because the materials expand and contract at different rates with temperature and moisture changes, cracks and gaps can occur. Exterior gaps are a concern because water can penetrate and cause deterioration. Interior gaps are also a concern because air leakage causes heat loss and heated air carries moisture which can lead to condensation in the walls.

Air Leakage

Air leakage can account for 30% or more of total heat loss in local homes. Caulking and weatherstripping are materials designed to reduce these leakage losses.

Warm air that leaks out through cracks and insufficient insulation gets replaced with cold air that is drawn in and then heated. When cold air leaks into the home, it can create cold drafts, cold rooms and, in extreme cases, frost on inside wall surfaces. At the same time, moisture escapes with the warm air through these same leaks. If this moisture condenses inside the walls or attic cavities, serious long-term structural damage and mould problems can result.

Sealing uncontrolled air leaks with caulking and weatherstripping can prevent the loss of heat and associated increased heating costs. However, it is important to maintain an adequate supply of fresh air for the health of occupants. (See section on "Can You Seal Too Much?") New homes have ventilation systems and fresh air ducts to ensure a continual supply of fresh air. In older houses without a ventilation system, air exchange usually occurs naturally (through air leakage), but at a cost of higher heating bills.

Sealing air leaks means that you lower the air exchange rate by eliminating excessive air leakage that usually occurs in winter and the excessive house dryness that is caused by high winter air exchange rates. And in the summer, it keeps the cooler air inside, reducing the need for fans and air conditioners.

The table below shows the Low, High and Average yearly heating system gas usage due to uncontrolled air leakage in local homes.

Home Age	Low Air Leakage	High Air Leakage	Average Leakage	Average Cost *
1900-1919	26 GJ	140 GJ	62 GJ	$620
1920-1929	23 GJ	145 GJ	60 GJ	$600
1930-1939	23 GJ	165 GJ	49 GJ	$490
1940-1949	17 GJ	147 GJ	39 GJ	$390
1950-1959	14 GJ	123 GJ	35 GJ	$350
1960-1967	16 GJ	201 GJ	34 GJ	$340
1968-1979	17 GJ	160 GJ	37 GJ	$370
1980-1989	15 GJ	167 GJ	42 GJ	$420
1990-2003	12 GJ	113 GJ	42 GJ	$420

** Based on cost of $10 per GJ including fixed charges, variables, GST, etc.*

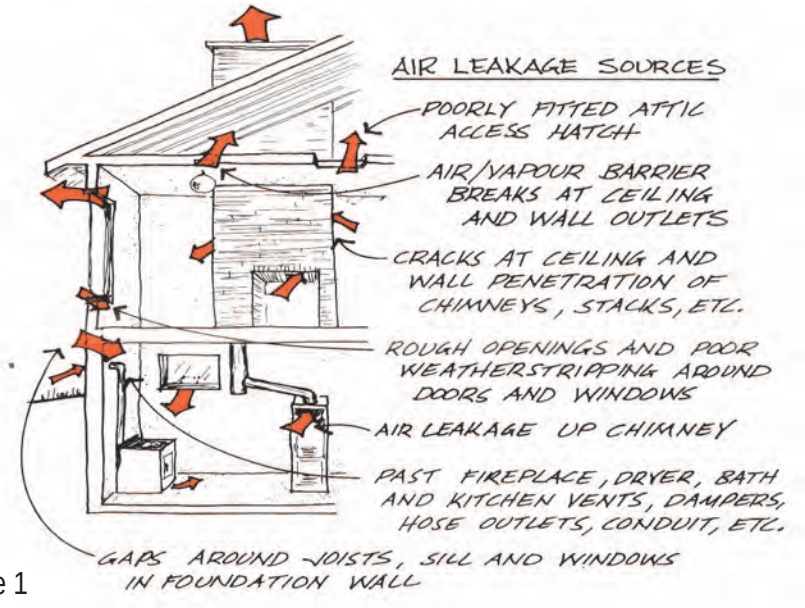


Figure 1

Common sources of air leakage are shown in Figure 1. If all of the small cracks and holes are added up they can be equal to a gap of 30 to 55 cm (12 to 22 inches) square. This is like leaving a small window open all year.

Humidity

Low humidity levels in your home during the heating season may cause static electricity, dust and dryness of the skin and throat. Sealing with caulking and weatherstripping will increase humidity levels and reduce these problems.

On the other hand, you may find that your home's humidity levels during winter are already too high. This encourages the growth of moulds, spores, etc. and can create health problems for some people. Excessive humidity levels may also cause significant damage to the structure of the house.

If your home has excessive humidity levels, it is recommended that this problem be solved before undertaking sealing. Refer to *Home$avers – Condensation Concerns* for information on how to ventilate your home to control humidity.

Air Quality

House air contains numerous pollutants. As concentrations of these pollutants increase, the occupants' health or comfort may start to be affected.

The safe concentration limits vary considerably from one pollutant to another and from one person to another.

There is no simple and conclusive test to identify whether the concentration of pollutants is too high. It is also hard to predict whether sealing will create a problem.

Fortunately, in most cases it is extremely difficult to seal a home to the point where airborne pollutants become a problem if the home has an effective ventilation system to supply fresh air.

If you plan an extensive job of sealing, ensure that your home is equipped with an adequate whole house ventilation system.

Air Sealing the Home

The following five tables show the reductions in air leakage achievable for local homes through air sealing with caulking and weatherstripping. Gas usage, savings figures and greenhouse gas (GHG) emission reductions figures were derived from an analysis of 4,000 Edmonton area EnerGuide Home (EGH) assessment results.

Local costs for the purchase of sufficient caulking and weatherstripping to reduce uncontrolled air leakage in the average home would be in the $100 to $150 dollar range depending on age and size of your home.

Example 1 – Homes 1900 to 1939

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	57	$570	2.83
Potential Gas Savings	24		
Potential Cost Savings *		$240	
GHG Savings ** (CO_2)			1.19

A 42% reduction in air leakage, $240 savings in yearly heating costs and a personal GHG emissions reduction of 1.19 tonnes a year.

Example 2 – Homes 1940 to 1967

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	36	$360	1.79
Potential Gas Savings	15		
Potential Cost Savings *		$150	
GHG Savings ** (CO_2)			0.75

A 41% reduction in air leakage, $150 saving in yearly heating costs and a Personal GHG emissions reduction of 0.75 tonnes a year.

Example 3 – Homes 1968 to 1979

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	37	$370	1.84
Potential Gas Savings	11		
Potential Cost Savings *		$110	
GHG Savings ** (CO_2)			0.55

A 30% reduction in air leakage, $110 savings in yearly heating costs and a personal GHG emissions reduction of 0.55 tonnes a year.

Example 4 – Homes 1980 to 1989

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	42	$420	2.09
Potential Gas Savings	13		
Potential Cost Savings *		$130	
GHG Savings ** (CO_2)			0.65

A 31% reduction in air leakage, $130 savings in yearly heating costs and a personal GHG emissions reduction of 0.65 tonnes a year.

Example 5 – Homes 1990 to 2003

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	42	$420	2.09
Potential Gas Savings	12		
Potential Cost Savings *		$120	
GHG Savings ** (CO_2)			0.60

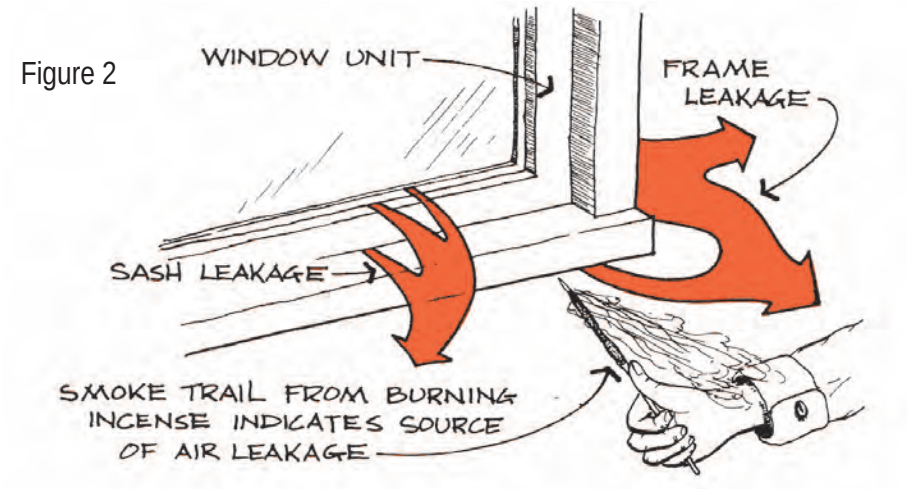
A 29% reduction in air leakage, $120 savings in yearly heating costs and a personal GHG emissions reduction of 0.60 tonnes a year.

** Based on costs of $10/GJ (2004/05 costs)*
*** Greenhouse gas (GHG) emission savings based on average gas usage savings*

Weatherstripping

Weatherstripping can control air leakage where two surfaces meet and move relative to each other, such as windows and doors (Figure 2). Weatherstripping is the easiest and least costly way to control heat loss by air leakage and improves comfort by eliminating drafts.

Figure 2



The first step is to determine where the air is leaking. Consider having an EnerGuide Home assessment completed to identify leakage points. If you would like to check yourself, air leakage can be detected by holding a smoking “draft indicator” near doors, windows and vents. The smoke follows the air currents and locates the draft. Simple indicators are:

- A smouldering piece of cotton string.
- Smoke from an incense stick or “smoke pencil”, a commercially available smoke-generating device.

Air leakage is easiest to detect when the air pressure difference between the inside and outside is the greatest. Choose a cool, windy day in the fall or a cold winter day. Run all exhaust fans and turn on the furnace to increase the pressure difference and air leakage. Move your draft indicator around door and window edges, electrical outlets and other potential leakage areas and mark drafty spots with chalk.

Check the drafty areas to see if the weatherstripping is worn out and should be replaced, or if it just needs adjusting. Use the work plan at the back of the booklet to record results. Based on the information in the following sections choose the appropriate materials, prepare the surface properly and install the weatherstripping correctly.

Surface Preparation

A properly prepared surface is essential for weatherstripping to provide an effective long-lasting seal.

Surface preparation involves several quick and easy steps. Materials to be weatherstripped should be thoroughly cleaned to remove dirt, oil, grease, flaking paint, wood splinters, etc. Uneven surfaces should be levelled with a hand plane or sander. Major gaps or cracks should be filled with latex wood filler.

Before weatherstripping windows and doors, any major structural flaws (warped frames, missing stops, etc.) should be repaired or trued. For adhesive-backed weatherstrips, the surface should be completely dry before application.

Application of Weatherstripping

Most weatherstripping can be easily installed with the use of standard tools such as a hammer, screwdriver, staple gun and hacksaw.

Weatherstripping can be installed throughout the year, but temperature will affect the installation of certain materials. In some cases, weatherstripping installed during warmer months may have to be adjusted to maintain a good seal when sub-zero temperatures are encountered.

As a general rule, adhesive materials used in weatherstripping products are not affected by extremes in temperature. However, while most adhesive-backed materials are meant to be installed without additional fastening, it is generally advisable to reinforce the seal with staples every 15 cm (6 in).

Weatherstripping should be installed in continuous pieces with a minimum of splices. Materials should butt tightly at corners. If there are gaps in the weatherstripping, seal them with caulking.

If there is a possibility of air leakage between the surface it is applied to and the weatherstripping (a gap), apply a small bead of caulking under or against the weatherstripping and the surface.

Types of Weatherstripping

Different weatherstripping materials are available.

Tubular weatherstripping provides one of the best seals. However, on doors or swinging windows, it requires the most closing pressure. This becomes important if the users do not have the strength to fully close the door or window. Vinyl strips are better in areas where this may be of concern.

Felt and open-cell foam strips must be tightly compressed to create an adequate seal. They keep out dust, but are inadequate as air barriers. This publication concentrates on weatherstripping materials made of vinyl, rubber, EPDM (ethylene propylene diene monomer), neoprene and other durable airtight materials.

For a summary of different types of weatherstripping, see Table 1.

Table 1: Weatherstripping Materials

Design	Type	Comments
Tapes 	Cloth/ plastic	Use on non-opening windows and doors. Good for one season. Quick, easy to install. Remains in full view. May remove paint when peeled off.
	Foam, adhesive	Use on windows, doors and attic hatch for compression fit. Available in open or closed-cell types. Closed cell more durable. Open cell inadequate as barrier. Quick, easy to install. Hidden from view.
	EPDM rubber, adhesive	Use on windows and doors for compression fit. Good durability, air seal. Quick, easy to install. Hidden from view.
Gaskets 	Tubular, Core filled	Use on windows and doors. Good durability and air seal. Requires nails/staples/screws which remain visible. Made with rubber, plastic or vinyl. Difficult to compress. Some have an adjustable metal attachment.
	Tubular Hollow	Use on windows and doors. Good durability and air seal. Requires nails/staples/screws which remain visible. Made with rubber, plastic or vinyl. Some have an adjustable metal attachment.
	Hollow on attachment strip	Use on windows and doors. Good durability and air seal. Usually requires nails/screws which remain visible. Slotted holes allow for re-adjustment. Made of rubber or vinyl with aluminium or vinyl attachment strips.
Strips 	Tension (spring metal or v-strip)	Use on windows and doors, especially for gap where sash of double hung window meets. Excellent durability and good seal. Usually made of metal (bronze) or vinyl. Must be nailed if metal, or used with adhesive. Hidden from view. Double strip vinyl available for better seal.

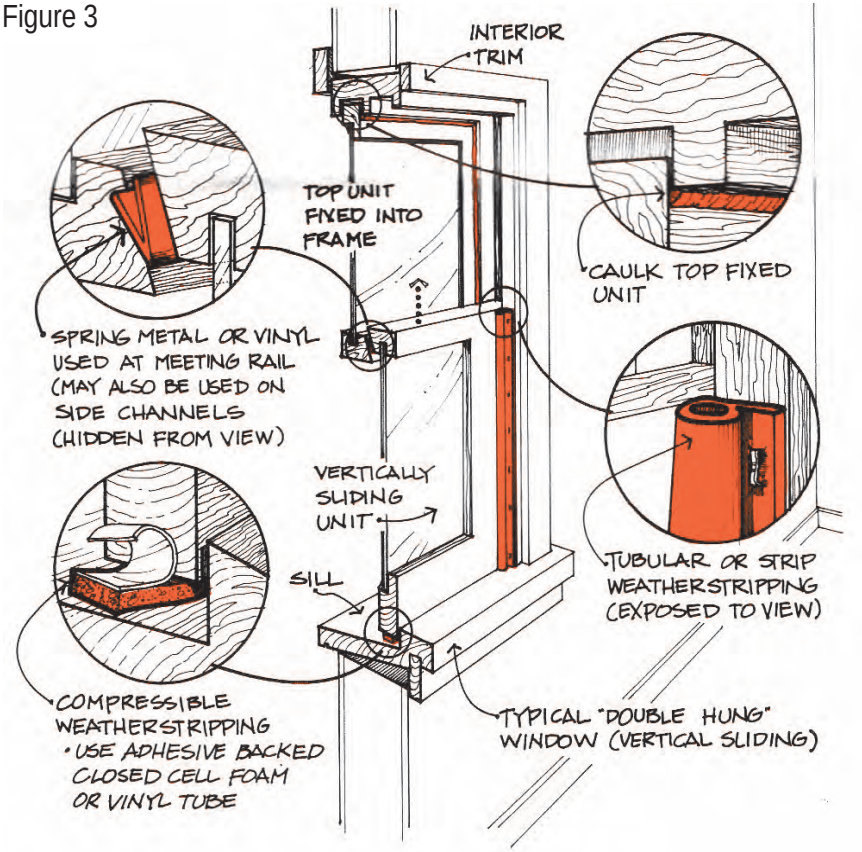
Table 1: Weatherstripping Materials (continued)

Design	Type	Comments
Strips (continued) 	Pile or Fin on attachment	Use on sliding windows and doors. Moderate to good seal and durability. Requires nails/screws which remain visible. Made with vinyl, rubber or polyester pile with a fin-shaped seal on wood, vinyl or aluminum attachment strip.
	Foam on attachment strip	Use on windows and doors for compression fit. More durable than adhesive type. Must be nailed or screwed. Hidden from view. Closed cell is more durable.
Specialty 	Spring loaded	Use on window and doors. Excellent durability and seal. Must be nailed or screwed. Made with aluminum or vinyl. Self-adjusting.
	Magnetic strip	Use on windows and doors. Excellent durability and seal. Must be nailed or screwed. Made with aluminium and vinyl.

Weatherstripping: Windows

The type of window has a direct bearing on the type of weatherstripping to use. Double hung or vertically sliding windows, common in homes 20 to 30 years old, can be weatherstripped with tubular or strip materials (Figure 3). The permanent or non-sliding sections should be caulked to eliminate air leaks.

Figure 3



Spring metal weatherstripping is the most durable but is difficult to install on existing windows. Tubular or vinyl strips can be mounted outside, but in this extreme climate will last longer on the inside. It is best to use a tension strip on the meeting rails in the centre of vertical sliders.

Horizontal sliders are common and include sliding glass doors. Ease of application depends on the type of sash (i.e. the framework that holds the window pane in the frame). If not previously weatherstripped, wood or vinyl-covered wood windows are usually best fitted with tubular or angled strip materials (Figure 4).

If the present weatherstripping is loose, torn or worn out, replace it with a similar type and size of weatherstripping.

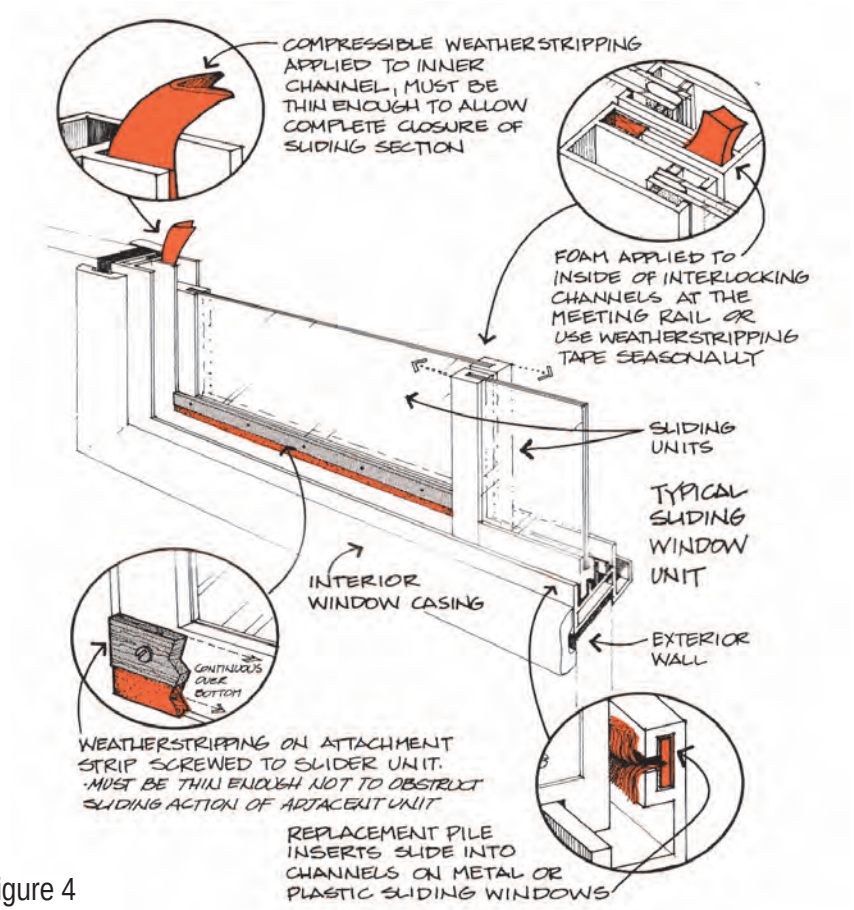


Figure 4

Metal or vinyl sash horizontal sliders are usually weatherstripped at the factory. However, if the weatherstripping is worn or defective, the seals can usually be replaced by sliding new material into the channels (Figure 4).

Be sure to measure the width and take a sample of the current material with you in order to purchase the correct size and type of weatherstripping.

If you are unable to find matching weatherstripping for your horizontal sliders at your local building supply store, try local window manufacturers or window installation companies.

Because there is such a variety of sliding windows, some innovation may be necessary. For sliding windows or doors with large, leaky gaps, seal the channels with polyethylene backer rods or seal-and-peel caulking (see elastomeric caulking in Table 3) in the fall and remove it in the spring. For narrower gaps, apply cloth or plastic tape in the fall and remove in the spring.

Awning, hopper or casement windows that swing open can be weatherstripped in the

same way as doors. The material is attached to the jamb and the door or window closes against it.

Figure 5 shows types of jamb weatherstripping suitable for doors or swinging windows. Weatherstrip all sides including the hinge side of the door.

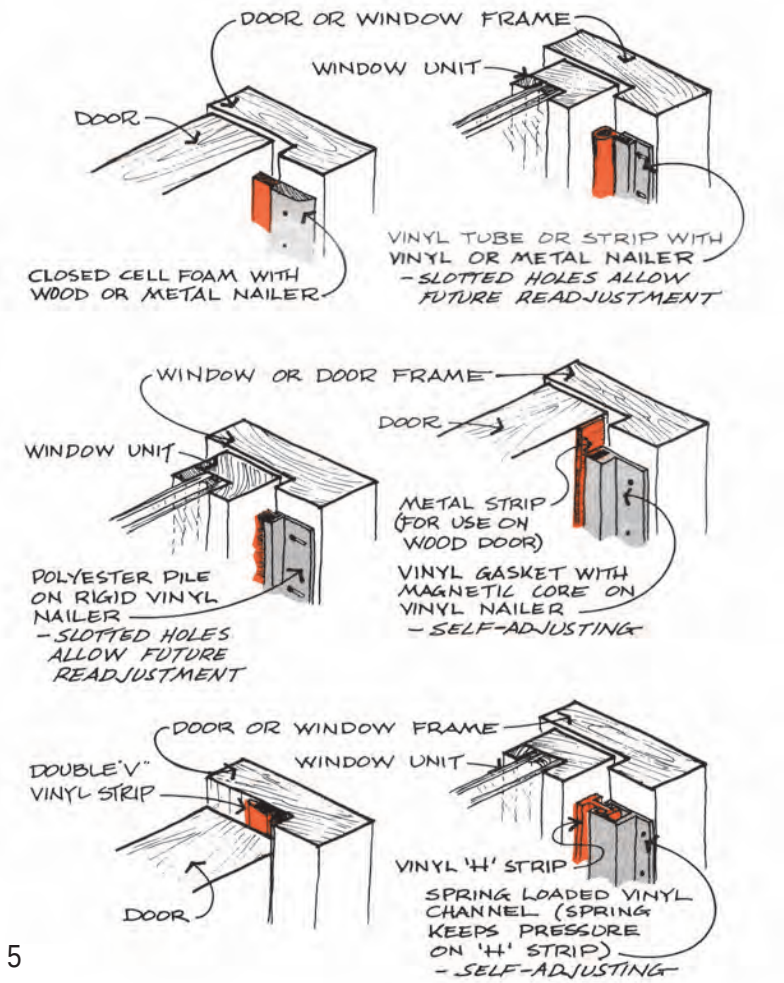


Figure 5

Most windows of this type are factory weatherstripped, but if the materials wear out, replace with similar types. Select a material with slotted holes or one that is self-adjusting to accommodate slight movement, warping or shrinkage.

New windows often have double weatherstripping, that is, two separate seals. This concept can be used when upgrading windows. For swinging windows, put one strip on the edge of the sash that moves and another compression strip on the jamb on the inside.

For a better seal, clean surfaces and apply a bead of caulking under the weatherstripping where it attaches to the flat surface.

Weatherstripping: The Bottom of Doors

The bottoms of doors, unlike jambs, have traffic wear and must be more durable. There are two ways to weatherstrip: using a threshold, or attaching a door bottom or sweep (Table 2).

When using a threshold or door bottom, try to use one that does not require trimming the door. Although some will adjust to accommodate different clearances (Figure 6) others will not. Door sweeps require no clearances because they attach to the side of the door.

Thresholds are generally installed to replace worn out ones. Often the vinyl or rubber weatherstripping is worn out, not the entire assembly. Determine if new inserts can be purchased separately. If the whole threshold must be replaced, select one with replaceable gaskets in order to save time and cost while reducing waste.

Door bottoms or sweeps are usually installed on doors with no existing bottom weatherstripping. They are installed flush with the floor of the existing sill to provide a positive seal against air movement. Select a sweep or door bottom that can be adjusted to compensate for wear and movement.

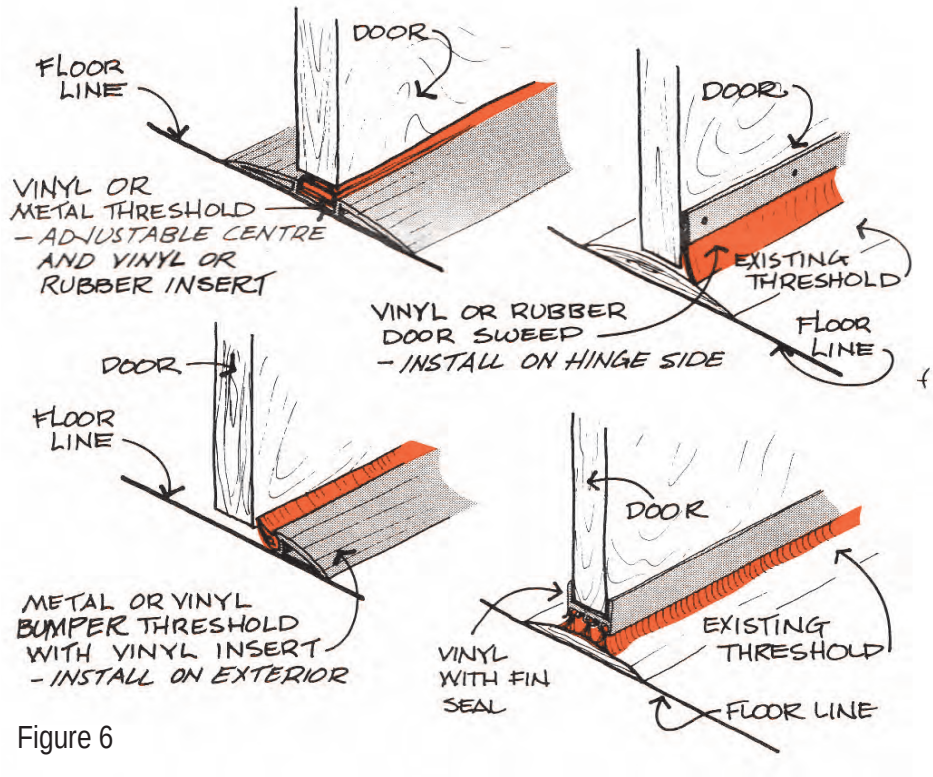
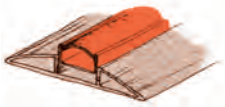
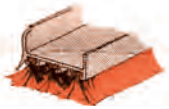
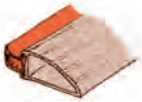


Figure 6

Table 2: Weatherstripping – Doors

Type	Comments
Saddle Threshold 	Requires minimum clearance of 15 mm (⅝ in). May have adjustable insert up to 30 mm (1¼ in). Check that replacement gaskets are available. Fair to good durability. Good seal. Made with vinyl or rubber and an aluminum base. Installed with screws.
Door Bottoms with Fin Seal 	Requires minimum clearance of 8 to 13 mm (¼ to ½ in). Some types can also be used as a threshold. Check that replacement gaskets are available. Screwed into bottom of door; door must be removed for installation. Made with rubber, metal, vinyl or pile on an aluminum or vinyl base.
Bumper Threshold 	Bottom clearance not required. Can be damaged by trapped stones, traffic wear, etc. Check that replacement gaskets are available. Good seal if swept regularly. Fair to good durability. Made with vinyl or rubber on a vinyl, wood or aluminum attachment. Installed with screws on exterior of door.
Door Sweeps 	Good for uneven floors. Adjustable; some adjust automatically for sweeping over deep carpeting. Easy to attach; may be adhesive-backed, nailed or screwed. Attach to inside face on in-swinging door or outside of an out-swinging door. Fair to good durability and seal, depending on material used. Made with vinyl, rubber or polyester pile on an aluminum, vinyl or wood attachment strip.

Weatherstripping: Other Openings

Other "door-type" openings include milk chutes, clothesline doors and attic hatches. Milk chute and clothesline doors can be weatherstripped with the same materials as windows and doors.

If the chute or clothesline door is not in use, fill the box with insulation and seal the inside door with caulking.

Attic access hatches should be weatherstripped with compressible tube or strip products installed as shown in Figure 7. If the hatch is too light for a tight seal, add fasteners or screw the hatch securely closed. The hatch must be adequately insulated.

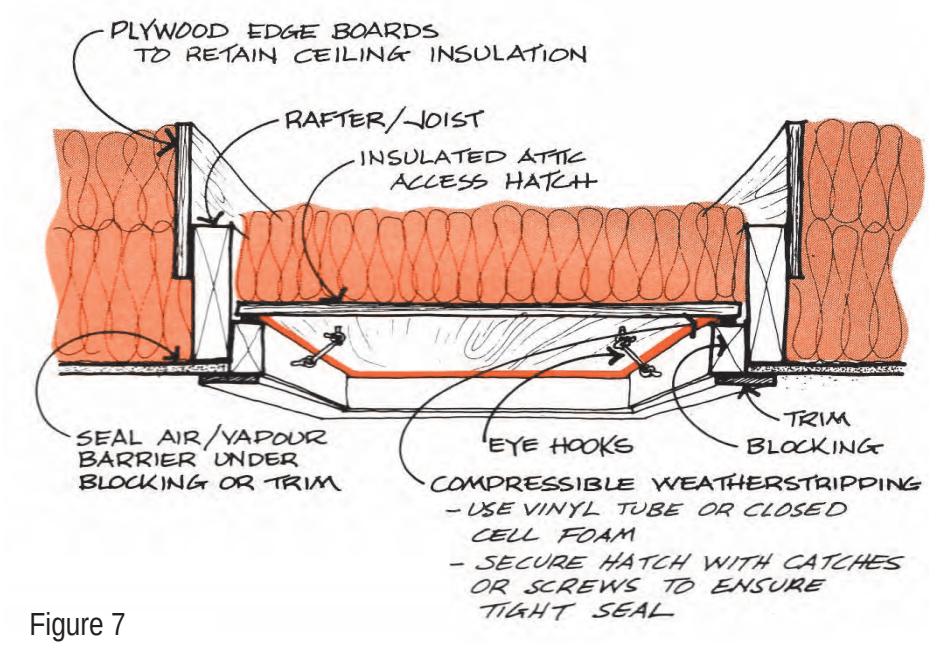


Figure 7

Other "doors" to the exterior include exhaust fan dampers. These cannot be weatherstripped. Make sure they are closed when not in use by feeling for backdrafts. A dust or lint build-up around the closing flap or a bent sticking hinge on a vent can prevent the flap from closing completely. Clean and adjust the dampers to correct this.

The duct that runs from the clothes dryer should be cleaned regularly to prevent a lint build-up around the damper.

The fireplace chimney damper should fit tightly. Use a light to check for gaps caused by debris build-up, warping or poor construction. The damper cannot be weatherstripped but can be cleaned or adjusted for a better fit. An alternative would be to install a new damper on top of the chimney.

Consider plugging the chimney opening in winter, or permanently if the fireplace is not used. A decorative, insulated fireplace "plug" can be inserted into the cold firebox opening (Figure 8). The plug will prevent heated room air from constantly rising up the fireplace chimney around a poorly fitting damper.

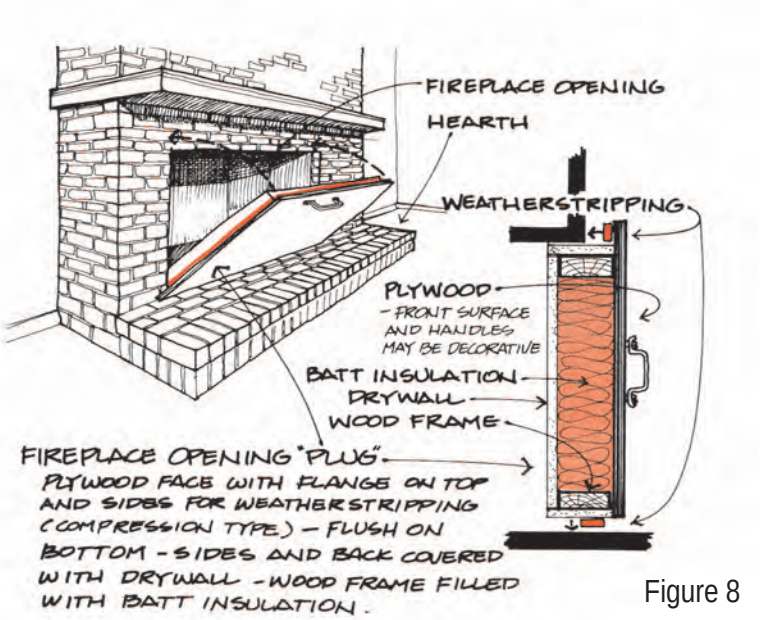


Figure 8

Caulking

Caulking is applied where two surfaces meet but do not move, such as sill plates or duct outlets. Applying caulking requires a little more effort and skill than weatherstripping but can still generally be done by the resident. Some areas such as plumbing stacks, chimneys or electrical outlets require specialized or combination weatherstripping and caulking techniques.

The best place to seal with caulking is on the inside, to prevent moisture accumulating in wall and ceiling cavities. Interior sealants should be chosen for their ability to maintain a good degree of flexibility and adhesion over a long period of time.

The preferred interior sealant will depend on its use. There are many caulking types available, including combinations of the basic types listed in Table 3. Always read the label and follow the manufacturer's instructions for proper use and application.

Factors to consider include whether the sealant will be exposed or concealed, the width of gap, types of adjacent materials and whether a high degree of flexibility is required.

Table 3: Types of Caulking

Type	Comments
Oil/Resin base	Durable for 1 or 2 years. Forms hard surface when dry, cracks.
Latex base (acrylic & non-acrylic)	Durable for 10 to 20 years. Acrylic has better adhesion and is more durable than non-acrylic. Bonds well to porous surfaces such as wood or concrete but not to metal, some plastics or glass. Easy to apply; does not require primer. Do not use in constant-moisture environments (showers) as susceptible to mildew. Cures in three days. Forms hard (non-acrylic) or flexible (acrylic) surface when dry; use for small joint movement between similar materials (e.g. from temperature change). Can be painted; available in colours. Most types clean with water.
Butyl rubber	Durable for 5 to 15 years. It bonds well to all surfaces, but tends to shrink. Does not require primer. More difficult to apply than latex. Can degrade in sunlight. Cures in seven days. Flexible when dry; use for small movement joints. Clean with paint thinner. Can be painted; available in colours.
Elastomeric (silicone or polysulphide)	Durable for more than 20 years. Bonds to most surfaces. Requires primer for some plastics, masonry and other porous material (specialized sealants are available). Won't seal over itself without a primer. Difficult to apply in cold weather. High moisture resistance. Silicone cures in 5 days, polysulphide in 30 days. Non-toxic when cured. Temporary types available that can be peeled off. Little shrinkage; remains flexible when dry; use for large movement joints. Needs special cleaners for tools and hands.
Polyurethane Foam	Available in aerosol can. Specialized product for large gaps. Requires care in applying as it can expand up to 2½ times. Bonds to most surfaces. Requires a primer before use on pressure treated wood or vinyl. Not all types are suitable for window rough openings. Tack free in hours, final cure 8 days. Flammable (must be covered with drywall on interior). High insulation value.

Table 3: Types of Caulking (continued)

Type	Comments
Silicone Sealants	Durable for more than 20 years. Bonds to most surfaces; may require primer on wood, steel or anodized aluminum. Available in some colors and clear (non-paintable). Good moisture resistance. Tack free in hours; cures in 3 to 5 days. Good flexibility; can bridge large movement joints. Apply only in a well ventilated area. Cleanup with solvent or paint thinner.

The most common and easiest form of caulking to use comes in 310 ml (11 oz) tubes and is applied by using a standard caulking gun. As shown in Figure 9, large-sized tubes are also available.

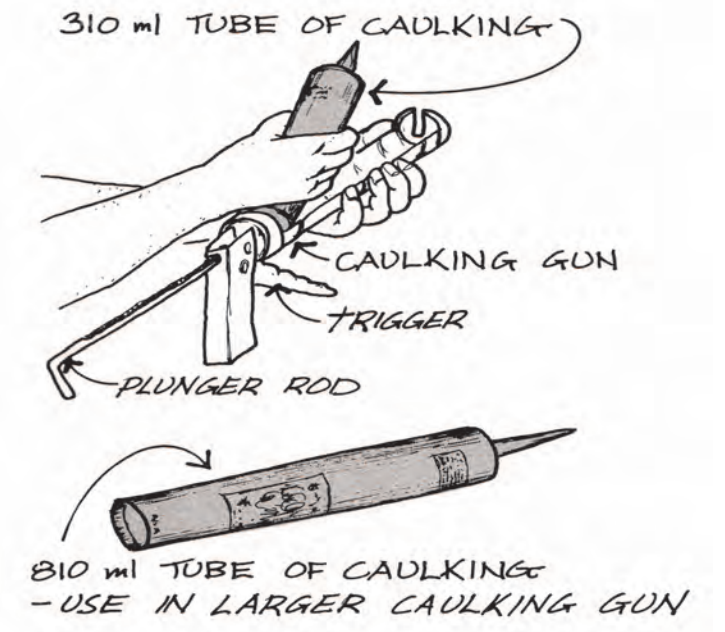


Figure 9

Before using caulking:

- Remove old caulking completely.
- Make sure all surfaces are dry and free of dirt, loose materials, grease or oil. Do not apply caulking at temperatures below 10°C (50°F) unless otherwise specified on label.
- Always read the label. See if the caulking is flammable, irritating to the skin or gives off dangerous vapours, and handle it accordingly.
- If priming is required, paint two light coats of alcohol shellac or a primer recommended by the manufacturer.
- Choose caulking suitable to the size of the crack to be filled and compatible with the materials it is to adhere to.
- Large cracks, deeper or wider than 12 mm (½ in) should be filled first with backing material, such as closed-cell polyethylene foam (called backer rod) or oakum.
- Tape edges of the crack to keep caulking off adjoining surfaces.

Practice may be required to make a neat, uniform "bead" when using a caulking gun. The nozzle can be cut straight or at a 45° angle. If the nozzle is tapered, cut it at the point that will give the required width – near the narrow end for a small bead, farther up for a wider bead. Be careful to leave enough caulking to accommodate shrinkage or joint movement.

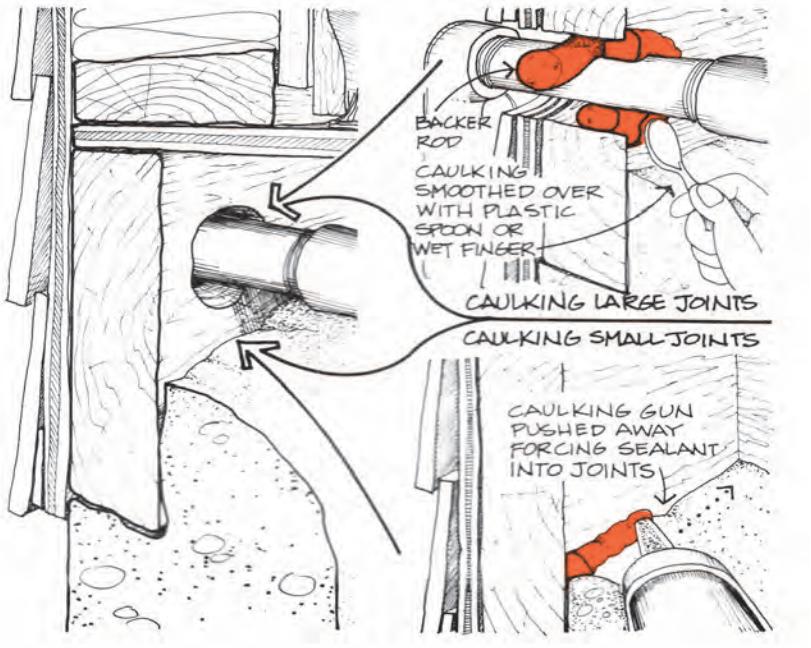


Figure 10

The caulking material should be pushed out of the nozzle as steady pressure is applied (Figure 10). Hold the angle of the gun constant and move ahead at an even rate. The resulting bead should provide a good seal.

Remember to release the pressure on the plunger after each run or you will get messy drips. Smooth the bead with a wet finger, or use a plastic spoon for toxic caulking such as silicone or oil-based.

For gaps larger than 9 mm (⅜ inch) in width or depth, polyurethane foam can be used (Figure 10). Other caulks require a backer material such as cord/rope caulking or foam weatherstripping to reduce depth. Most caulking will crack and break free if it does not have three-point contact (two sides and behind).

When finished, seal the tip of the caulking gun tightly after cleaning out excess caulking. Shelf life for most unopened caulking is two years. For immediate clean up, follow the instructions provided on the caulking package.

Sealing the Joist Space

The exposed section of foundation walls and the joist space (i.e. the gaps between the supporting beams) have cracks and openings, resulting in a high rate of air movement. It is easier to seal the joist space from inside.

Figure 11 shows how the sill plate and joists can be caulked. A good quality caulking for this area is acrylic. Be sure to seal inside and outside service pipes, ducts or conduits that go through the walls or end joists.

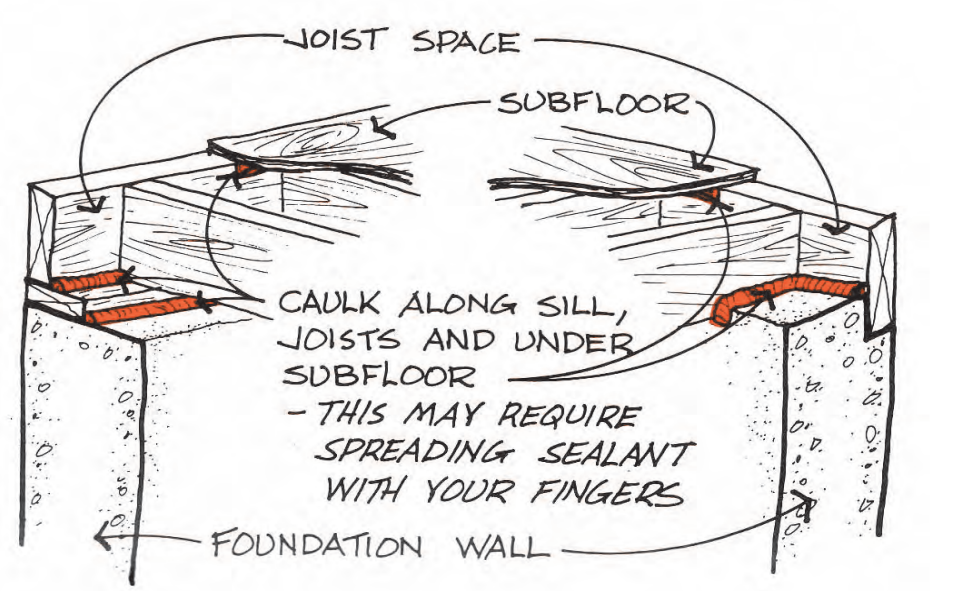


Figure 11

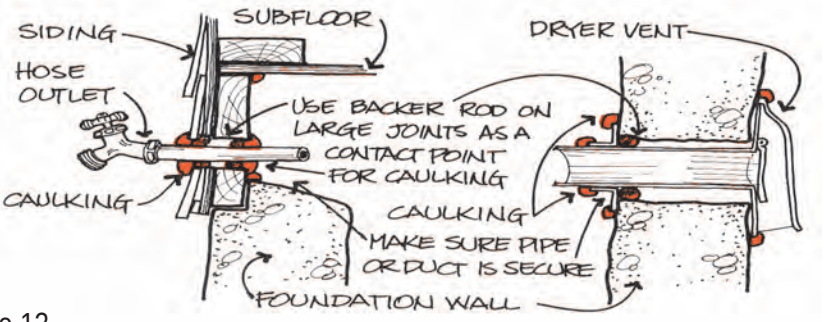


Figure 12

Large gaps should be tightly stuffed with cord/rope caulking or filled with expanding foam as a backing for caulking (Figure 12). Use good quality, durable, long-life caulking material because it may be covered when you insulate the joist space. Elastomeric caulks suitable for concrete application work best.

Sealing the Attic Space

If the attic has a vapour barrier, cracks around pipes, vents and chimneys or along partitions between the warm living space and cool attic must be plugged to stop air leakage (Figures 13 and 14).

Plywood “collars”, neoprene roof flashing, or polyethylene can be made to fit snugly around plumbing and vents. The material must be secured and caulked to the pipe and existing vapour barrier.

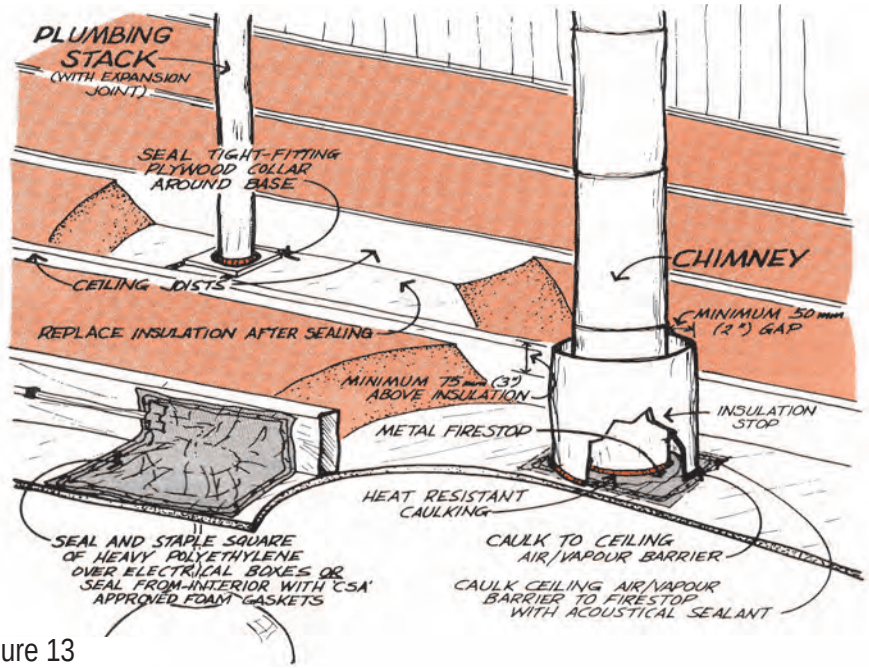


Figure 13

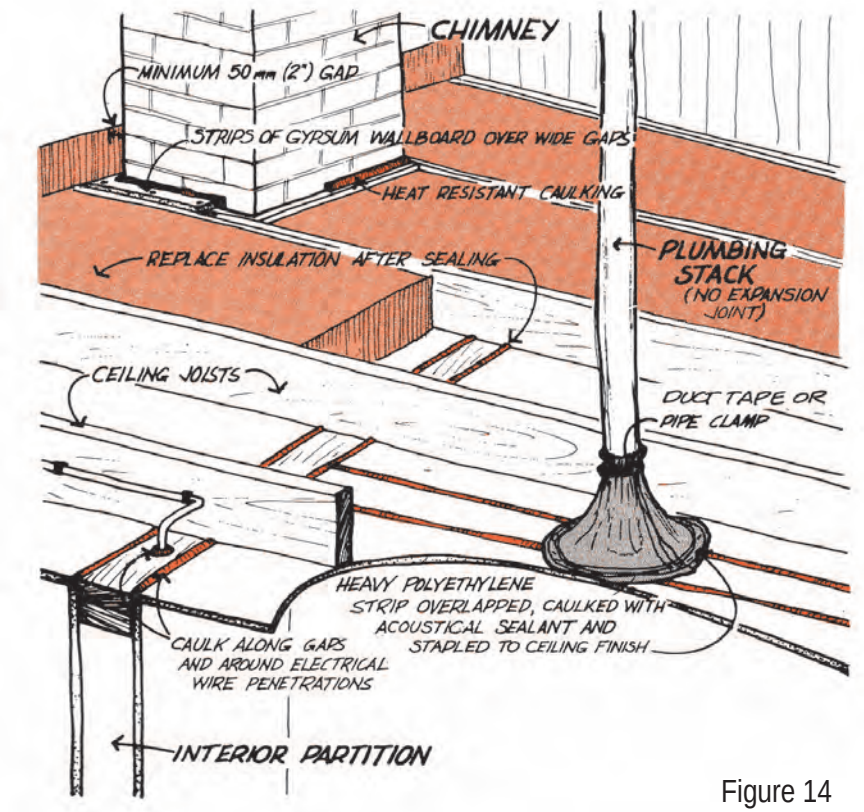


Figure 14

Metal fire stops must be used around metal chimneys. The metal must be sealed to the vapour barrier. Do not use normal caulking material but use heat resistant "muffler cement" to seal the fire stops to the chimney metal.

Strips of gypsum wallboard sealed with heat-resistant caulking can be used around masonry chimneys.

Improve the vapour barrier over ceiling electrical boxes by attaching an additional piece of polyethylene over these areas.

Recessed lights must have adequate air space around them to prevent any fire hazard. Figure 15 shows an acceptable method of sealing and insulating around such fixtures. Be sure to check the manufacturer's specifications and maintain recommended clearances.

Be sure to disconnect the circuits in the areas of work. Try to caulk the points where electrical wires penetrate the open plates of walls.

Before leaving the attic, replace insulation in all areas where it was disturbed. Do not place attic insulation within 50 mm (2 in) of chimneys.

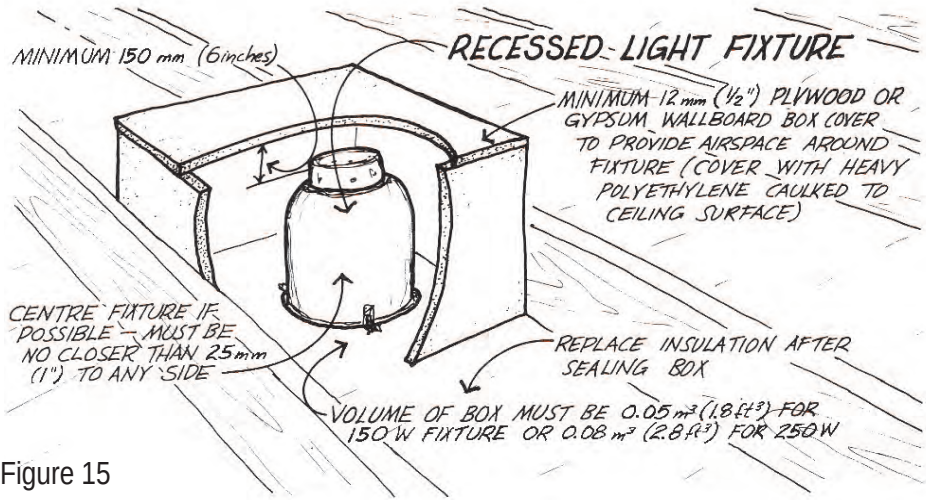


Figure 15

Sealing Around Windows and Door Openings

The installation space or rough opening around windows and doors is a major source of air leakage. Usually insulation has been stuffed into the gap. This insulates but does not stop the airflow. This leakage can be prevented with caulking cords or foam (Figure 16). When using foam, be sure to use a low-expansion foam. High-expansion foam may warp windows, affect proper adjustment or lead to gas leakage from gas-filled window units.

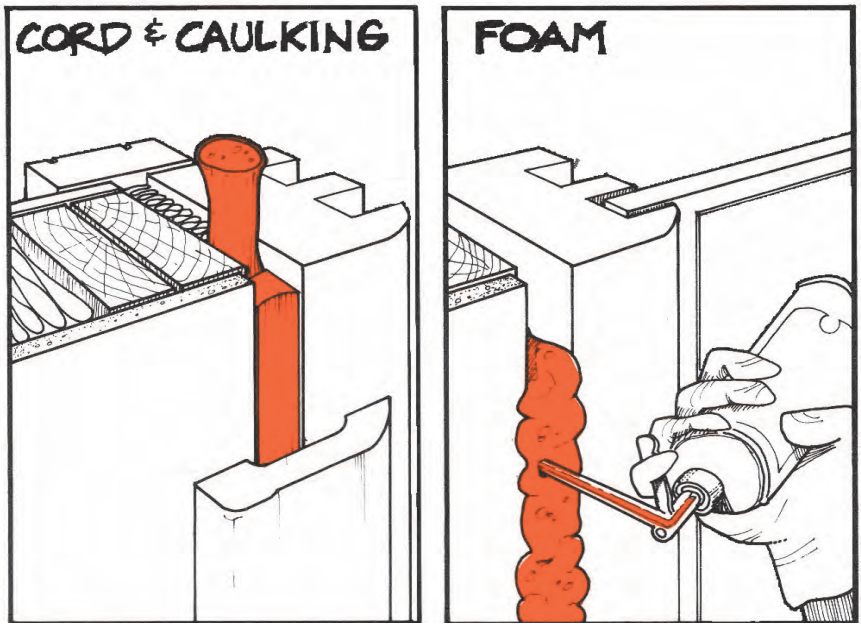


Figure 16

Sealing Loose Panes of Glass

If glass panes are loose in their frames, new caulking is required to stop air leakage. Putty compounds are often used and are the least expensive solution. Clean off the old material before reglazing. *Home$avers – Windows* discusses this method in detail.

A cartridge-type caulking material can stop air leakage around sealed units and their frames (Figure 17). Remove the window trim and lay a bead of caulking (for glass) along the bottom of the sealed unit. Replace the trim.

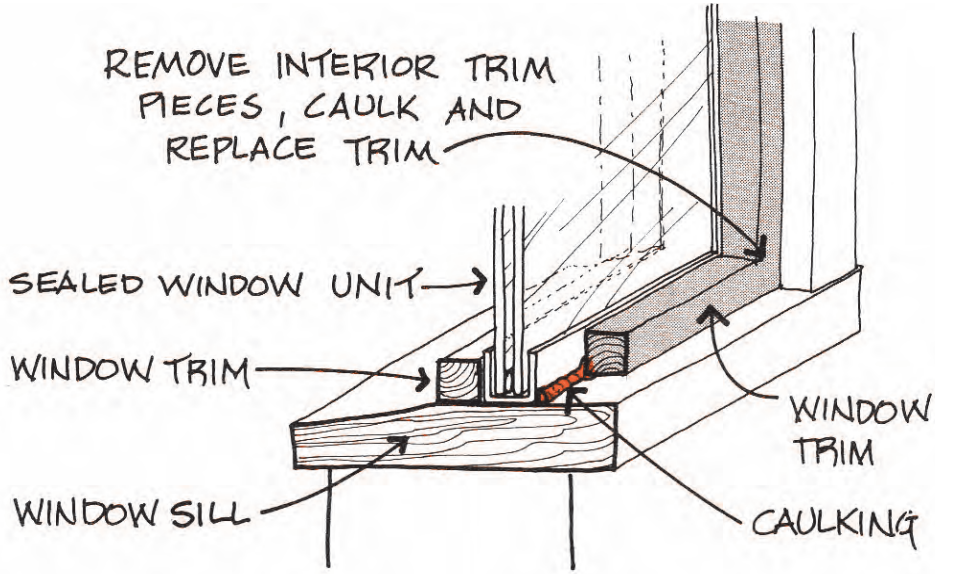


Figure 17

Glass panes in metal and vinyl frames are sealed with vinyl strips. The strips are durable and should not require replacement during the life of the window.

Sealing Wall Outlets and Switches

Electrical outlets and switches are another source of heat loss, especially those located on exterior walls. Tests indicate that between 10 to 20% of total air leakage heat loss can occur through these outlets, which are another source of cold drafts in the home.

You can reduce losses using one of these methods:

- Use clear silicone sealant and draw a bead around the plate and wall and around the switch or outlets and the plates (Figure 18).
- Use commercially available inexpensive Canadian Standards Association (CSA) approved gaskets between the plate and wall (Figure 19).

Electrical codes forbid placing any object inside electrical boxes, so all sealing must be external to the box. Do not use polyurethane foam as it is combustible and may expand into the electrical box.

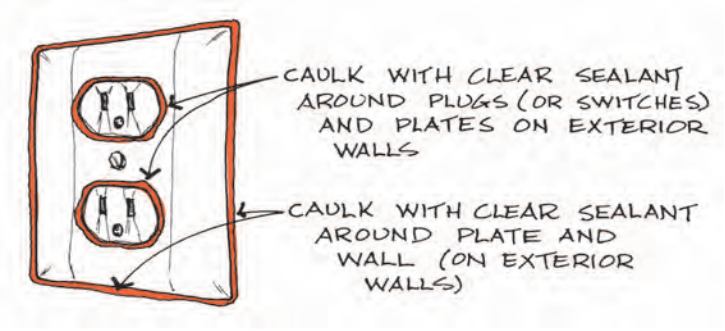


Figure 18

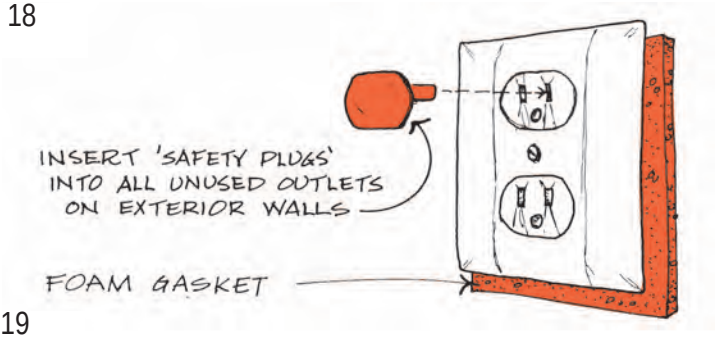


Figure 19

Child “safety plugs” can be placed in unused outlets to stop airflow through the holes (Figure 19).

If you are removing wall finishes, renovating or installing new wiring, install a vapour barrier behind new electrical boxes. Use commercially available polyethylene box covers. Seal the box covers to the wall vapour barrier with an acoustical sealant before re-covering the walls.

Can You Seal Too Much?

With most homes it would be difficult to seal the house to the point where air quality problems occur. Although a very remote chance, it is possible that if the home’s heating and ventilation systems (fresh air supply) are not up to current standards, it might be possible to seal the home too air tight. If the home is up to current code requirements, it has a makeup air duct connected to the cold air return, which will help ensure the home has a fresh air supply.

If your home is older, the fuel-burning appliances were not provided with their own supply of combustion air from the outdoors. Air is required by gas burning appliances for the efficient burning of fuel and to remove the resulting combustion by-products up the chimney or flue.

If you plan an extensive job of sealing, have a heating contractor ensure that any fuel-burning appliances in the home are provided with an adequate supply of combustion air as per current standards.

Once you have caulked and weatherstripped your home, if you notice that any of your fuel-burning appliances (e.g. fireplaces, boilers, furnaces or hot water tanks, etc.) are not operating properly, or you can smell any fumes, you may not have an adequate supply of combustion air.

If this happens, you or a heating contractor will need to install a separate combustion air duct to the gas-fired appliance.

In newer homes, there should be separate combustion and fresh air ducts to the furnace area. In these cases, air sealing will not affect the performance of the appliance.

If upgrading your appliances, consider purchasing sealed combustion gas appliances to eliminate any backdrafting potentials.

Install a carbon monoxide detector to ensure you are maintaining good indoor air.

Summary

Reducing air leakage into and out of your home should be considered a first step and a must for making your home energy-efficient. The costs associated with weatherstripping and caulking are small, and though installation takes time, it is not overly difficult. Once completed, it will save you money, improve the comfort level by eliminating drafts and reduce your share of the GHG emissions contributing to climate change.

Use the work plan on the following page, and ensure that you:

1) Address significant condensation concerns prior to undertaking weatherstripping and caulking.
2) Check potential areas of air leakage and identify the major sources. Don't forget to include vents and dampers on fans and fireplaces.
3) Weatherstrip windows, doors and hatches.
4) Seal around door and window trims.
5) Caulk cracks, outlets, vents and pipes penetrating the house exterior. Remember to do the ceiling as well as exterior walls.
6) Check for air leakage again in order to test effectiveness of sealing.
7) Continue to watch for signs of increased condensation and treat if necessary.

Work Plan

This work plan is designed to help you detect air leakage areas and to record materials required. Take this work plan, along with your draft detector and tape measure, around your house and test and note the air leakage points.

Using the next page in this booklet, record the materials required. Take the work plan with you to your local hardware and building supply store to purchase the materials you need.

Remember to test your home on a day when drafts will be greatest (i.e. cold and windy) and don't forget to turn on all exhaust fans, the clothes dryer and your furnace to create the most air leakage possible.

Area	Feature	Description
Basement	Windows	Caulk around window frame.
		Replace weatherstripping.
	Sill plate	Caulk between floor joists and concrete.
	Clothes dryer vent	Caulk around vent.
		Make sure vent flap seals properly.
	Fresh air duct	Caulk around duct.
	Electric service cable	Caulk around cable.
	Telephone cable	Caulk around cable.
	Outside faucet	Caulk around faucet.
	TV Cable	Caulk around cable.
Walls	Outlets, switches	Install gaskets behind plates, safety plugs.
	Windows	Caulk around window frame.
		Replace weatherstripping.
	Doors	Caulk around the door frame.
		Replace weatherstripping.
	Fireplace	Install glass doors, "plug", and chimney top damper.
		Check damper for proper seal.
	Baseboards	Remove and caulk behind.
	Milk chute	Caulk and ensure flaps work properly.
	Ventilation fans	Caulk around outside edge.
	Mail slot	Check for seal.
Ceiling	Attic hatch	Weatherstrip around perimeter & insulate.
	Plumbing stack	Install vapour barrier and caulk.
	Bathroom vent	Caulk around outside edge.
	Kitchen vent	Caulk around outside edge.
	Recessed lights	Install vapour barrier and caulk.
	Chimney	Install metal collar and caulk.
	Electric wire penetrations	Caulk.

Materials: Types, Quantity	Tested	Sealed

Natural Resources Canada – Office of Energy Efficiency

www.oee.nrcan.gc.ca – The Office of Energy Efficiency offers a wide range of free publications, programs and services to help Canadians save energy and reduce the greenhouse gas emissions that contribute to climate change.

Recommended Reading: *Keeping the Heat In* is a comprehensive source of energy efficiency how-to information for homeowners. This free publication is available from Natural Resources Canada. Call toll free at 1-800-387-2000.

Alberta Environment

www.environment.alberta.ca – Search for *Saving the World Begins at Home* for numerous conservation tips to practise at home.

Canada Mortgage and Housing Corp.

www.cmhc.ca – CMHC is a valuable resource for information. The CMHC Order Desk is a one-stop shop for all free and priced publications, fact sheets, reports, videos and other CMHC resources. You can order online, or through their call centre at 1-800-668-2642.

Climate Change Central

www.climatechangecentral.com – A provincial program that encourages Albertans to take action on climate change through consumer rebate programs, demonstration projects and information for homeowners, businesses, agriculture and transportation sectors.

EPCOR

www.epcor.ca – The website contains information on energy and water efficiency with calculators, tools and downloadable publications to assist you in reducing your energy and water consumption.

Tools include a *Home Energy Audit,* a do-it-yourself home audit with a library of resources; *EPCOR House*, an animated tour of a typical home with efficiency information; and calculators for most major appliances, plus a *simple electricity calculator* and *water audit tool*. Tools are located in the EPCOR-Customer Service drop down menus.

Environment Canada

www.ec.gc.ca – Environment Canada's website, "The Green Lane", provides weather and environmental information to help connect Canadians, exchange information and share knowledge or environmental decision making.

Notes:

Become A CO_2RE Member

We all contribute to the problem of climate change and each of us can contribute to the solutions. Become a CO_2RE member. Membership is free and you can sign up at www.edmonton.ca/co2re.

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Home$avers Booklets

- Attic Insulation
- Basement Insulation
- Caulking and Weatherstripping
- Condensation Concerns
- Conserving Electricity
- Heating Systems
- Renewable Energy (online only)
- Ventilating Your Home
- Water Conservation
- Windows

Other Publications

- General CO_2RE Brochure
- Apartments & Condominiums
- Eco-Landscaping

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