

CO₂RE Home\$avers

Caulking and Weatherstripping



Take Action on Climate Change

CO₂RE
Carbon Dioxide Reduction Edmonton

A Partner in Canada's
 **One-Tonne**
CHALLENGE
www.climatechange.gc.ca

Supporting Sponsors



Federation
of Canadian
Municipalities



Climate Change Central



Government
of Canada

Gouvernement
du Canada

Technical Support



Natural Resources
Canada

Ressources
Canada

CO₂RE Community Business Partners



About CO₂RE

Created by Edmontonians for Edmontonians...

Carbon Dioxide Reduction Edmonton (CO₂RE) is a developing organization formed to implement Edmonton's Community-Wide Greenhouse Gas Emissions (GHG) Reduction and Energy Strategy. CO₂RE is supported by the City of Edmonton and a group of local organizations dedicated to implementing the strategy and reducing greenhouse gas (GHG) emissions in our city.

The CO₂RE mission is to work with Edmonton residents, businesses, institutions and industry providing services, programs and initiatives to assist in reducing energy use, thereby reducing the levels of the GHG emissions that are responsible for Climate Change.

CO₂RE 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.

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.co2re.ca**!

Free Membership

Why get a membership? Becoming a CO₂RE member is free and the more people who join us in taking action on climate change, the faster we will achieve our goals. CO₂RE is working with local companies to offer incentives on energy-efficient products and programs to further assist homeowners. You'll also receive a regular newsletter with new ideas and updates. Sign up today at **www.co2re.ca**.

Industrial and commercial/institutional companies can contact our manager at 944-CORE (2673) to find out how they can participate.

Introduction

Heat loss by conduction and radiation is controlled by insulation.

Conduction heat loss is primarily air leakage, either in the form of convective currents moving warm air to cold surfaces or warm air leaking out and cold air leaking into the house.

Air leakage can account for 30% or more of total heat loss in local homes.

Caulking and weatherstripping are materials designed to reduce these uncontrolled leakage losses.

Warm air leaking out must be replaced with cold air drawn in and then heated.

Excessive cold air leakage into the home creates cold drafts, cold rooms and in extreme cases, frost on inside wall surfaces. Moisture also escapes with the warm air, and if it condenses inside the walls or attic cavities, serious long-term structural damage and mold problems can result.

Air change in homes is needed, either natural or mechanically induced to ensure an adequate supply of fresh air necessary for occupant health. In older houses without a ventilation system, the fresh air supply is provided by uncontrolled air leakage through cracks and window openings. Newer homes have ventilation systems and fresh air ducts to ensure a supply of fresh air.

A good air sealing job means that you lower the air change rate by eliminating the excessive air change (air leakage) that usually occurs in winter and the excessive house dryness that is caused by high winter air change rates.

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.

Air Leakage

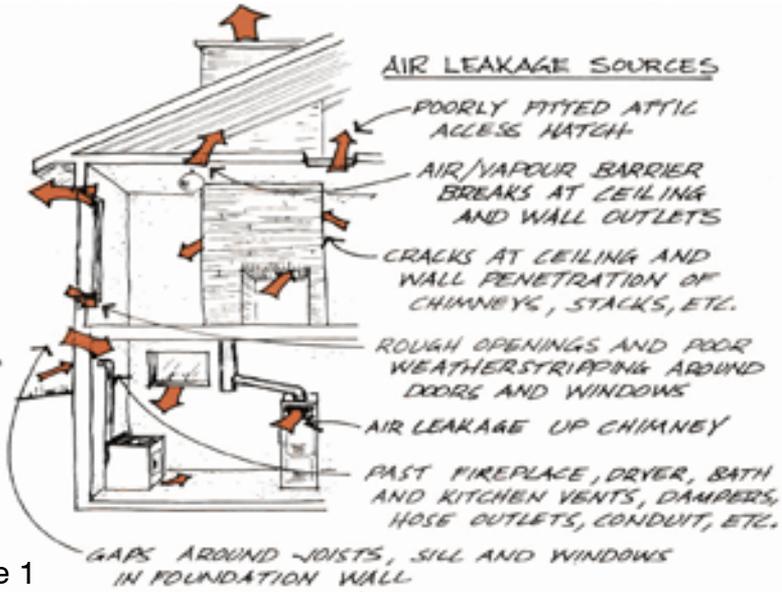


Figure 1

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 winter.

Air Sealing the Home

The 5 example tables provided 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 (EGH) home assessment results.

Local costs for the purchase of sufficient caulking and weatherstripping to reduce uncontrolled air leakage by 50% for the average home would be in the \$100 to \$150 dollar range depending on age and size.

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 ** (CO₂)			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 ** (CO₂)			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 ** (CO₂)			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 ** (CO₂)			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 ** (CO₂)			0.60

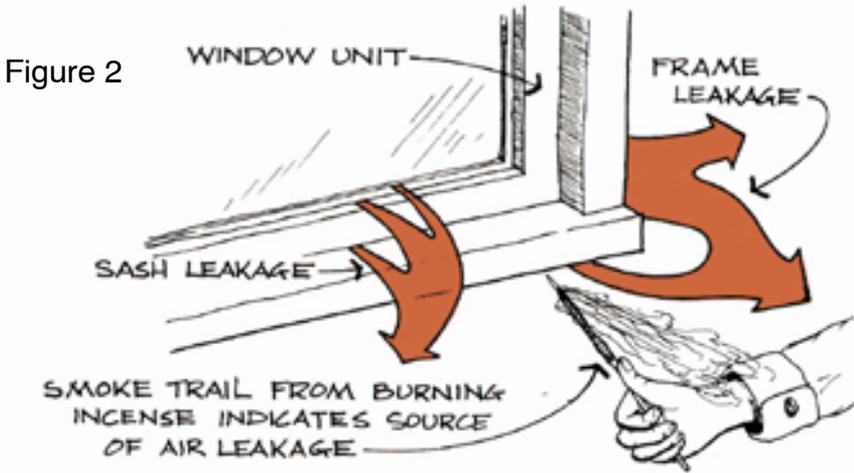
A 29% reduction in air leakage, \$120 savings in yearly heating costs and a personal GHG emissions reduction of 0.60 Tonnes a year

* 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.



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 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 and longer life.

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 installed are meant to be without additional fastening, it is often advisable to reinforce the seal with staples every 15cm (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 it is applied to.

Jamb Weatherstripping for Doors and Windows

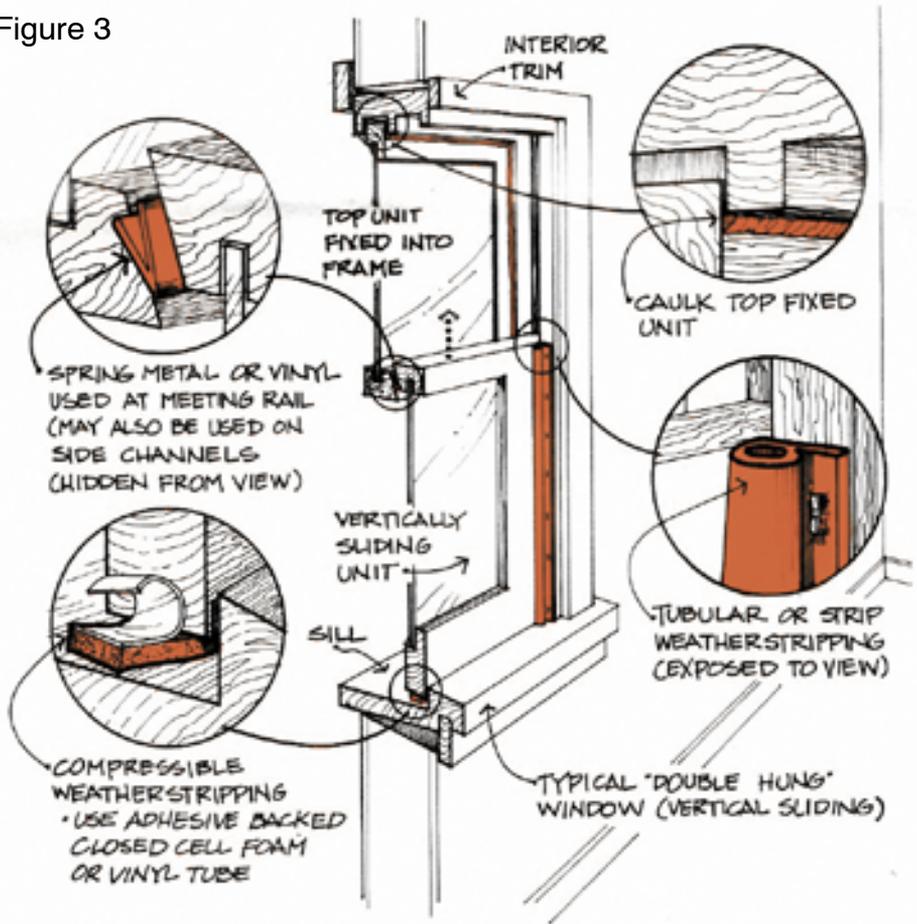
Different weatherstripping materials are described in Table 1. The types used for windows and the sides and tops of doors are described here.

Tubular weatherstripping provides one of the best seals. However, on doors or swinging windows, it requires the most closing pressure, important if the users are children, handicapped or elderly. Vinyl strips are better for their use.

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, neoprene and other durable airtight materials.

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 is the most durable but it 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. 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.

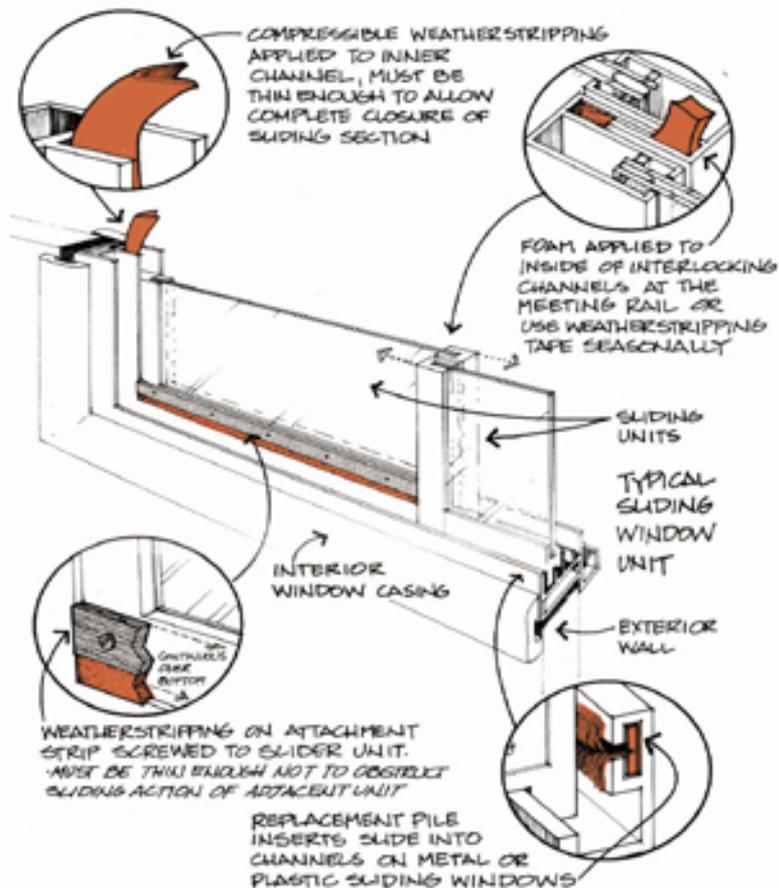


Figure 4

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

Be sure to measure the width and take a sample with you in order to purchase the correct size and matching 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 (Yellow pages).

Table 1
Weatherstripping Materials

Design	Type	Comments
<p>Tapes</p> 	Cloth/ plastic	<p>Use on non-opening window, door. Good for one season. Quick, easy to install. Remains in full view. May remove paint when peeled off.</p>
	Foam, adhesive	<p>Use on windows, doors, and attic hatch for compression fit. Available in open or closed-cell types. Closed cell more durable. Quick, easy to install. Hidden from view.</p>
	EPDM rubber, adhesive	<p>Use on windows, doors for compression fit. Good durability, air seal. Quick, easy to install. Hidden from view.</p>
<p>Gaskets</p> 	Tubular, Core filled	<p>Use on windows, doors. Good durability, air seal. Must be nailed & stapled or screwed in full view. Made with rubber, plastic or vinyl. Difficult to compress. Some with adjustable metal attachment.</p>
	Tubular Hollow	<p>Use on windows, doors. Good durability, air seal. Must be nailed & stapled or screwed in full view. Made with rubber, plastic or vinyl. Some with adjustable metal attachment.</p>
	Hollow on attachment strip	<p>Use on windows, doors. Good durability, air seal. Usually nailed or screwed in full view. Slotted holes allow re-adjustment. Made of rubber or vinyl with aluminium or vinyl attachment strips.</p>

Weatherstripping Materials

Design	Type	Comments
<p>Strips</p> 	Tension (spring metal or v-strip)	<p>Use on windows, doors: especially for gap where sash of double hung window meets.</p> <p>Excellent durability, good seal.</p> <p>Usually made of metal (bronze) or vinyl.</p> <p>Must be nailed if metal, or adhesive.</p> <p>If vinyl, invisible when installed.</p> <p>Hidden from view.</p> <p>Double strip vinyl available for better seal.</p>
	Pile or Fin on attachment	<p>Use on sliding windows, doors.</p> <p>Moderate to good seal, durability.</p> <p>Must be nailed or screwed in full view.</p> <p>Made with vinyl, rubber or polyester pile with fin seal on wood, vinyl or aluminum attachment strip.</p>
	Foam on attachment strip	<p>Use on windows, doors for compression fit.</p> <p>More durable than adhesive type.</p> <p>Must be nailed or screwed.</p> <p>Hidden from view.</p> <p>Closed cell is more durable.</p>
<p>Specialty</p> 	Spring loaded	<p>Use on window, doors.</p> <p>Excellent durability and seal.</p> <p>Must be nailed or screwed.</p> <p>Made with aluminum or vinyl.</p> <p>Self-adjusting.</p>
	Magnetic strip	<p>Use on windows, doors.</p> <p>Excellent durability and seal.</p> <p>Must be nailed or screwed.</p> <p>Made with aluminium and vinyl.</p>

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. 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.

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.

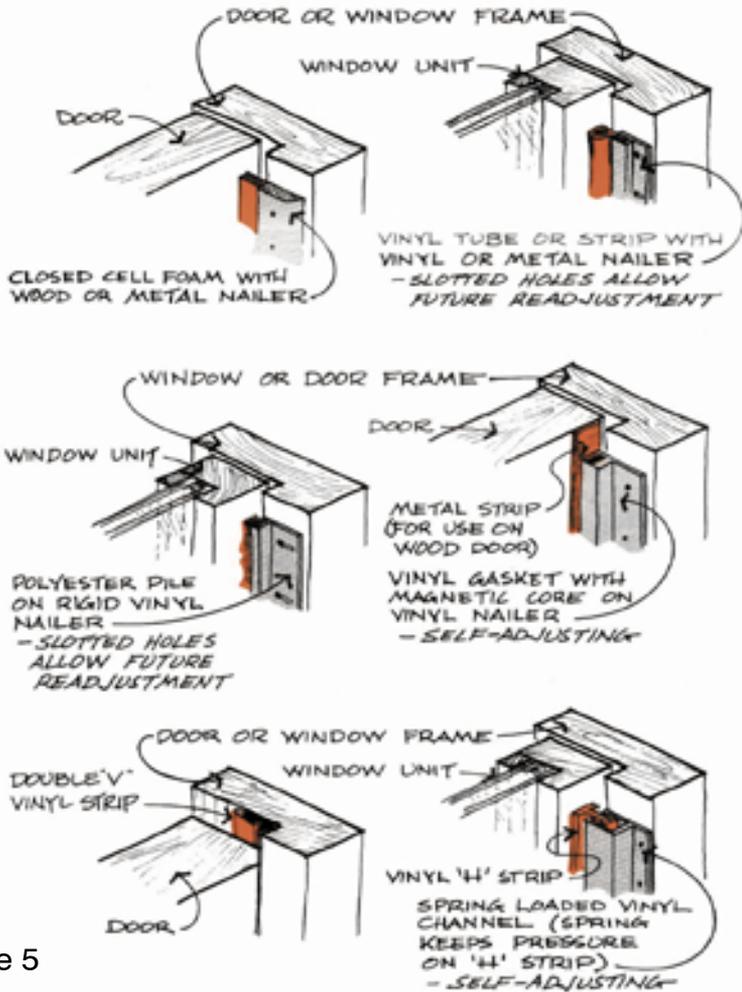


Figure 5

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).

Try to choose a threshold or door bottom that does not require trimming the door. Some will adjust to accommodate different clearances (Figure 6), but others will not. Door sweeps require no clearances because they attach to the side of the door.

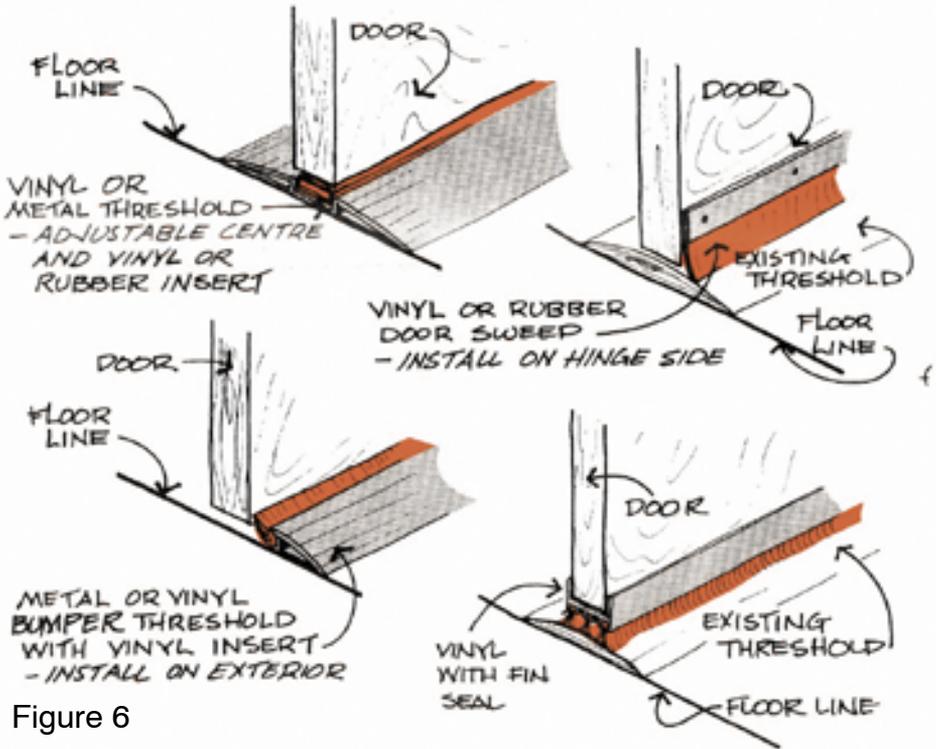


Figure 6

Thresholds are generally installed to replace worn out ones. Often the vinyl or rubber weatherstripping is defective, not the entire assembly. Determine if new inserts can be purchased separately. If the whole threshold must be replaced, select one with replaceable gaskets.

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.

Table 2**Weatherstripping – Door Bottoms**

Type	Comments
 <p>Saddle Threshold</p>	<p>Requires minimum clearance of 15 mm ($\frac{5}{8}$ in). May have adjustable insert up to 30 mm ($1\frac{1}{4}$ 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.</p>
 <p>Door Bottom</p>	<p>Requires minimum clearance of 8 to 13 mm ($\frac{1}{4}$ to $\frac{1}{2}$ in). Some types can also be used as a threshold. Check that replacement gaskets are available. Screwed into bottom; door must be removed for installation. Made with rubber, metal, vinyl or pile on an aluminum or vinyl base.</p>
 <p>Bumper Threshold</p>	<p>Bottom clearance not required. Can be damaged by trapped stones, traffic wear, etc. Check that replacement gaskets are available. Good seal if regularly swept. Fair to good durability. Made with vinyl or rubber on a vinyl, wood or aluminum attachment. Installed with screws with screws on exterior of door.</p>
 <p>Door Sweeps</p>	<p>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.</p>

Weatherstripping: Other Openings

Other “door-type” openings include attic hatches, clothesline doors and milk chutes. 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.

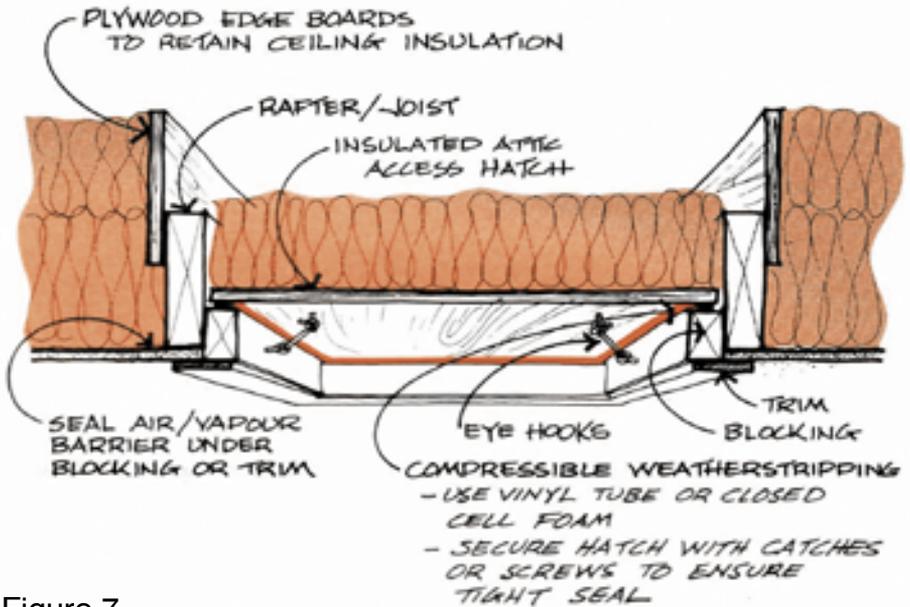


Figure 7

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 and 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.

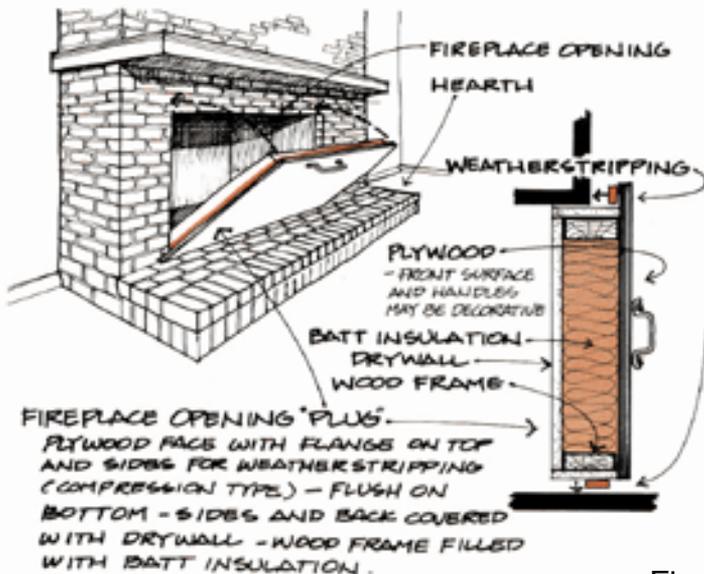


Figure 8

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. Some areas such as plumbing stacks, chimneys or electrical outlets require specialized or combination weatherstripping and caulking techniques.

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 because air leakage causes heat loss and heated air carries moisture, which can lead to condensation in the walls.

The best place to seal with caulking is on the inside, to prevent moisture accumulating in wall and ceiling cavities. Interior sealants, though not subject to the same severe weather conditions as exterior types, 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. 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 shows the characteristics of various caulking materials.

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

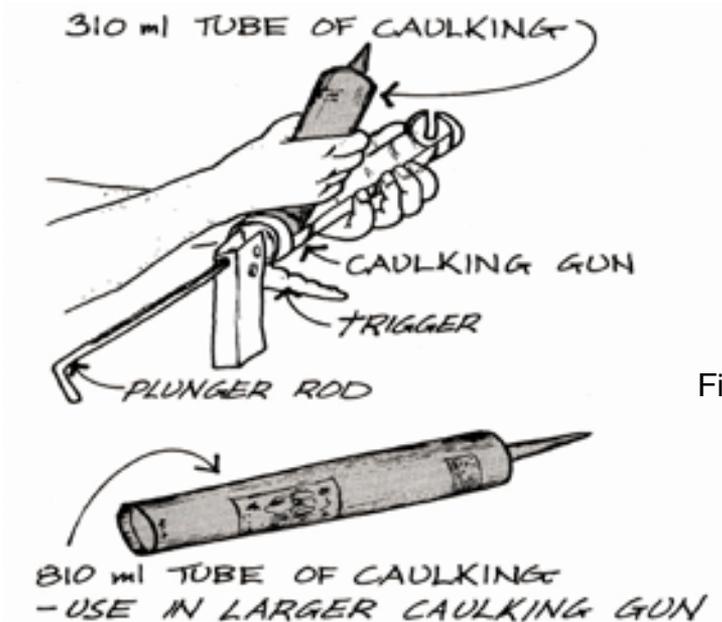


Figure 9

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 ($\frac{1}{2}$ 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.

There are many caulking types available; including combinations of the basic types listed. Always read the label and follow the manufacturer’s instructions for proper use and application.

Table 3
Types of Caulking

Type	Comments
<i>Oil/ Resin base</i>	<p>Durable for one or two years. Forms hard surface when dry, cracks.</p>
<i>Latex base (acrylic & non-acrylic)</i>	<p>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 movement joints between similar materials. Can be painted, available in colours. Most types clean with water.</p>
<i>Butyl rubber</i>	<p>Durable for five to fifteen 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.</p>
<i>Elastomeric (silicone or polysulphide)</i>	<p>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.</p>

<p><i>Polyurethane Foam</i></p>	<p>Available in aerosol can. Specialized product for large gaps. Requires care in applying, expands 2½ times. Bonds to most surfaces. Requires a primer before use on pressure treated wood or vinyl. Tack free in hours, final cure 8 days. Flammable (must be covered with drywall on interior). High insulation value.</p>
<p><i>Silicone Sealants</i></p>	<p>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.</p>

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).

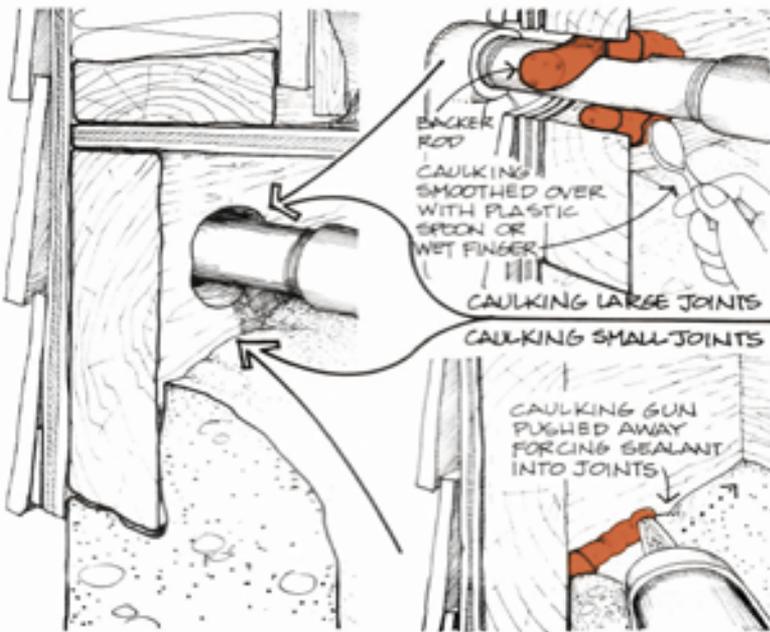


Figure 10

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

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

For gaps larger than 9 mm ($\frac{3}{8}$ inch) in width or depth polyurethane foam can be used. Other caulks require a backer material such as 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, you can use water for most silicone and acrylic latex caulking. For other caulking try a standard solvent like rubbing alcohol, lacquer thinner or mineral spirits (paint thinner).

Sealing the Joist Space

The exposed section of foundation walls and the joist space 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.

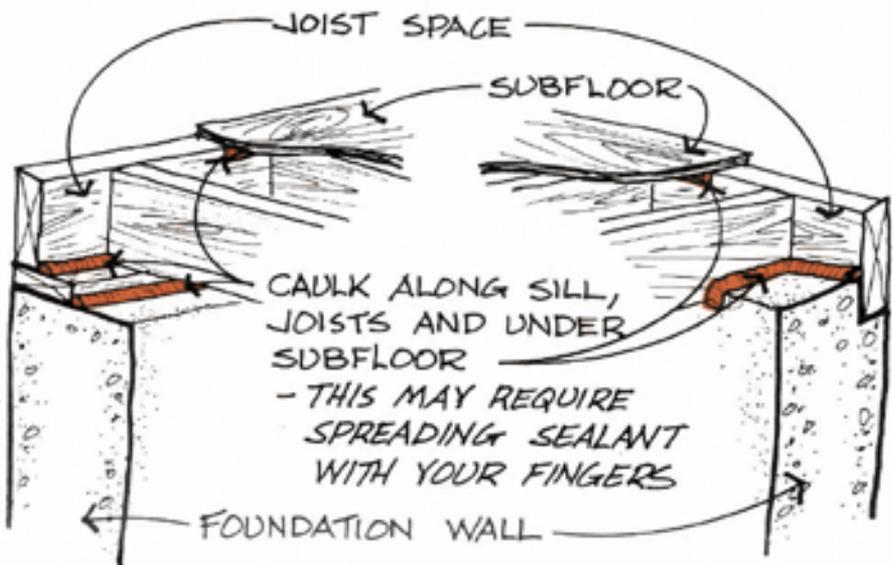


Figure 11

Large gaps should be tightly stuffed with 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 give the best service.

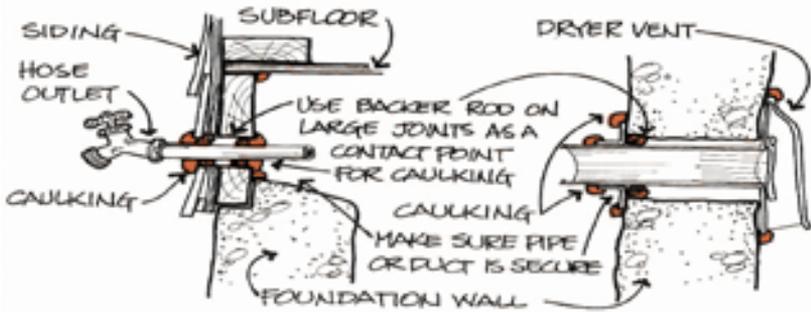


Figure 12

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).

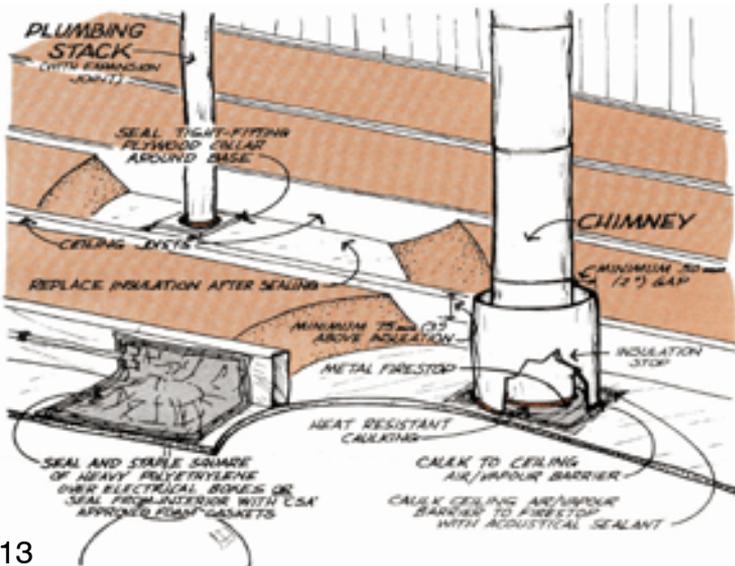


Figure 13

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.

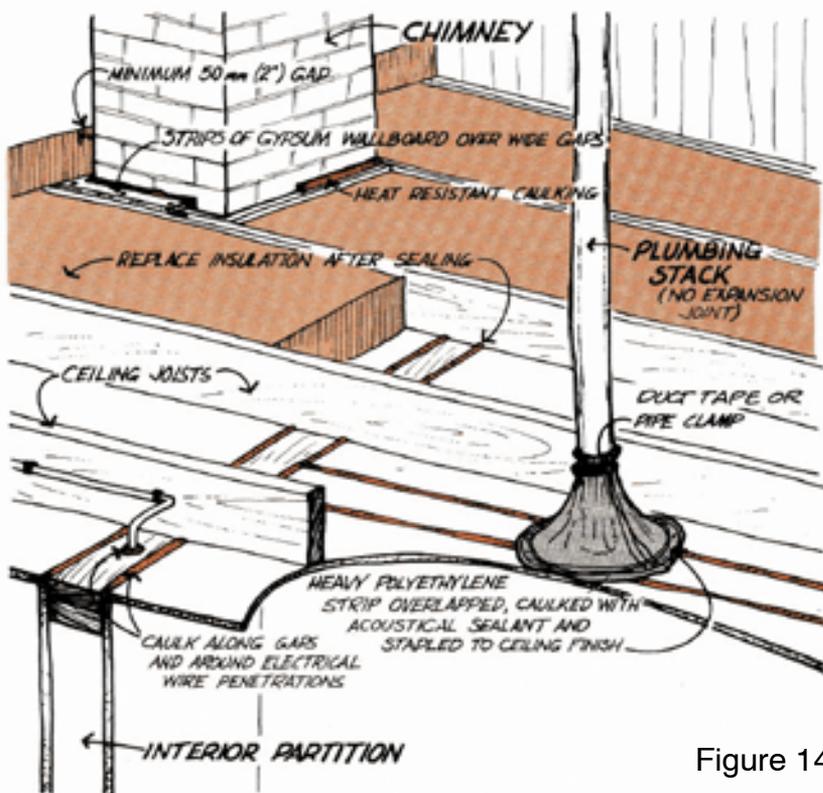


Figure 14

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 placing 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 manufactures 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.

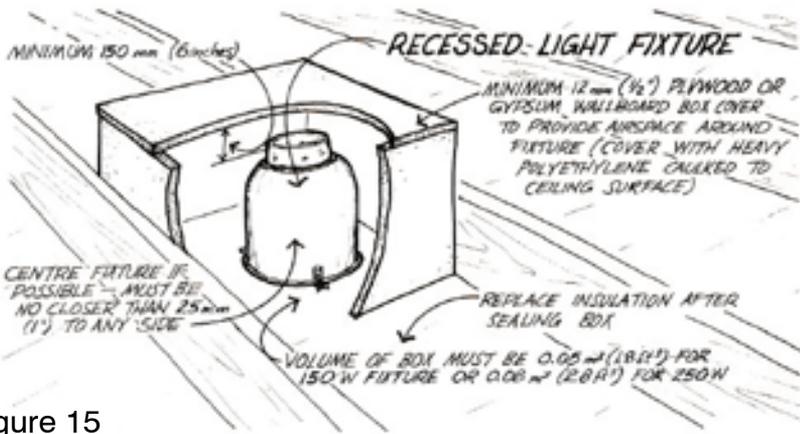


Figure 15

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

Sealing Around Windows and Door Openings

The installation space or rough opening around windows and doors is a major area of air leakage. Usually insulation has been stuffed into the crack. This insulates but does not stop the airflow. This leakage can be stopped with methods shown in Figure 16.

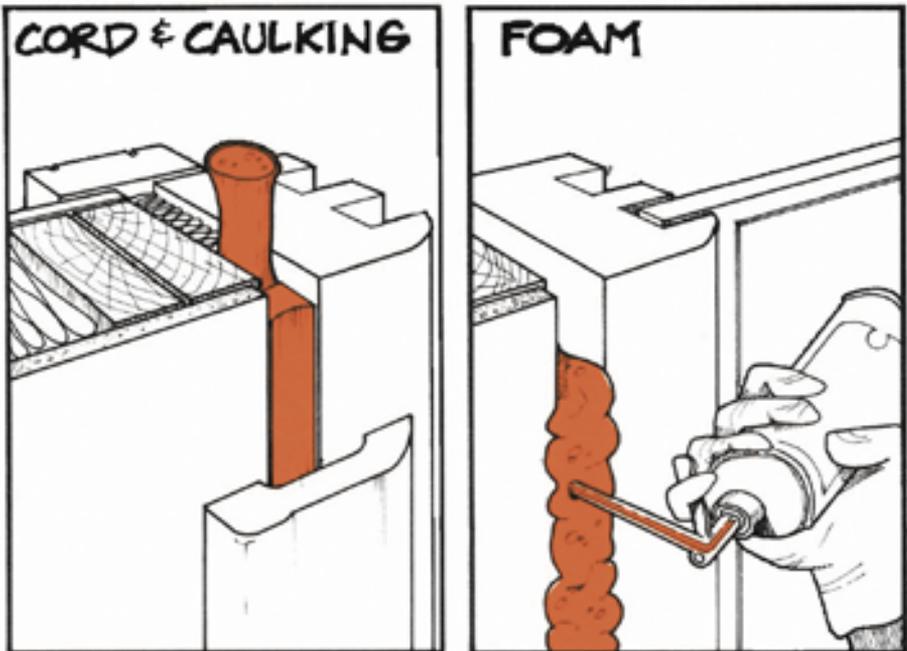


Figure 16

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.

The “*Home\$avers – Windows*” publication discusses this method in detail. A cartridge-type caulking material (Figure 17) can stop air leakage around sealed units and their frames. Remove the window trim and lay a bead of caulking (for glass) along the bottom of the sealed unit. Replace the trim.

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.

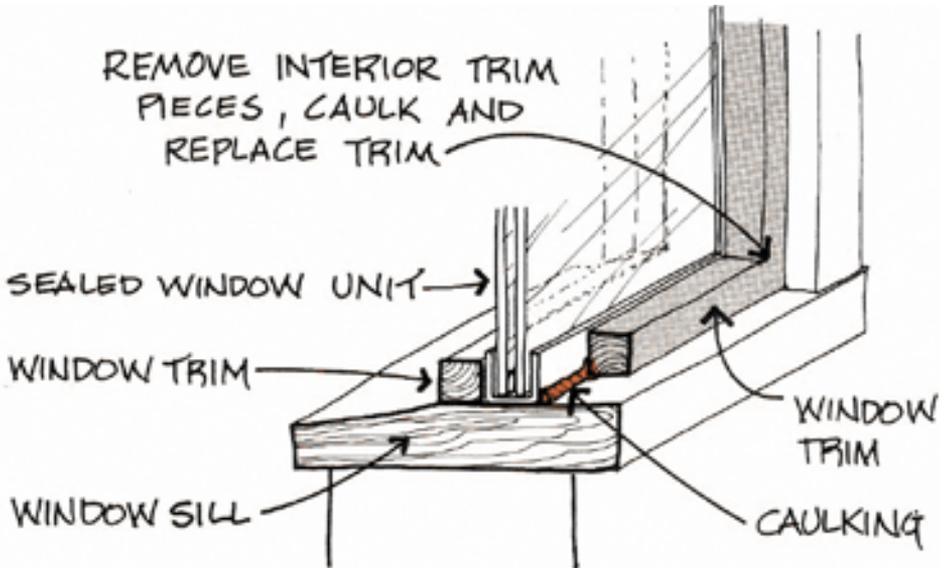


Figure 17

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).

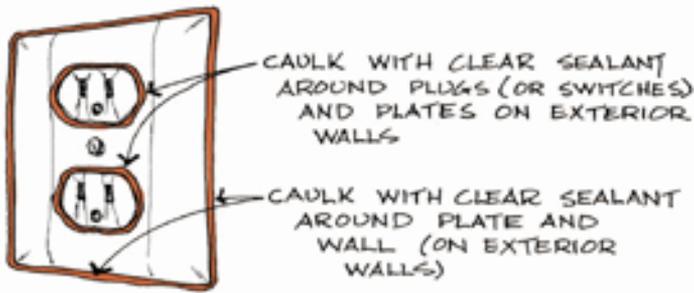


Figure 18

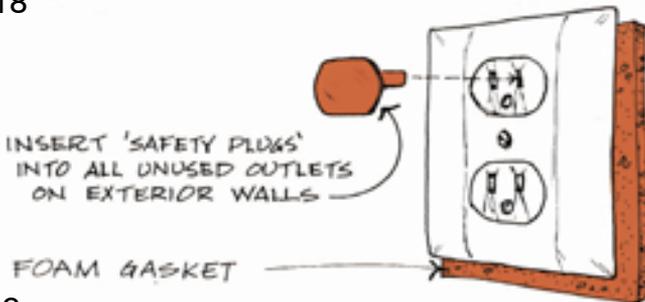


Figure 19

Disconnect the power. Electrical codes forbid placing any object inside the boxes, so all sealing must be “external”. Do not use polyurethane foam (it is combustibile and may expand into the electrical box).

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 homes heating and ventilations systems are not up to current standards (fresh air supply) 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 upgrading your appliances consider purchasing sealed combustion gas appliances to eliminate any backdrafting potentials and install a carbon monoxide detector to ensure you are maintaining good indoor air.

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.

House air contains numerous pollutants. As concentrations of these pollutants increase, the occupants' health or comfort will 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.

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.

Summary

Improving air tightness should be considered a first step and a must for making your home comfortable and energy efficient. The costs associated with weatherstripping and caulking are small. Installation takes time, but is not overly difficult. Fuel savings and GHG reductions are considerable.

- Use the following work plan.
- Check potential areas of air leakage and identify the major sources.
- Weatherstrip windows, doors and hatches.
- Check vents and dampers on fans and fireplaces.
- Caulk cracks, outlets, vents and pipes penetrating the house exterior. Remember to do the ceiling as well as exterior walls.
- Seal around door and window trim.
- Test again for effectiveness of sealing.
- Observe windows for condensation in cold weather.
- Increase the fresh air supply to control condensation. This may require adding a fresh air supply to older homes.

An EnerGuide for Houses (EGH) evaluation would identify the air leakage points in your home as just part of the valuable advice homeowners receive on energy-efficient improvements for their homes. There are delivery agents in the Edmonton area who provide this service as part of Natural Resources Canada's EnerGuide program.

The auditors provide independent expert advice on what can be done to improve comfort, reduce energy bills, and cut down on greenhouse gas emissions. EnerGuide for Houses is partially funded by the Government of Canada. As a homeowner, you pay \$150 for an EnerGuide for Houses evaluation, a service valued at over \$300.

EnerGuide for Houses evaluations (EGH) in the Edmonton area are available from:

ATCO Energy Sense

Phone: 310-7283

Email: energysense@atco.com

Website: www.atcoenergysense.com

Green Communities Association

Phone: (780) 433-8711

Email: franc@dcplanet.org

VerdaTech Inc.

Phone: 1-866-241-6804

Email: sfarrell@verdatech-inc.com

Website: www.verdatech-inc.com

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

Work Plan

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

Using the tables 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.

Additional Information Sources

Natural Resources Canada – Office of Energy Efficiency

www.oeenrncan.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.

EnerGuide for Houses (EGH) evaluations is a program from Natural Resources Canada. This detailed home assessment provides independent expert advice on the different systems of your home and what can be done to improve comfort, reduce energy bills, and cut down on greenhouse gas emissions that contribute to climate change. Consider having an EGH completed on your home.

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.**

Canada Mortgage and Housing Corp.

www.cmhc.ca/publications – 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**.

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

The Green Lane in Environment Canada's internet source for weather and environmental related to clean air, clean water and climate change. Visit them at www.ec.gc.ca

The information contained in this publication is provided as a public service and represents current research results and information sources available to CO₂RE and has been externally reviewed. CO₂RE and the City of Edmonton however, assume no liability for any damage, injury or expense that may be incurred or suffered as the result of the use of this publication.

Become A CO₂RE Member

We all contribute to the problem of Climate Change — and each of us can contribute to the solutions. Become a CO₂RE Member.

Membership is free and you can sign-up on the CO₂RE website at: www.co2re.ca

CO₂RE

Carbon Dioxide Reduction Edmonton

Publications Currently Available in this Series

Attic Insulation	Conserving Electricity
Basement Insulation	Heating Systems
Caulking and Weather-stripping	Ventilating Your Home
Condensation Concerns	Water Conservation
	Windows

Publications Available Spring 2005

Transportation	Eco-efficient Landscaping
Crawlspace Insulation	New Homes
Re-siding for Energy Conservation	Green Power
	Storey-and-a-Half Insulation



Office of the Environment

2nd flr, Century Place

Edmonton, Alberta

Contact by phone:

944-CORE (2673)



Printed on recycled paper
containing 30% post-consumer fibre.