Washington Energy Extension Service

CAULKING AND WEATHERSTRIPPING

EY 3400
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The most effective way to lower your heating bill is to reduce the rate at which your home loses heat. The purpose of this pamphlet is to focus on some of the simplest and lowest cost measures available to both homeowners and renters for reducing heat loss.

In a typical home, heat loss occurs primarily in two ways: 1) conduction, and 2) infiltration. Conduction is the movement of heat through solid surfaces such as walls, ceilings, floors, doors and windows. Once it has moved to the surface of the house, heat is carried away by convection and radiation. Conduction accounts for 70 - 80% of the total heat loss in the home and can be significantly reduced by adding insulation, storm windows, or insulated glass.

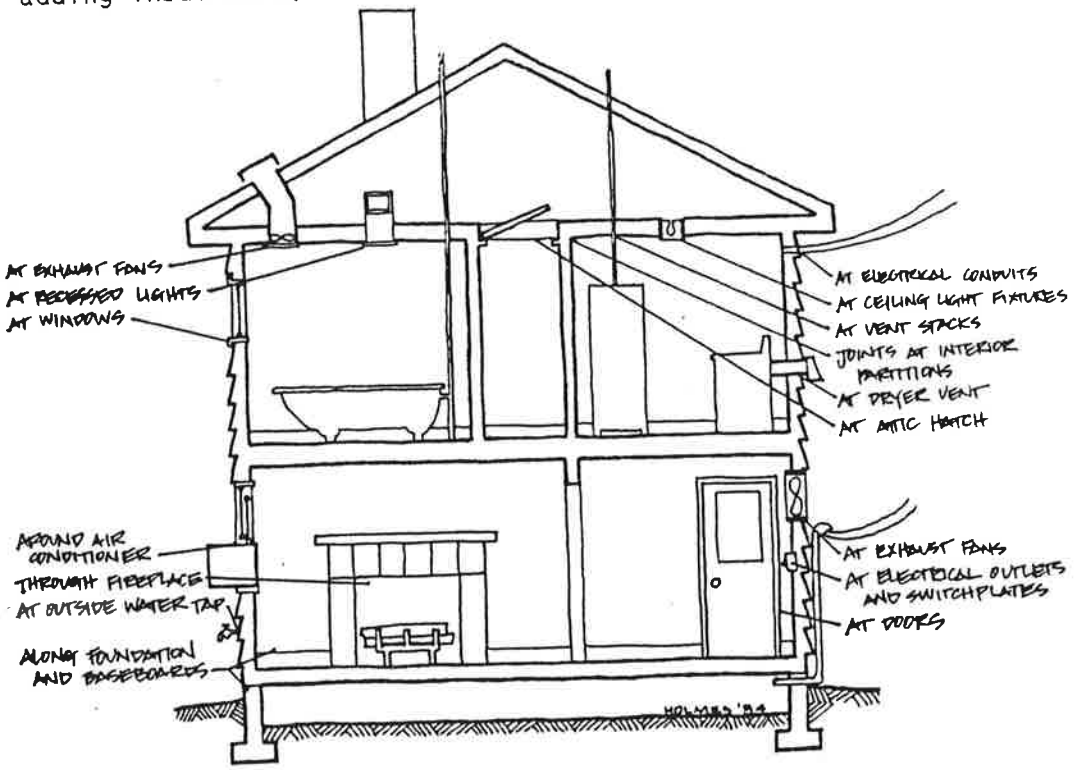

Figure 1. Air Leakage Spots in Conventional Home

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Offered in cooperation with PUGET POWER

The other way in which heat loss occurs in the home is by infiltration. Infiltration is the replacement of warm inside air with colder air from the outside. Infiltration occurs through cracks around windows, doors, plumbing and light fixtures, fireplaces, foundations, and penetrations through siding (see Figure 1). When added together, these cracks can represent a hole in the house that is as much as four square feet in area. Infiltration often accounts for 20 - 30% of the total heat loss in the home.

Although some degree of ventilation is necessary to maintain air quality, most homes can benefit from a substantial decrease in the infiltration rate. Infiltration can be reduced relatively inexpensively and easily by caulking and weatherstripping cracks and penetrations in the home. Caulk is a compound used to seal cracks between fixed components of the home; weatherstripping is used to seal gaps between building components that are operable, such as windows and doors. This pamphlet will discuss the advantages and disadvantages of various types of caulking and weatherstripping, and methods of installation.

CAULKING

- Inspection

Weatherization begins with an inspection of the exterior of the house. Cracks are commonly found around door and window frames, at joints in the siding, between fireplaces and siding, between the porch and house, where siding meets the foundation, around eaves and molding, and areas around vents, electrical outlets, or water faucets (see Figure 1). Inside the home look for cracks or openings around water pipes and drains, where the furnace flue goes through the ceiling, around light fixtures, and around the attic entry. Below is a list of areas where heat escapes.

Heat Escapes Into Unheated Attic

- Through attic door or trap door
- Recess around plumbing vent stack
- Intake grills and louvers for ceiling-mounted attic exhaust fans
- Openings in tops of interior walls
- Clearance space around interior walls
- Openings for heating or air-conditioning ducts
- Recessed lighting fixtures which present special safety problems

Heat Escapes Through Exterior Walls

- Openings around wall or window-unit air conditioners
- Along the sill plate
- Baseboard
- Around electrical conduits entering house usually in foundation
- Electrical outlets and switches on outside walls
- Around pipes for outside water taps
- Telephone and television wires
- Dryer vents
- Exhaust-fan outlets in kitchen or bath
- Windows and doors

Heat Escapes Around The Chimney

- Around the vent for a gas water heater
- Through fireplace opening or a loose flue damper

SEALING UP THE INTERIOR FIRST

Before spending time and money on exterior caulking measures, it's a good idea to identify and seal up interior sources of infiltration. In many older homes, these sources can be a major contributor to heat loss and uncomfortable drafts. Look for holes in the wall, cracked plaster, loose-fitting light fixtures, broken windows, and cracked putty. Fill holes in the wall with patching compound. Broken windows and brittle putty should be replaced. Latex caulk works well to seal hairline cracks found at the top of interior walls, around window frames, where fireplace brickwork meets the walls and ceiling, and at light fixtures. Use a thin bead of clear latex caulk following it with a damp sponge to smooth the surface.

• Types of Caulking

There are many kinds of caulking compounds available on the market today. They vary considerably in characteristics, ease of application, and cost. They may be categorized as oil-based , latex, butyl, or elastomeric caulks. Although caulking compounds can be purchased in small squeeze tubes or in bulk quantities, the most convenient and easily available containers are 8½" cartridges used with caulking guns. One cartridge will seal approximately two typical doors or windows.

Oil or resin based caulk is the least expensive (about $1 per tube) and the least durable of all types, lasting about one year. In addition, it will not bond satisfactorily to metal, masonry or wood, and must be painted. Another disadvantage is that many can only be applied when it is 60°F or warmer outside.

Latex and acrylic latex caulks are much more desirable for most weatherization purposes. While they cost more than oil-based caulks ($2 - $3 per cartridge), they are much more durable, lasting five to seven years. These caulks come in a variety of colors, although they will last longer when painted. Very little surface preparation is required, and they can even be applied to a damp surface. Latex and acrylic latex caulk can be applied when it is as cold as 40°F outside. Another advantage is that tools, clothing, and hands can be cleaned with water. Latex caulk does not bond well to metal, nor is it suitable for sealing cracks between different materials, such as masonry and siding.

Butyl-rubber caulk can be used on almost any type of surface because it is more flexible than latex or oil-based caulks. This makes it especially appropriate for sealing cracks between masonry and wood. The surface must be dry and clean before application, and the air temperature must be 40°F or warmer. Its cost is comparable to latex caulk, and it can be expected to last five to ten years when painted. Butyl caulk is available in several colors, and must be cleaned up with thinner or a similar solvent.

For areas requiring very durable, pliable caulks, such as around metal, you may want to use an elastomeric compound. Included in this group are polysulfides, polyurethanes, and silicones. Elastomeric caulks are generally expensive ($5 - $7 per tube), but can last as long as 10 to 20 years. Silicone caulk is extremely resistant to water, and is particularly appropriate for exposed, weathered areas. Many elastomeric caulks are not compatible with paint, however, they are available in a few basic colors. Because application and clean up are more difficult than other types of caulks, be sure to follow the manufacturer's directions carefully.

Other materials that may be useful for plugging air leaks include rope caulk and fillers. Rope caulk is an inexpensive (3 - 4¢ ft.) temporary plug for wide, long cracks. It can even be removed at the end of the heating season and, in some cases, be used again the following winter.

For wide or deep cracks that need to be plugged permanently, oakum, or a polyurethane foam filler is recommended. These materials are particularly useful for cracks between foundations and siding. Polyurethane foam is available in pressurized cans. It can be difficult to apply correctly, particularly if the manufacturer's instructions are not followed carefully. Partially used cans should be used quickly because they have a short shelf life.

- How to Caulk

The materials needed to caulk a home include a caulking gun, caulking compound, scissors or utility knife, a screwdriver or bottle opener, and a ladder. If you have not used a caulking gun previously, take some time to become familiar with its operation. The most common type of caulking gun has a holder for the caulking tube, a handle, a plunger for pushing the caulk out of the tube, and a trigger-like lever for advancing the plunger (see figure 2). The plunger is a long rod that runs the length of the holder, usually having teeth on one side. When the rod is turned so that the teeth face downward, squeezing the trigger-lever will advance the plunger and force out caulk. When the teeth are turned upward the plunger can be pulled or pushed along the length of the holder without squeezing the lever.

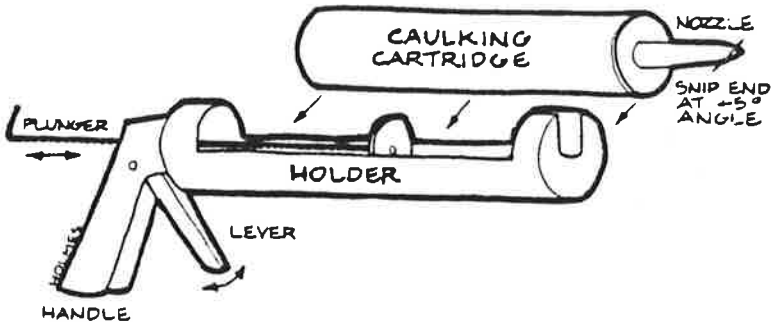


Figure 2. Caulking gun and cartridge

Before loading a caulking tube into the gun, snip off the tip of the tube with scissors or utility knife at a 45° angle so that you have an opening of about 1/8" or less. If the hole is too small, it can always be enlarged later. After snipping the tip, insert a long nail or similar object through the opening until it punctures the diaphragm at the base of the nozzle. Failure to do this can cause the caulk to explode out the side of the cartridge when pressure is applied.

Before caulking a crack, remove any older loose caulk with a screwdriver or the pointed end of a bottle opener, and wipe the surface clean with a rag. Old caulking that is firmly attached can be left in place. Load the caulking gun, hold the gun at a 45° angle, and slowly pump the lever so that you can get a smooth flow of material onto the surface. The caulking gun can be "pulled" or "pushed" along the crack--whichever feels easiest for you. Use enough caulk to overlap both sides of the crack. If the caulk appears uneven, it can be smoothed out later by running your finger along the joint. When you want to stop caulking for a moment be sure to release the pressure on the cartridge by pulling the plunger back, otherwise the tube will continue to discharge caulk.

Partially-used cartridges can be stored satisfactorily by plugging the opening of the nozzle with an object such as a large nail or screw. Be sure to follow the instructions on the caulking tube with respect to application, painting, and precautions.

WEATHERSTRIPPING

- Inspection

Weatherstripping is used to seal cracks in areas where movement is required, primarily around doors and operable windows. Frequently, cracks in these areas are so wide that light can be seen through them. Less obvious air leaks can be detected by holding smoldering incense near the area. Any leaks will cause the smoke to drift. When properly installed, weatherstripping can cut infiltration of cold air significantly and pay for itself quickly.

If you find that your door rubs against the frame when you open and close it, it may not be square with its frame. This may cause greater air leakage and can make it harder to weatherstrip. Minor problems can often be remedied by planing the door at the point where it sticks. If the door sticks along its entire length on the latch side, it is usually easier to plane the hinge edge. Planed edges will have to be refinished or painted.

- Types of Weatherstripping

There are many kinds of weatherstripping available to the consumer. They vary widely in price, in ease of installation, and durability. The type you select will depend largely on your specific needs. Figure 3 illustrates the major kinds of weatherstripping that are commonly available.

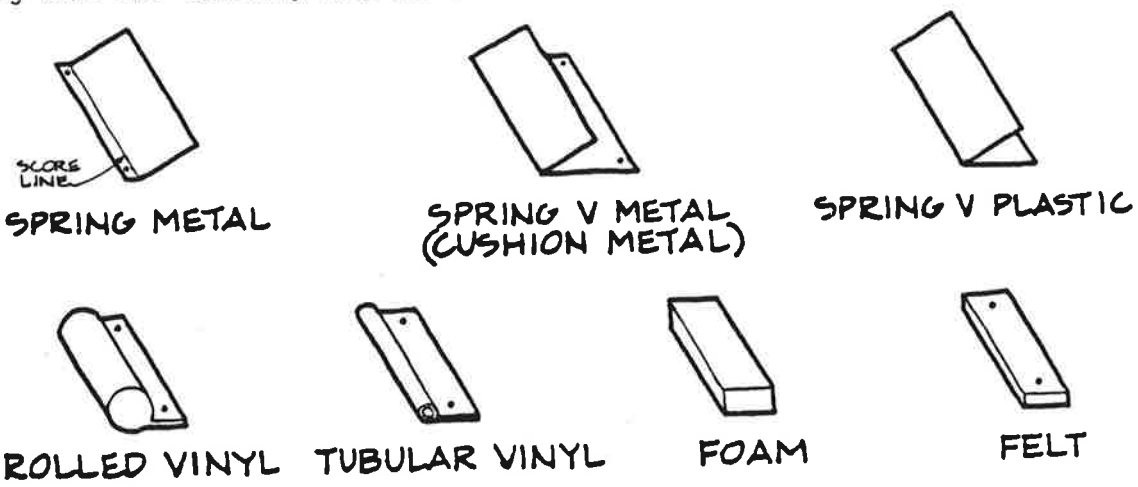


Figure 3. Types of weatherstripping

A traditional and very durable weatherstripping is spring metal, usually made of brass, aluminum, or stainless steel. At 25¢ to 40¢ per foot, it is one of the most expensive types of weatherstripping, but can be expected to last 10 to 15 years. The spring metal is nailed in place and must be scored when installed so that it springs out from the door frame. Scoring is accomplished by firmly running a screwdriver or awl along a groove next to the nails (see figure 3).

Spring V metal or cushion metal is a V-shaped weatherstripping, also made of brass, aluminum, or stainless steel. As with spring metal, it is nailed in place and can be expected to last 10 to 15 years. It ranges in price from 23¢ to 35¢ per foot.

Spring V plastic or vinyl strip is similar to cushion metal in configuration but is made from durable plastic backed with an adhesive to hold it in place. It costs the same as its cushion metal counterpart, but is easier to install. It can be cut easily and trimmed with a pair of scissors, and it is also one of the few kinds of weather-

stripping that will work well in aluminum framed sliding windows. Although it is a relatively new product, manufacturers claim that plastic V weatherstripping can last more than five years. Another advantage is that it comes in several colors so that it is less noticeable when the door or window is open. Both types of metal weatherstripping and spring V plastic are hidden when the door or window is shut.

Other common types of weatherstripping include rolled vinyl and tubular vinyl. Prices range from 8¢ per foot for rolled vinyl and 9¢ per foot for tubular vinyl to as much as 35¢ per foot for vinyl with a supporting aluminum flange. The cheaper types may last one to three years, while those with metal flanges can last two to five years. One disadvantage with these types of weatherstripping is that they are conspicuous even when the doors or windows are closed.

Adhesive-backed foam is one of the easiest to install and least expensive weatherstripping materials on the market. Foam weatherstripping is available in open-cell and closed-cell varieties. Generally, closed-cell foams make a better air seal than open-cell types. Because foam can deteriorate quickly, only lasting about one year, it is best used in areas that are not exposed to the weather or around doors that are not opened very often. Another disadvantage is that its use is limited to areas where the material will be compressed but not sheared.

Before vinyl, foam, and plastic became popular weatherstripping materials, a commonly used material was felt. Made from hair, cotton, wool, or synthetics, this material can be nailed in place or held with an adhesive backing. Felt weatherstripping costs 4¢ to 16¢ per foot, and is estimated to last one or two years. As with adhesive foam, it should only be used in places where it will be compressed, not sheared, and where it won't get wet.

Another material that is particularly effective for stopping air leaks around doors is interlocking weatherstripping. This type of weatherstripping consists of two interlocking strips of metal; one strip attached to the door and the other strip attached to the door frame. The material is expensive, costing 35¢ to 40¢ per foot, but can be expected to last as long as 10 to 20 years. Because it can be very difficult to install properly, professional assistance is recommended.

- Installing Weatherstripping: Doors

Before installing weatherstripping around doors, it is important to be familiar with the various parts of a door and door frame (see figure 4). The parts of a door frame that hold the hinges and the latch are referred to as the side jambs. The top of the door frame is called a head jamb, and the raised wooden or metal structure on the floor at the bottom of the door, if present, is called a threshold. The door stops are thin strips of wood attached to the jambs that prevent the door from swinging past its closed position.

Spring metal, spring V metal, and spring V plastic are usually applied to the jambs so that the door slides alongside the weatherstripping as it shuts (see figure 5).

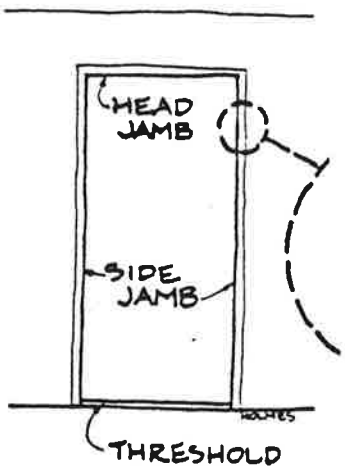


Figure 4. Anatomy of a door

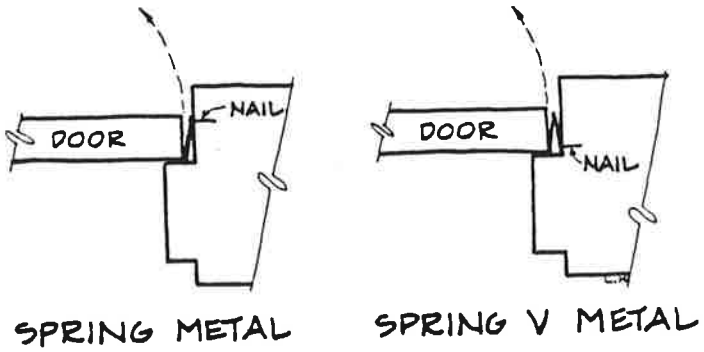


Figure 5. Top view of door with weatherstripping

Gasket-type weatherstripping, such as rolled vinyl and tubular vinyl, is attached to the door stop so that the vinyl is slightly compressed when the door is shut (see figure 6). Adhesive foam and felt can only be placed in areas where the material will be compressed by the door (see figure 7).

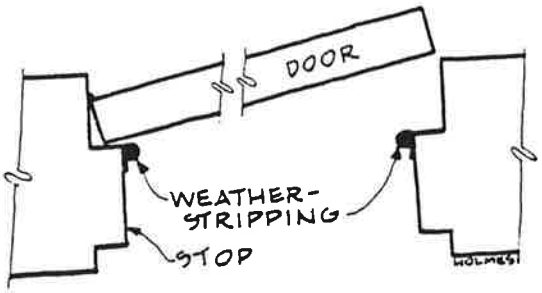


Figure 6. Top view of door with gasket-type weatherstripping

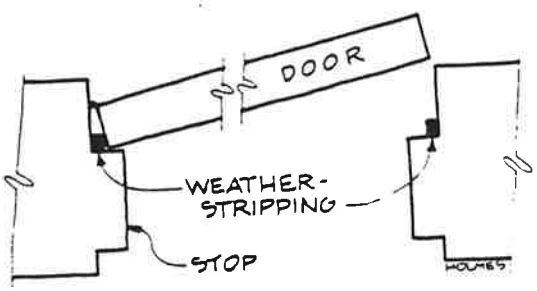


Figure 7. Side view of door with foam or felt weatherstripping

The bottom of a door is usually weatherstripped differently than the sides or head because it lacks a jamb and a stop. The bottom of the doorway usually has a raised threshold made out of wood or aluminum that can be used in combination with specially designed weatherstripping to reduce air leaks. Three common types of door bottom seals include door sweeps, door shoes, and gasket thresholds (see figure 8). Door

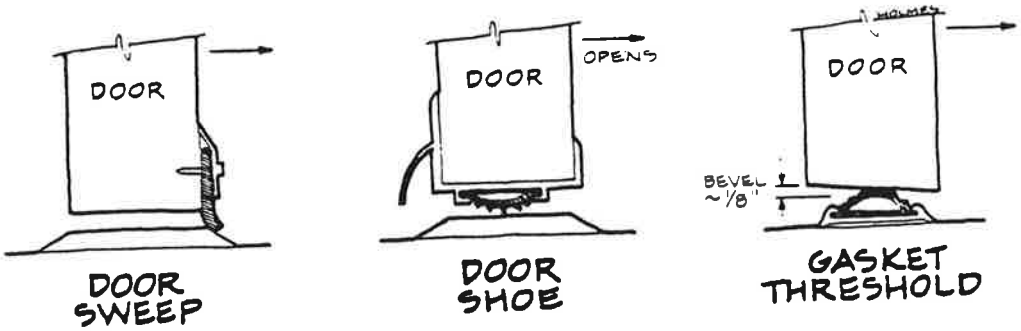


Figure 8. Weatherstripping for door bottoms

sweeps cost $1.50 to $5; door shoes cost $8 to $10; and gasket thresholds cost $3-$4.

If your door does not already have a threshold, probably the easiest way to seal the gap is to install a gasket threshold and shorten the door accordingly. Whenever a gasket threshold is used, it is recommended that you bevel the bottom edge of the door about 1/8" so that it operates more smoothly. The gasket will eventually wear out, but is replaceable. Because replacements can be difficult to find in later years, it's wise to buy an extra gasket when the threshold is purchased.

Double or French doors are weatherstripped similarly to standard doors along the top and bottom, but have the added problem of a gap between the two doors. Although weatherstripping made specifically for double doors can be found, more conventional materials can be equally effective. Often one of the doors will have a narrow strip of wood called an astragal. The astragal is attached vertically along the door's edge and functions as a stop for the opposite door (see figure 9). If the door lacks

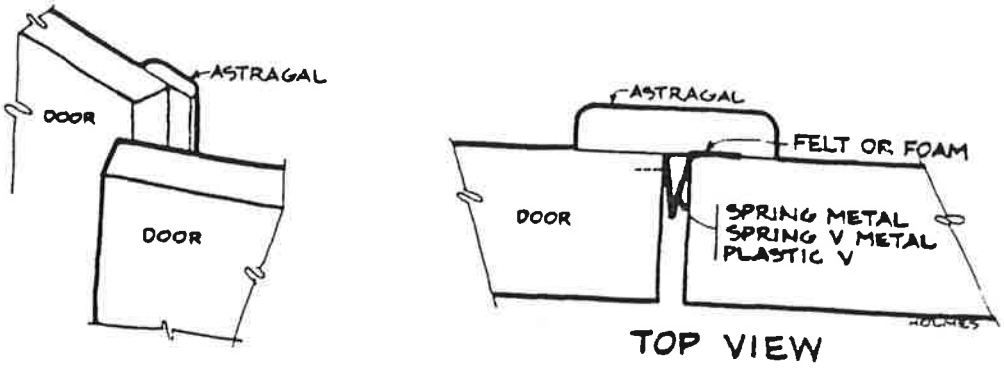


Figure 9. French or double doors

an astragal, you will have to install one before attempting to use conventional weatherstripping. On the edge of the door with the astragal, install spring metal, spring V metal, or plastic V. Along the inside surface of the astragal install adhesive foam or wool felt.

For the bottoms of garage doors specially designed weatherstripping can be purchased for 40¢ to 50¢ per foot. A less expensive solution is to nail a section of worn out garden hose to the bottom of the door; make sure that the door will still close properly, and that the hose material will compress to form a seal.

• Installing Weatherstripping: Windows

There are three basic types of operable windows: double hung, sliding, and casement. Double hung and sliding windows slide vertically or horizontally in a channel, whereas casement windows are hinged and swing outward.

Regardless of their type, all windows in your home fit tighter when they are locked in place. If your windows already fit tightly when locked, and you do not feel cold drafts when you stand nearby, you may not need to weatherstrip them at all. For windows that are loose or leaky, weatherstripping can pay for itself in one or two years.

Casement windows are weatherstripped similarly to doors. Those with aluminum frames require an adhesive-backed material such as plastic V, foam, or felt. Weatherstripping can usually be applied to the outside of the window frame, making it less obtrusive. Wooden casement windows can be weatherstripped with any of the materials used on doors.

Double hung windows are usually more difficult to weatherstrip than casements. A double hung window consists of a window frame with channels along the sides and a sill at the bottom, and the upper and lower sashes that hold the glass. The lower sash is usually movable, whereas the upper sash can be fixed or movable. Where the lower window sash abuts the sill, any weatherstripping that can withstand compression (e.g. spring metal, spring V metal, plastic V, foam, felt, or tubular vinyl) may be used (see figure 10).

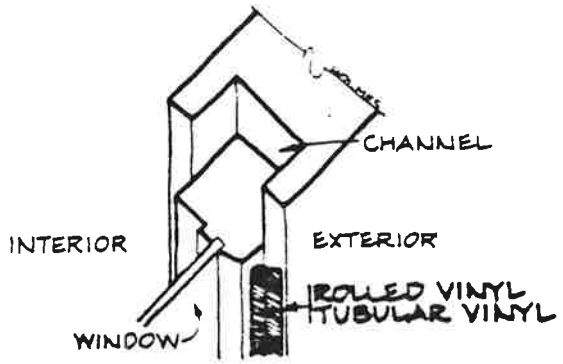
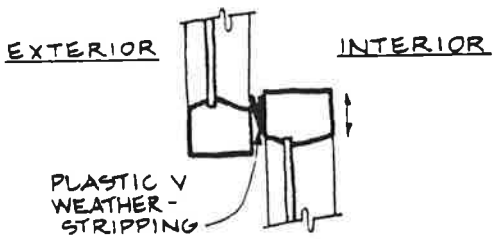


Figure 11a. Gasket-type weatherstripping

It is not usually necessary to remove the window when installing weatherstripping in the channel. Instead, open the window fully and measure the length of the exposed channel. Cut



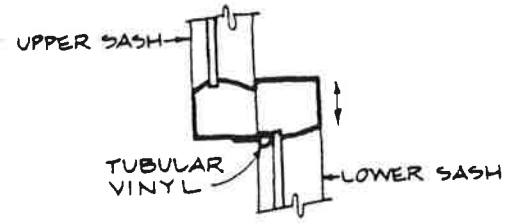


Figure 12. Side view
Weatherstripping between sashes

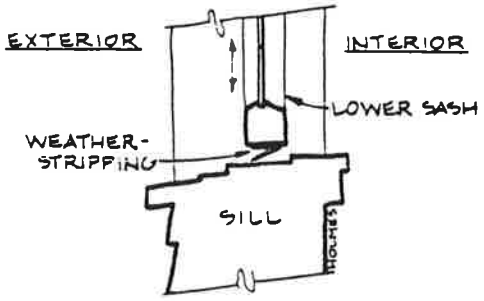


Figure 10. Side view of window with weatherstripping

The weatherstripping may be attached either to the sill or the sash, however it is generally less visible when it is applied to the latter. To seal the sides of the window, tubular or rolled vinyl can be applied to the outside of the window frame (see figure 11a), or spring metal, spring V metal, or plastic V can be installed in the channel itself (see figure 11b). Pulley seals can be used to cover up pully penetrations on all double hung windows. The pulley seals are adhesive-backed plastic covers designed to block infiltration while still enabling the pulley to operate.

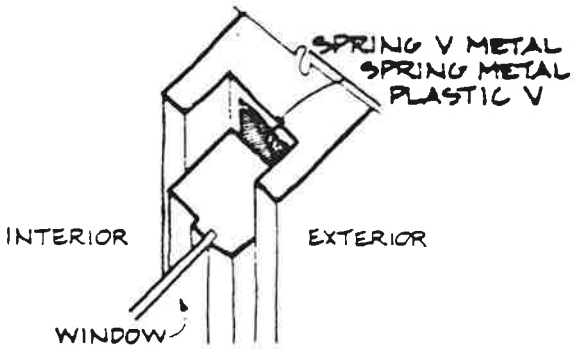


Figure 11b. Spring metal, spring V metal, or plastic V weatherstripping

your weatherstripping at least 2" longer than this measurement and slip it up the channel between the window and frame until the bottom of the weatherstripping is even with the sill. Fasten the weatherstripping to the channel and shut the window. Fasten any weatherstripping that protrudes above the sash.

If your upper sash opens, it should be weatherstripped similarly. The area between the upper sash and lower sash must be weatherstripped as well. Either spring metal, spring V metal, or plastic V can be used between the windows, or gasket-type vinyl can be fastened to the bottom of the upper sash (see figure 12). Unless your upper sash lowers, it will be very difficult to nail spring metal or spring V metal in place, therefore you may find plastic V or a gasket-type weatherstripping more convenient to install.

Sliding windows are similar to double-hung windows turned on their side and should be weatherstripped accordingly. The windows may be more difficult if they are framed with aluminum because the track or channel is often narrow and grooved. Some manufacturers make weatherstripping that is designed specifically for their frames. It is suggested that you buy extra replacement weatherstripping when you purchase the window because it may be difficult or impossible to find years later. An alternative to custom weatherstripping is to trim and install plastic V as shown in Figure 13. It is one of the few common types of weatherstripping that will work in this situation.

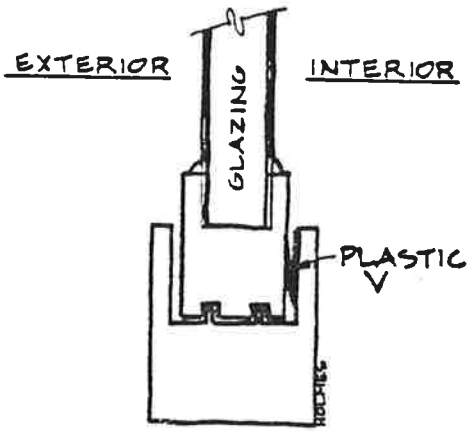


Figure 13. Aluminum framed window

Jalousie or louvered windows provide a nightmarish challenge for the installer of weatherstripping. Clear vinyl tape can be applied to the edge of each individual louver (see figure 14), but the best way to weatherize this kind of window is to replace it with a more energy efficient style or cover it with a storm window.

- Other Ways to Reduce Infiltration

Electrical Outlet and Switchplate Gaskets:
In some homes considerable warm air can be lost through light switches and electric outlets. Many electric utilities provide free gaskets that can be quickly installed behind the cover plates. Gaskets can also be pruchased at hardware stores. Install them on outlets and switchplates on all walls, both interior and exterior. Shut off the electricity before installing the gaskets.

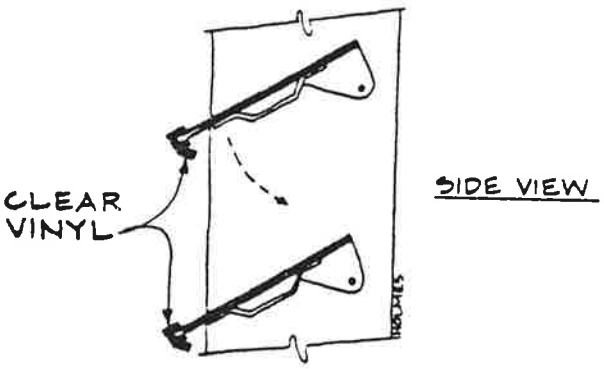


Figure 14. Jalousie or louvered window with weatherstripping

Fireplace:
If you have a fireplace, you can be losing a great deal of warm air up the chimney. It is recommended that you keep the opening covered with glass doors or a sheet metal cover (see the W.E.E.S. factsheet "Metal Fireplace Covers") when the fireplace is not being used.

Vents and Plumbing Fixtures:
Infiltration can occur through exhaust fans and plumbing in the kitchen and bathroom. If your vent does not have a damper that closes when the fan is off, you may want to

install one. Check plumbing under the sink in the kitchen and bathroom. Gaps around the pipes should be stuffed with newspaper or fiberglass insulation filler. If small enough, it can be sealed with caulk.

Attic Entry:
Attic entries should be weatherstripped and caulked to reduce the flow of warm air from heated areas into the attic.

Storm Windows and Doors:
Storm windows not only improve the insulating qualities of your windows, but also help reduce the infiltration of cold air. Likewise, storm doors help reduce air leaks around exterior doors.

SUGGESTED READING

- Gay, Larry (ed), The Complete Book of Insulating. Stephen Green: Brattleboro, Vermont, 1980.
- Morrison, James W., The Complete Energy Saving Handbook for Home-owners. Harper & Row: New York, 1979.
- Sunset Books. Insulation and Weatherstripping. Lane Publishing Co.: Menlo Park, California, 1978.

This factsheet was written by David Schaub. Illustrations provided by Leslie Holmes.

Oil/Resin	1-3 years	$1-2	60°F	Does not weather well. Can not withstand joint movement. Must be painted.
Latex and Acrylic Latex	5-7 years	$2-3	40°F	Cleans with water. Comes in many colors and clear. Can withstand moderate joint movement. Can be painted.
Butyl	5-10 years	$2-3	40°F	Cleans with thinner. Seals cracks between dissimilar materials well. Can be painted.
Elastomeric Polysulfide Polyurethane Silicone	10-20 years	$5-7	-35°-40°F	Very pliable and durable. Adheres to wide variety of surfaces. Most can not be painted. Highly resistant to moisture.
Rope	1-2 years	4-6¢/ft.	40°F	Comes in rope-like form. Best as temporary plug of large cracks. Can be removed and reused.

WEATHERSTRIPPING

TYPE	DURABILITY	COST	EASE OF APPLICATION	CHARACTERISTICS
Spring Metal (flat)	10+ years	25-40¢/ft.	Fair	Must be nailed and scored. Can be difficult to make even seal.
Spring V Metal	10+ years	23-35¢/ft.	Fair-Difficult	Requires a medium to large size gap for installation.
Spring V Plastic	5+ years	18-35¢/ft.	Easy	Self-adhesive. Wide range of application.
Tubular Vinyl	3-7 years	9-35¢/ft.	Fair	Friction or shearing forces shorten life. Aluminum support increases durability.
Rolled Vinyl	3-7 years	8-35¢/ft.	Fair	Very conspicuous. Seals gaps of varying widths effectively.
Foam	1-3 years	6-10¢/ft.	Easy	Self-adhesive. Cannot withstand friction. Requires medium-large gaps.
Felt	2-5 years	8-16¢/ft.	Fair-Difficult	Cannot withstand friction. Handles narrow range of gap width.
Interlocking	10-20 years	35-40¢/ft.	Very Difficult	Very effective. Installation by professional may be necessary.
Door Sweep	5-7 years	$2.50-$5.00	Fair	Vinyl will eventually wear out. Is replaceable. Must have threshold in place to be effective.
Door Shoes	5-7 years	$8-10	Difficult	Vinyl will eventually wear out. Is replaceable. Must have threshold in place to be effective.
Gasket Threshold	4-5 years	$3-4	Fair	Gasket will eventually wear out. Is replaceable. Especially suitable for use in room with heavy pile rug or carpeting.