

WINDOWS

Weatherizing Double-Hung Windows

By John Krigger

Replacing a window is an expensive proposition. In many cases, weatherstripping and repairing the existing double-hung makes economic and aesthetic sense.

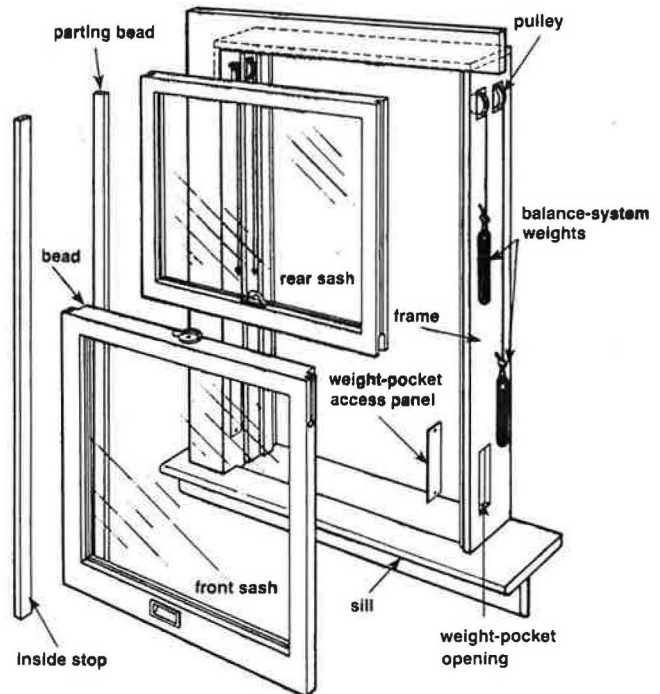
Double-hung windows with pulleys, cords, and counterweights were developed in England around 1650. They were first used in America at William and Mary College, which was completed in 1702. By the mid-eighteenth century, customers could order pre-assembled double-hungs in standard sizes from wholesale millwork outlets. The design remained little changed until 1946, when the last counterweighted double-hung window rolled off the assembly line at Andersen Windows Corp.

Today, more than one hundred million of these sturdy old relics still grace residential and commercial buildings across the U.S. Owners or managers often replace older windows with new double- or triple-paned windows. This is a costly strategy, however, and the energy savings, comfort improvement, and beautification may not always justify the replacement cost. In fact, many older double-hung windows can be repaired and tightened to an acceptable condition. This article discusses a variety of simple ways to seal and repair windows for less than it costs to replace them.

Developing a Strategy: Repair or Replace?

Is the goal of a project overall rehabilitation or simple weatherization? If air sealing is the main concern, the auditor should compare the air leakage through the windows with other sources of infiltration, using a blower door if available. (See articles on blower doors: Mar/Apr, May/June, Jul/Aug, Sep/Oct, and Nov/Dec '86 and Sep/Oct '87.) Windows may not be a major infiltration source when compared to plumbing chases, chimneys and elec-

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Parts Of A Window

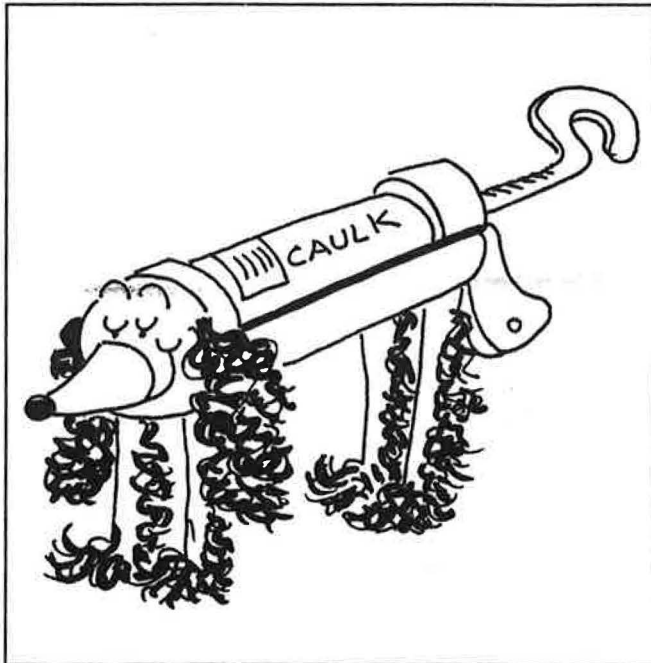
trical fixtures, but they are always a major consideration in the rehabilitation, maintenance, and general weatherization of buildings.

A hundred-year-old building with a sound foundation and shell may stand for many more years, and the original double-hung windows—if kept in good working condition—should last as long as the building. Repair usually makes more economic sense than replacement, because five hours and \$25 in materials will fix all but the most damaged window. By comparison, window replacement is expensive and is likely to cost more than \$250 per window for labor and materials, even if the old frame and trim are left intact.

Many of the lower-priced new windows do not equal the quality or life expectancy of a refurbished double-hung window. Double-hungs are often made of solid wood of a larger dimension than most new windows, while many lower-priced new windows use finger-jointed wood, plastic track materials, impossible-to-replace weatherstripping and, other inferior features. If the new window goes into the existing frame, there may be aesthetic

Drawing courtesy of Rodale Press, Emmaus, PA

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A Caulker Spaniel

problems where the new meets the old. So, refurbishing and sealing old double-hung windows makes sense in many cases, even if a house is undergoing major rehabilitation. Unless the jambs, trim, and sashes are warped, split or rotted, the savings from sealing and repairing can justify the cost of repairs.

What about storm windows? Exterior storm windows protect wood double-hung windows from weather and reduce infiltration and conduction losses, thus prolonging the life of older windows. It pays to shop carefully for storm windows because they vary so widely in price and quality.

You can usually add a storm window and rehabilitate the existing double-hung (the prime) window for less than it would cost to install a replacement window. If the prime window is not weatherstripped when the exterior

General strategy	Time required	Specific steps
Quick fixes	15 - 60 minutes	Seal entire window shut; seal top sash shut; seal pulleys and meeting rails.
More extensive sealing	15 - 45 minutes	Weatherstrip sides of window; weatherstrip meeting rail of top sash; weatherstrip bottom sash.
General repairs	2 - 6 hours	Remove old paint; install a new pulley seal; repair glazing and replace cracked putty; reinforce corners of loose sashes.

Table 1. Repairing double-hung windows.

storm window is installed, however, condensation can become a problem. A fairly tight exterior storm window installed on a leaky prime window can trap warm moist air in the space between the windows and cause fogging and freezing on the interior surface of the storm window. To avoid this problem, caulk and weatherstrip the prime window. Interior storm windows generally fit more tightly than exterior storm windows, but they don't have the advantage of protecting the prime window from weather.

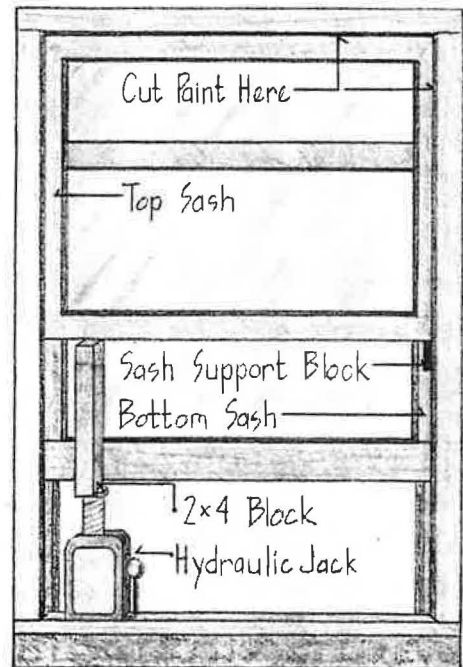
The amount of work a window requires depends on several factors: the nature of the job (simple weatherization or complete rehabilitation), the needs of the occupants and building owners, and of course, the labor and materials budget. I have defined three levels of increasing activity and expense: quick fixes, more extensive sealing, and general repairs (see table 1). Once the decision has been made to repair, it is necessary to examine all the windows and develop an overall plan for weatherstripping and repairing them.

Quick Fixes: Basic Weatherization with the Window in Place

Basic weatherization of a double-hung window without removing the sash usually takes from 15 minutes to an hour and is almost always cost-effective. This section discusses a variety of quick and inexpensive options, such as sealing some windows shut, sealing the top sash shut, and addressing the main sources of air leakage.

Blocking Off Windows

At least one window in each room should open and close to provide ventilation and a means of escape in case



Raising the top sash View from outside

Figure 1. Blocking the top sash permanently into place.

of fire. One option to consider at the outset in homes with multiple windows in one room (where ventilation is more than adequate) is to seal shut one or more of the windows. Check with the owner, occupants and code officials before deciding which, if any, windows can be sealed.

While only a few windows should be fully sealed, the top sash of many windows can be sealed. This is possible where the top sashes do not operate, are unused, or are not needed to enhance ventilation. In many cases, immobilizing the top sash won't significantly reduce ventilation. However, if you block the top sash permanently into place, you have more time to tighten the bottom sash.

Before the top sash on each window is caulked shut, it should be blocked permanently into place, because there is sometimes a gap at the meeting rails where the top sash has slipped down and been painted into place. Close the gap by cutting the paint around the top sash both inside and outside. Then move the sash all the way up. The careful use of a small hydraulic jack might be considered if the sash can't be raised by hand. Put a piece of 2" X 4" between the sash and jack, along the side channel of the window, then push up (see figure 1). Repeat the process at the other corner if necessary. Don't push up with the jack in the middle of the meeting rail, because that can break the glass! A piece of standard door stop, two-inches-long, nailed to each channel under the meeting rail will then hold the top sash in place.

If it is impossible to move the top sash up, an alternative is to move the lower sash down by cutting the bottom of the lower sash at a bevel to match the sloping window sill. This is another way to make the meeting rails come together. Cutting the lower sash can weaken it, however.

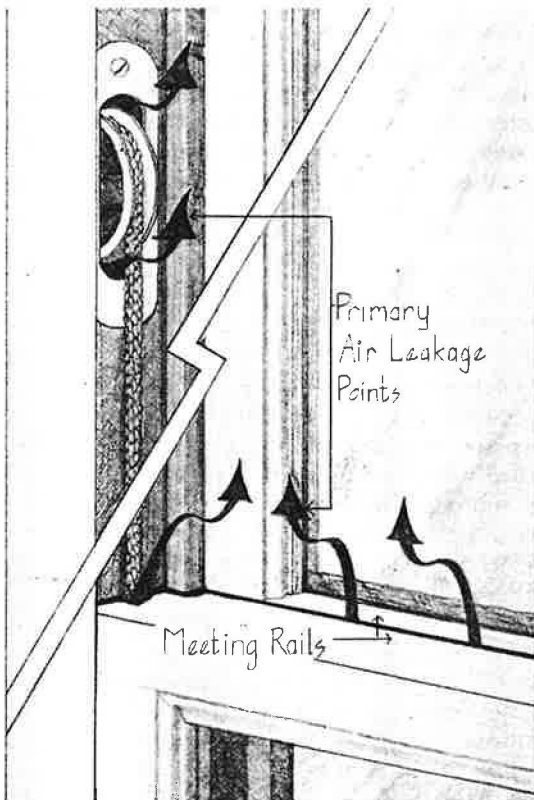


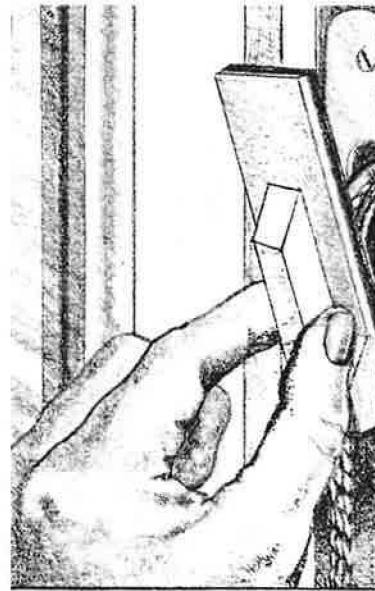
Figure 2. Primary air leakage points.

If both sashes must operate, the procedure for weatherstripping the top sash is the same as that described below for the bottom sash.

Sealing the Pulleys and Meeting Rails

Old double-hung windows leak most often at the pulleys, the corners of the meeting rails, and along the meeting rails—where the top and bottom sashes fit together. These primary air leakage points can easily be sealed without dismantling the window or removing the sashes (see figure 2).

Weatherstripping the pulleys and the meeting rails takes about 15 minutes and significantly reduces air leakage. On some windows, weatherstripping these areas seals well enough that no further work is necessary. To block most of the air from coming through the pulleys, install pulley seals. These are plastic covers backed by an adhesive foam pad that block air leakage but permit the rope to move in and out through the pulley.¹ Pulley seals are easy to install. Bend the pulley seal to fit the hole around the rope, and attach it to the jamb with the screws provided (see figure 3).



Pulley Cover

Figure 3. Installing a pulley seal.

To seal the corners of the meeting rails, make a corner seal of flexible plastic, such as freezer vinyl, which is used to strip doors in refrigerated food warehouses. Clear plastic is best, because it is hardly noticeable after it is applied. To fit the vinyl properly, make a paper pattern that fits around the rope but reaches the window channel on either side of the rope at the corners of the meeting rails. Check to see whether it fits all the windows you are going to weatherstrip; it usually does. Use the pattern to cut a number of corner seals from the plastic. The seal should be a couple inches long. Leave some clearance between the edge of the corner seal and the window channel when installing the corner seal, so that it doesn't bind. Staple and glue the corner seal into place with four or five staples and clear caulk (see figure 4).

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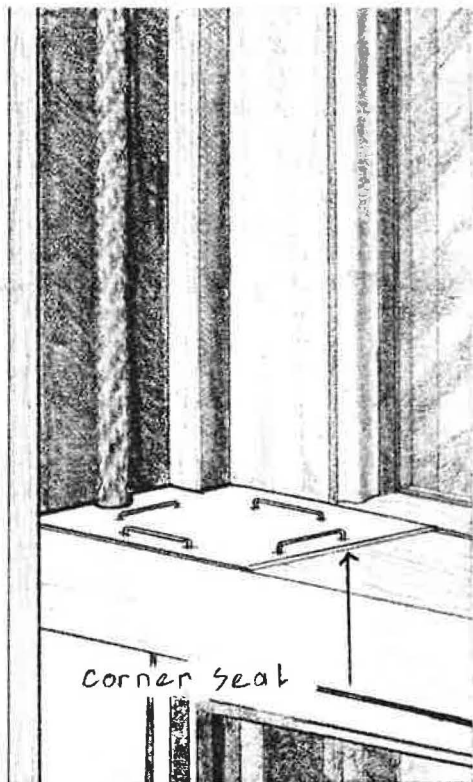


Figure 4. A corner seal stapled and glued into place.

Next, apply weatherstripping to the length of the meeting rail. A bronze weatherstripping called "Meeting Rail" made by Kel-Eez Co. can be installed on the meeting rail of the bottom sash without taking the bottom sash out.² Use brads or staples to hold the weatherstripping in place. There must be a little room between the top and bottom meeting rails for the weatherstripping to fit snugly

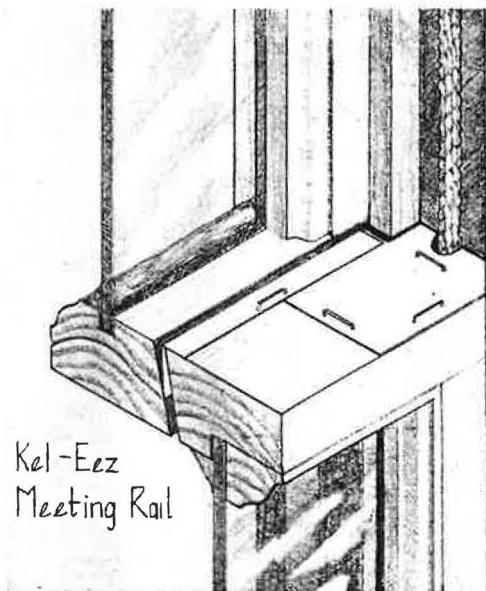


Figure 5. Meeting rail weatherstripping made by Kel-Eez.

without binding. To improve the seal, caulk the surface of the fastening lip of the weatherstripping before installing it on the bottom sash (see figure 5).

Seal the rest of the window by caulking cracks around the window frame with a latex or silicon-latex caulk. Fill in any cracks where the window trim is separated from the wall. Seal all cracks between non-moving window components.

More Extensive Sealing: Side and Bottom Weatherstripping

While sealing the pulleys and the meeting rails blocks most air leakage, the sides and the bottom of a window may require weatherstripping as well. Weatherstripping the sides of a window usually entails removing the sash. This is a more time consuming activity (15 to 45 minutes per window) that may be undertaken in tandem with major repair work described later in this article.

Adhesive-backed plastic V-seal on a roll works well as a side seal or for the bottom sashes. It doesn't require much clearance, it doesn't bind, and it provides a good seal. The side seal can be installed in two ways: on the window jamb with the point of the V facing the inside (the sash will reinstall easier this way), or on the parting bead where the outside face of the bottom sash rests and slides. Weatherstripping along the parting bead stops air leaks at the corner of the meeting rail more effectively and is thus usually preferable to weatherstripping the jamb. Before removing the bottom sash, test it by pushing the window back and forth and from side to side to determine clearances at the jamb and the parting rail. Don't weatherstrip the parting bead unless there is at least $\frac{1}{8}$ inch of clearance. The same holds for weatherstripping the jamb.

Remove the sash by carefully prying one of the stops away from the jamb and pulling the sash out. Generally, only one stop must be removed. Use a sharp utility knife to cut the paint between the jamb and the stop. This will prevent the paint from chipping when you pry off the stop. Pull the ropes from the holes as you lift the bottom sash out of its channels.

When applying the side seals, the V-seal need not extend up any further than the meeting rail. Always clean the wood surface thoroughly before applying the self-adhesive weatherstrip. Never depend on a self-stick weatherstrip. Anchor the V-seal with a $\frac{1}{4}$ -inch staple every four inches. Staple as close as possible to the top and bottom of the piece of weatherstripping.

Bronze V-seal, any of the new silicon bulbs, and EPDM rubber bulbs all work well for weatherstripping the lower sash. The weatherstripping should compress evenly and tightly, so that it will not push up the bottom sash. This would cause the meeting rails to be uneven.

While the bottom sash is removed, you can install a bronze or vinyl V-seal (bronze is best) to the sloped surface of the meeting rail of the top sash (see figure 6). Installing V-seal weatherstripping on the meeting rail of the bottom sash is not a good idea because it tends to bind when the bottom sash moves up and down. Choose a V-seal that comes to a sharp point at the V. Avoid those

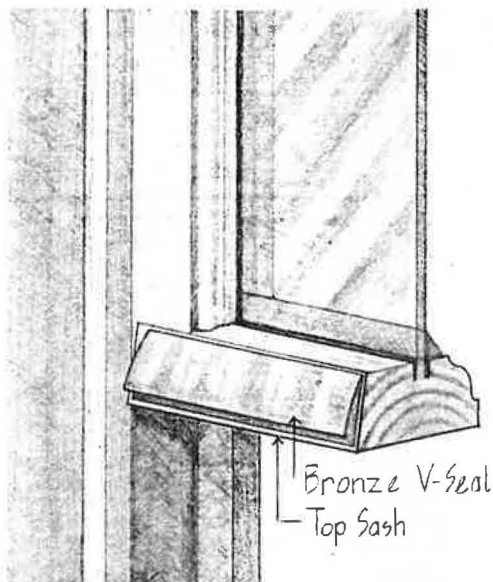


Figure 6. Bronze V-seal attached to the meeting rail of the top sash.

with a tiny bulb that might tend to bind where the meeting rails come together. Caulk the surface of the V-seal weatherstripping to improve the adhesion and seal. The factory-installed adhesives that come with some of the plastic weatherstripping often fails. Again, staple all weatherstripping every four inches to ensure permanent adherence.

General Repairs to Double-Hung Windows

The success of an air sealing project often depends on the repair work that is done to the window. Although this repair work may require two to six hours per window, it will greatly increase the effectiveness of the air-sealing work and lengthen the useful lifetime of the window.

Remove Old Paint

Paint often causes windows to stick or prevents them from closing. You can restore the window to working order by scraping off the bumps and filling in the holes. Multiple layers of drippy paint can be quickly removed with heat or a chemic weatherstripping the window; otherwise, the weatherstripping might bind. Paint during warm weather when possible, and ventilate rooms where paint, putty, and caulk are being used.

Sometimes it's more expedient to dispose of window trim and stops that are overpainted rather than to scrape and repaint them. Fill the gouges and holes in the sashes and frame; this blocks moisture that can rot the wood and provides a smooth surface for paint. Pay particular attention to the sill, which is often cracked and weathered. Epoxy-based putty is best for filling the larger holes and cracks, and silicon-latex caulk is fine for filling smaller holes and cracks.

Install a New Pulley Rope

It takes only a few minutes to replace a pulley rope. Usually one screw holds the panel that provides access to

the weight pocket in the jamb. Remove the screw and the access panel, and pull out the weight. Then cut the broken rope off the weight and tie the new rope to it. (To determine the length of the new rope, measure the length of the rope in the opposite channel and then add a little extra—so you can tie a knot to attach the rope to the bottom sash). Then replace the weight in the weight pocket.

Use a length of beaded chain to feed the rope through the pulley. Feed the chain down through the pulley until you can see it through the weight pocket access door. Tape the end of the chain to the end of the new rope with electrician's tapes, and pull the chain until the rope comes into view through the back side of the pulley. Tie a double knot and insert the knot into the hole in the edge of the sash when you are ready to re-install the sash into the frame.

Glazing Repairs

Glazing also needs attention during window repairs. Putty can be easily removed by heating it with an electric putty warmer or propane torch. The faster you scrape out the putty after heating it, the easier it will come. Use a chisel and a scratch awl to scrape out the putty, and try not to mar the wood. Clean the edges of the channel with a wire brush and a dust brush. After cleaning the glazing surfaces, prime them with a latex primer. The primer helps the putty to adhere.

Spread a uniform layer of putty on the surface where the glass will sit. (Glazing compound in a tube is often easier to use than canned putty spread with a putty knife.) Bed the glass gently into the putty and insert the glaziers points by pushing them gently into the sash, wiggling the blade of the putty knife as you push. To finish the job, apply putty around the edge of the glass and sash, and bevel it with a putty knife or with the specially designed tip of the putty tube.

If necessary, reinforce loose sashes with L-shaped corner braces, which are fastened to the sash with wood screws. Wooden dowels were original equipment for holding the mortised sash corners together. If the corner of the sash is loose, these dowels can be replaced, and the corner can be glued when the sash is reassembled. If the corner is just a little loose, wood screws and L-shaped corner braces can be used to fasten it. Braces are easier to install, since you don't need to take the sash apart. Make sure the sash is square before bracing the corners!

Recommendations

Replacing a window is expensive and may not be necessary. Weatherizing windows can often save energy at a much lower cost than replacing windows, without much difference in overall thermal performance.

There are three levels of repair: quick fixes include blocking off some windows entirely, sealing the upper sash, and sealing the pulleys and meeting rails; more extensive repairs involve weatherstripping the sides and bottom of the window; finally, repair work that includes removing paint, installing a new pulley rope and repairing glazing, may take from two to six hours per window but can increase the effectiveness of the air-sealing work

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and lengthen the useful life of the window. It's worth the time and effort to learn to fix double-hung windows. ■

For more information

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Endnotes

1. Pulley seals are made by Anderson Pulley Seal, 920 W. 53rd St., Minneapolis, MN 55419. Tel: (612) 827-1117.
2. Kel-Eez Co. is located at P.O. Box 8144, Akron, Ohio 44320-0114. Tel: (216) 376-0662.

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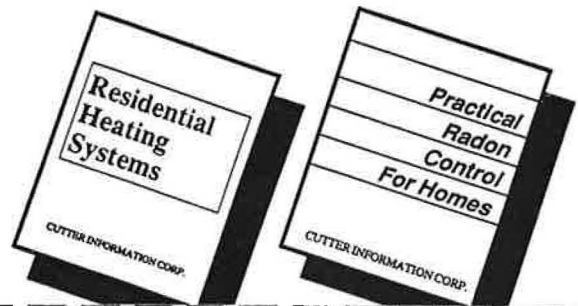
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