Wall Vapor Barriers

Vapor barriers are most important in climates where there is a large difference in humidity between outdoor air and indoor air. Vapor barriers should be installed on the warm side of the wall. The vapor barrier in cold climates should be on the indoor side of the wall. The vapor barrier in hot, humid climates should be on the outdoor side of the wall.

Vapor barriers stop moisture from diffusing through building materials like sheetrock and wood-composite siding. Vinyl and metal siding are vapor barriers. Metal siding collects condensation during very cold weather because it's a vapor barrier on the cold side of the wall.

In moderate climates, with air conditioning and heating, moisture is coming from outside to inside during the summer and from inside to outside during the winter. It may be best to avoid vapor barriers by letting the cavities be porous to drying from either side of the wall in warm climates.

The ground under the home can be a major source of water vapor, which then condenses on cool surfaces. Ground moisture barriers stop water vapor rising through the soil under the home, and also prevent evaporation of water seepage from damp ground. Ground moisture barriers should be installed on dirt floors in all crawl spaces. Heavy polyethylene plastic (at least 6 mils thick) makes a good ground moisture barrier.

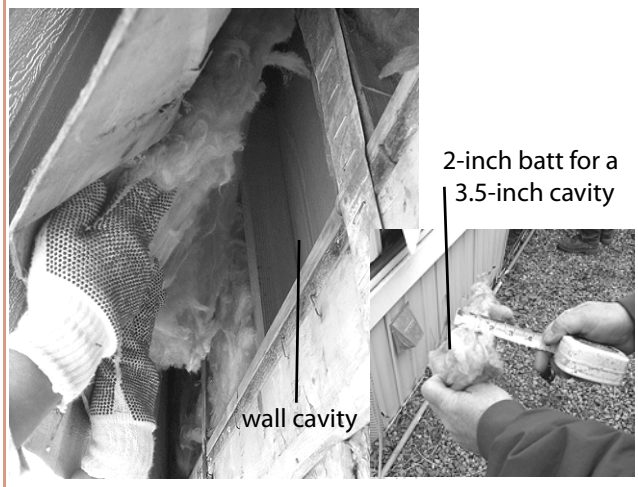
Wall Insulation

Although installing wall insulation is a difficult energy retrofit, it can be cost-effective in cold climates with moderate to high fuel costs.

Mobile home walls are often partially void of insulation because of insufficient insulation thickness, settling, or poor installation.

Adding more wall insulation will save around 10% of existing heating costs in cold-climate homes that have 2 inches or less of wall insulation. In warmer climates, it is generally not as cost-effective to re-insulate partially insulated walls.

Figure 8-7 Inspecting Wall Cavities



Many wall cavities have insulation that doesn't completely fill the cavity, rendering the insulation far less effective than when insulation packs the cavity.

Remember: Working with insulation creates dust that can irritate your lungs, eyes, and skin. For your safety, wear a respirator, safety glasses, gloves, and coveralls.

Comparing Wall Insulation Methods

Compacted fiberglass insulation produces a slightly higher R-value per inch of thickness than un-compacted fiberglass. Compacted fiberglass also stops air more effectively than looser fiberglass. Compacting insulation is important for re-insulating wall cavities in order to achieve maximum R-value and to stop air movement.

Three different methods of wall insulation are discussed below: 1. Blowing insulation; 2. Stuffing fiberglass batts; and 3. Removing exterior siding to install batts. Each has advantages and disad-

vantages when compared to the others. On some homes, because of variations in the wall, the three methods might even be combined.

1. **Blowing insulation into wall cavities** works well in most applications. Generally, blowing insulation is slower than stuffing insulation and faster than removing siding.
2. **Stuffing batts into wall cavities** with a flexible stuffing tool is usually the fastest way to insulate walls. With stuffing, however, it is difficult to fill corners, narrow cavities, and areas around doors and windows. The stuffing method can work well, when combined with blowing or removing siding. However, stuffing doesn't work on every home.
3. **Removing exterior siding to allow for batt insulation** is the most time-consuming method, but it does facilitate wall repair (if needed) and it doesn't require a blowing machine. Insulating the open cavity is easy with exterior siding removal or interior paneling removal during major renovations.

All of the above wall insulation methods should be accompanied by the repair and refastening of any damaged or loose interior and exterior wall panels.

Blowing Insulation into Wall Cavities

Fiberglass insulation can be blown into walls using a blowing machine, hoses, and a flexible fill-tube. The best fill tubes for mobile home walls are stiff but flexible plastic pipes about 8-feet long and 1-to-2 inches in diameter. Corrugated plastic tubing used with agricultural or spa pumps works well. You can take the 2-inch size and drive over it with a car to flatten the round shape of the tube into an oval. This oval-shaped tube fits in most $21^1/_2$-to-$5^1/_2$-inch-deep wall cavities. A flattened $1^1/_2$-inch-diameter tube will fit into a partially insulated $1^1/_2$-to-$3^1/_2$-inch-deep cavity. Marking these fill tubes in one-foot intervals helps you know how much of the tube remains in the wall when you are pulling the tube out.

The blowing machine's delivery rate and its air pressure determine the insulation's density and the time required to fill a cavity. If the delivery rate is too fast, the hose may clog. If the delivery rate is too slow, the cavity takes too long to fill, and the insulation packs excessively, possibly bulging interior or exterior paneling. Choose a delivery rate and pressure that fills the wall quickly and steadily without bulging the wall or clogging the hose.

Figure 8-8 Inserting the Fill-tube

The technician inserts the fill-tube into a wall cavity. text here

The areas above many windows are small and may not be worth the considerable effort required to fill them with insulation. Removing siding or interior panels or drilling holes in interior or exterior sheeting is difficult but will work.

Blowing insulation – metal-sided homes

For mobile homes with metal siding, a simple and straightforward fiberglass insulation blowing procedure is described below:

Step 1: Check the interior paneling and trim to make sure they are securely fastened to the wall. Repair holes in interior paneling and caulk cracks at seams to prevent indoor air from entering the wall. Note the location of electrical boxes and wire to avoid hitting them when you push the fill tube up the wall.

Step 2: Remove the bottom horizontal row of screws from the exterior siding. If the vertical joints in the siding interlock, fasten the bottom of the joints together with $^1/_2$-inch sheet metal screws to prevent the joints from coming apart. Pull the siding and existing insulation away from the studs, and insert the fill tube into the cavity with the point of its tip against the interior paneling.

Step 3: Push the fill tube up into the wall cavity until it hits the top plate of the wall. The tube should go in to the wall cavity 7-to-8 feet. It is important to insert the tube so that its natural curvature presses its tip against the interior paneling. When the tip of the fill tube, cut at an angle, is pressed against the smooth paneling, it is least likely to snag the existing insulation on its way up the wall. If the fill tube hits a belt rail or other obstruction, twisting the tube will help its tip get past the obstruction.

Step 4: Stuff a piece of fiberglass batt into the bottom of the wall cavity around the tube to prevent insulation from blowing out of the wall cavity. Leave the batt in-place at the bottom of the wall, when you pull the fill tube out of the cavity. This piece of batt acts as temporary gasket for the hose and insulates the very bottom of the cavity after the hose is removed. This batt also eliminates the need to blow insulation all the way to the bottom, preventing possible spillage and overfilling. If you happen to overfill the bottom of the cavity, reach up inside the wall to pack or remove some insulation, particularly any that lies between the loose siding and studs.

Step 5: Draw the tube down and out of the cavity about 6 inches at a time. Listen for the blower fan to indicate strain from back-pressure in the wall. Watch for the insulation to slow its flow rate through the blower hose at the same time. Also watch for slight bulging of the exterior siding. These signs tell the installer when to pull the tube down.

Step 6: Carefully refasten the siding using the same holes. Use screws that are slightly longer and thicker than the original screws.

Blowing Insulation—Wood-Sided Homes — For homes with wood siding, drill holes ($2^1/_2$ inches to $3^1/_2$ inches in diameter) into each cavity a foot or two from the bottom of the wall. Insert the fill tube up into the wall, following procedures outlined above to avoid snagging the existing insulation.

Or, cut 3-by-6-inch rectangular holes centered over the studs to gain access to two wall cavities through one hole. This method produces one-half the number of holes compared to drilling.

Depending on the method used, patch the holes with rectangular patches, round plastic or wooden plugs, or a continuous piece of wood trim. The wood trim should be beveled at the top to shed water and sealed carefully to the siding with caulking.

Stuffing Batts into Wall Cavities

Batt-stuffing is another technique used to re-insulate metal-sided mobile homes. Batt-stuffing would only work on wood-sided homes if the siding were cut off at the bottom for moisture-damage repair as described earlier. Fiberglass batts can be stuffed into empty or partially-insulated wall cavities with a strong but flexible plastic stuffer, made of clear polycarbonate plastic sheet 8 feet long and 13 inches wide and $^1/_4$-inch-thick. Polycarbonate sheet is available through glass dealers. Bending the last foot of the stuffer at about a 15° angle will make it more versatile for stuffing different types of wall cavities.

Batt-stuffing is much faster than blowing, but it won't work in all wall cavities—some will still have to be blown. Batt-stuffing does not work near corners or doors where the siding is difficult to loosen and pull back. Batt-stuffing also may

not work well on some partially insulated walls that are particularly tight due to belt rails, wiring, or other obstructions.

Figure 8-9 Stuffing Batts

Fiberglass batts can be stuffed into partially insulated wall cavities, using a flexible metal or plastic batt stuffer.

Batt-stuffing can be very fast and easy when it works. The only way to discover whether it works on a particular home is to try it.

Here are 7 steps to follow for stuffing fiberglass batts into mobile home walls.

Step 1: Check the interior paneling and trim to make sure it is securely fastened to the wall. Prevent indoor air from entering the wall cavity by caulking cracks and repairing holes in interior paneling.

Step 2: While you are still inside, remove hanging pictures and the screws or nails that hang them. Check the wall's electrical boxes to see if they can be easily removed. If so, remove anchoring screws from the boxes and pull the boxes temporarily out of the wall to clear the cavity for batt stuffing. Don't remove the boxes from the wall unless you can easily refasten them—you can always blow insulation into those cavities instead.

Step 3: Remove the bottom two horizontal rows of screws from the exterior metal siding. If the joints in the siding interlock, fasten the bottom of the joints between pieces of siding together with $^1/_4$-or $^1/_2$-inch sheet metal screws to prevent the interlock from separating. For homes with horizontal siding, simply remove the bottom section of siding.

Step 4: Cut an un-faced fiberglass batt at least 8 inches longer than the height of the cavity. Cut a piece of flexible plastic sheeting (4-to-6 mils thick) the same size. Lay the plastic on the ground and place the batt on top of the plastic. Then put the batt stuffer on top of the batt. The top of the batt stuffer should be 4-to-8 inches down from the top of the batt. (Kraft-faced batts and new plastic-jacketed batts may also work well.)

Step 5: Fold the batt and film over the top of the batt stuffer. Pull back the siding. Put the side with the plastic sheeting against the interior paneling. Use the batt stuffer to push the batt and plastic film up into the wall cavity to its top. The plastic sheeting on one side and the stuffer on the other protect the batt act as lubricants to help it move up the wall without tearing. The existing insulation should be compressed against the exterior siding as you push in the new insulation. Shove the batt up into the wall cavity until the stuffer and batt hit the top plate of the wall.

Step 6: Let the excess batt insulation hang out to remind you which cavities have been stuffed. As mentioned earlier, some cavities will not accept stuffing and will require blown insulation. After you blow insulation into those cavities that require it, you can cut off the excess batt from cavities you stuffed. Or, fold it up into the wall.

Step 7: Carefully refasten the siding using sheet metal screws one size thicker and one size longer than the ones you removed.

Removing Exterior Siding to Insulate

Removing a mobile home's exterior siding is more time-consuming than blowing or stuffing insulation, but it requires less experience and no special equipment. Un-faced fiberglass insulation, sometimes known as friction-fit fiberglass is used.

Siding removal can produce superior results because you have complete access into the cavities to seal cracks and holes in the cavities, install insulation, and attach an air-infiltration barrier to the wall's exterior under the siding (to inhibit air leakage and convection in the wall cavities).

Siding removal is a practical alternative when you are:

1. Replacing siding (especially if existing siding is water-damaged);
2. Replacing or repairing doors and windows;
3. Repairing a wall's structural parts; or
4. Re-insulating a wall with missing or damaged insulation.

Doors and windows are usually installed over vertical metal siding, pinning it to the structural wood frames of the windows or doors. In most homes, the door and windows must be removed in order to pull the siding off.

To avoid leaving wall cavities exposed overnight, only remove as much of the siding and windows as you can reinstall in one workday. Using reversible drills to remove doors, windows, and siding, three good workers can re-insulate one-half of an averaged-sized single-wide home and reinstall that half's siding in an 8-to-10-hour day.

When insulating after siding removal, fill the whole wall cavity—from top to bottom, side to side, and interior to exterior wall surfaces. Although using insulation designed for deeper cavities may cause the insulation to bulge slightly before siding replacement, the wall will have a superior R-value, compared to a wall with less insulation and more air spaces. Use waste pieces of batt insulation to stuff around outlets and wires. Remember that even small voids will reduce the R-value.

Manufacturers use different ways of attaching mobile home siding at its top and bottom. Carefully study your home's siding details to estimate how much work siding removal will entail. It may help to remove an easy panel—one without windows or doors—to judge removal difficulty and also to inspect the wall cavity.

If the siding is tied into the metal roofing at a joint at the roof's edge, you don't absolutely have to break that joint, which is often sealed with roof coating and putty tape. Sometimes you can prop the siding away from the framing to install insulation underneath it after loosening the siding's top and middle. Letting the siding hang, as described above, can be dangerous on a windy day and should only be done in calm wind conditions.

Figure 8-10 Installing Fiberglass Batts in an Open Wall Cavity

After siding is removed, batts designed for a $3^1/_2$-inch-cavity are compressed into a $1^3/_4$-inch cavity.

Figure 8-11 Sealing Walls

A technician caulks around electrical outlets and seams from the outside after siding panels have been removed tor re-insulation.

If you do have to disassemble the joint between roof and siding, seal the joint carefully with putty tape or exterior caulking under the roof edge and j-rail when you install old or new siding—the smallest leak at this joint can let a lot of water into the home.

Here are 8 steps to follow when insulating exterior walls by removing exterior siding.

Step 1: Use masking tape to mark each joint between siding panels. Also mark joints between siding and trim. Place tape across the joint, and write the same number on each side of the joint. Then, cut the tape. The tape and numbers will make reassembly much easier.

Step 2: Remove the windows and doors: They are usually fastened with hex-head screws and sealed with putty tape. Carefully pry the window or door away from the siding little by little moving around its frame with a flat pry bar. Label the windows and doors with masking tape noting their locations and the direction they face to ensure correct reinstallation.

Step 3: After the siding and trim have been marked, remove them. Most metal-sided mobile homes have starter strips at the top of the wall that are fastened to the metal roof. You don't have to remove this starter strip. The siding will slide out from underneath it, when you remove the screws going through both the starter strip and siding.

Step 4: If you find a vapor barrier fastened to the outside of wall studs, remove this vapor barrier. With the wall cavities now exposed, examine the studs, window sills, and plates. Repair any damage by fastening wood or metal patches to weak framing members and replacing rotten ones. Caulk and seal: cracks around outlets, holes in the interior paneling, and seams between studs and interior paneling (optional). At the same time, refasten any loose interior paneling from indoors.

Step 5: Insulate the cavity with un-faced fiberglass batts. Peel extra, partial sheets of batt to completely fill cavities around electrical boxes, wire, and other obstacles. Ideally, the insulation should touch the entire surface of interior paneling and touch the entire surface of the exterior air barrier, filling every cubic inch of every wall cavity.

Step 6: Wrap the newly insulated walls with an *vapor permeable air barrier.* This *house-wrap*, as it is sometimes called, stops air leakage but lets moisture out of the wall. This air barrier is stapled to the exterior side of the studs. Staple it in place, joining its edges at studs for support and sealing the edges with caulking or construction adhesive. The air barrier is tough material so tearing and puncture are not much of a problem. If you do punch a hole in the air barrier, repair it with rugged polyethylene tape or an air-barrier patch, glued on with construction adhesive.

Step 7: The old siding may not align perfectly with existing holes in the wood. This will not be a problem because the new screws will bore their own new, tight holes. Use larger screws, if the holes line up, so the screws aren't loose inside the old holes. After reinstallation, the siding should be flat and tight, looking as good as it did before.

Step 8: Reinstall windows and doors, using new putty tape. Then, caulk carefully around the exterior frames to prevent water leaks. Also, seal the screw heads with clear caulk.

Figure 8-12 Air Infiltration Barrier

After installing batts in an open wall cavity from outside and before the siding is re-installed, an air barrier is stapled and sealed tightly over the insulation.