PROBLEM CLINIC:

WOOD, VINYL, AND ALUMINUM SIDING

BY
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UNDERSTAND THE MATERIALS YOU'RE USING IF YOU WANT TO STAY OUT OF TROUBLE

When riding around New England we see houses with wood siding that has stood up to the elements for over 50 years (Figure 1). We also see new houses with wood siding that has failed in less than five years (Figure 2). We see many houses, old and new, that have been re-sided with other materials that have also failed. This article will discuss why some siding applications have such short lives, and how to prevent these premature failures.

Wood Siding

People often say they like wood siding because it is a natural building material. My reply is that there are no natural building materials. All have a prior purpose on earth, all have limitations and different characteristics. When we ignore these limitations and characteristics, problems result.

Many older wood sidings performed successfully because they were cut from the heart of the tree where the wood is hard, dense, and less absorptive (heartwood). Also they were cut across the edge of the grain (Figure 3), making "edge-grained" or "vertical-grained" siding, which is inherently stable dimensionally. Many new wood sidings fail because they are cut from the sapwood, a softer wood that is more absorptive to begin with, and cut across the grain ("flat-grained"), making it still more absorptive. When it is applied rough side out, the added surface area also adds to its tendency to absorb water.

Many older wood sidings were protected by roof overhangs. Many did not fail because they were properly protected from water penetration by several coats of lead-based paint that stopped water absorption. Today we do not have lead-based paints and the paints and stains used vary considerably in effectiveness. Often they are improperly applied.

Most siding failures result from exterior water absorption, not from vapor transmission through the walls from the inside (permeability). Often paint peeling and warping of siding is blamed on moisture coming from the inside of the house and being trapped by the paint, then condensing and pushing the paint off the wood. But this is not possible when an impervious sheathing such as plywood, resinboard, or some nonstructural sheathings are installed; all are effective vapor retarders.

Interior moisture can and does escape at the joints of these sheathings. When interior moisture is the cause, the deterioration occurs at the joints and outline each sheet. This is more common in poorly ventilated roofs. Sidings cut from the softer, less dense sapwood cut across the grain will absorb water very fast in large quantities. As the water is absorbed by the wood cells, the siding grows— putting pressure on the nails and often popping them. The pressure on the nail will depend on the amount of water absorbed, but can be as much as 100 pounds. Then as the sun dries the front of the siding, it tries to shrink back to its original size, but the back-still wet—is still expanded. The dry front and the wet back create the stresses that curl and warp the wood. Once it curls or warps it will not return to its original shape.

Flat-grained wood has a natural tendency to curl; wood with knots has a natural tendency to warp. Water absorption by the siding adds to the curling and warping. Also, most damage occurs on the sunny side of the house due to the faster drying cycle.

When wood siding is properly sealed or painted it will absorb very little water and will not swell and shrink. Properly painted means a minimum of two solid coats of a high quality coating applied when the wood is dry. This argues for applying the first coat of finish before the siding is installed and has a chance to get rained on.

When the wood is wet and expanded, the cells are full of water. If painted in this condition the paint or stain will not be absorbed or well bonded. As the siding dries, the water pulled out by the sun collects under the paint, causing bubbling and peeling. Also, because the wood shrinks as it dries, the coat of paint ends up larger than the board, and flaking results.

Soft, absorptive sidings need to be

Figure 1. Good quality wood siding easily lasts 50 years if protected from the weather by finishes and building overhangs.

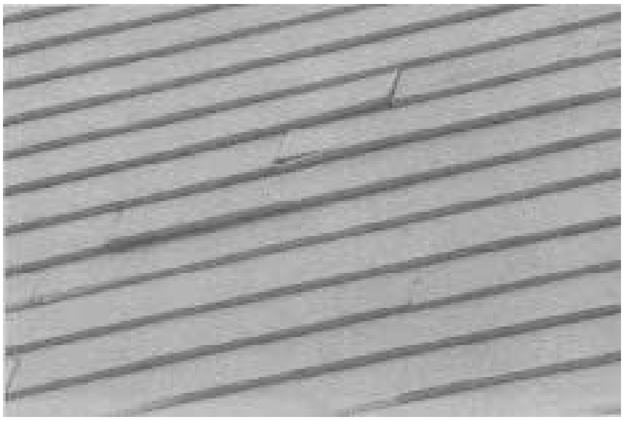


Figure 2. Due to inferior wood and inadequate finishing, some modern wood sidings fail in five years. Note splitting near end joints, and also cupping and twisting.

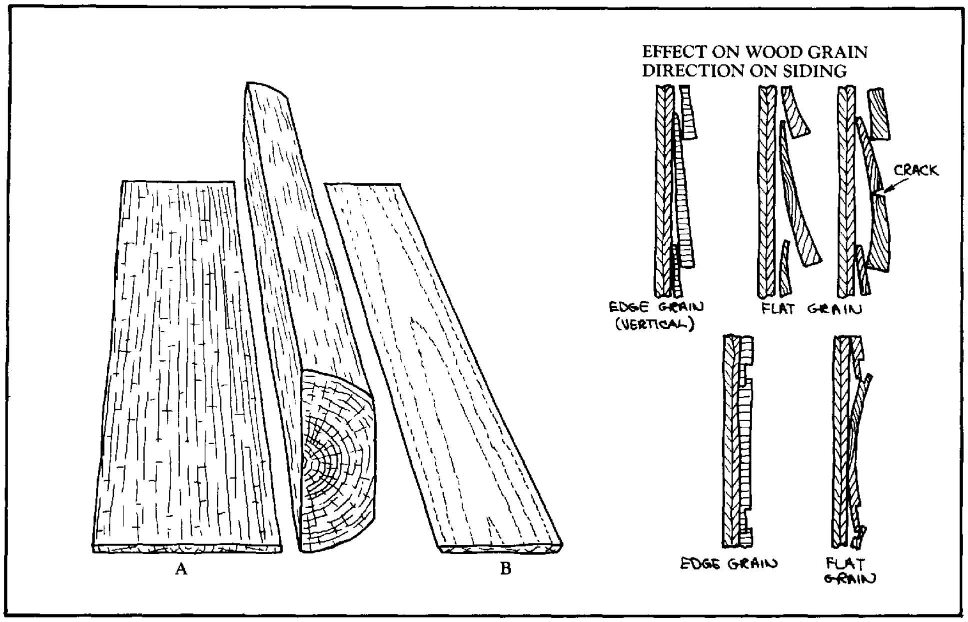


Figure 3. Edge-grained or vertical-grained lumber (A) has better dimensional stability and is less absorptive than flat-grained wood (B). Also, wood from the center of the tree, called heartwood is harder, denser, and less absorptive than the outer wood, called sapwood. To prevent cupping and curling (right) poorer grade sidings should be prefinished when dry.

As previously stated, wood absorbs much better through the ends. This makes the sealing of the ends, and use of proper corner boards, very important. The corner boards and trim boards should be thick enough to extend beyond the edges of the siding and protect them from rain.

I have seen new houses with wood, hardboard, and aluminum sidings, where the sheathing was wet and damaged due to water entering the top of the walls behind the siding. The water entered because of careless application of the trim boards and no roof overhang.

Some bevel siding fails because the water penetrates right through the thin exposed section of the clapboard damming up against the sheathing and being absorbed into the thicker lower section of the same clapboard. A 6-inch clapboard is not watertight 4 inches up unless properly sealed.

Wood sidings will last longer than most of us if care is taken in their application. Care includes roof overhangs on all four sides. These add years to the life of siding and the paint by helping to keep them dry. The deeper the overhang is, the better. Care also sealed on the back as well as the front. Cut ends must be sealed because rain is absorbed into the open end grain easier than through the cell sides (across the grain). Figure 4 shows what can happen when siding is not protected from water penetration. The addition roof shown was cut into perfectly good wood siding that was 30 years old. The cut ends were not sealed, however, and within a year, the siding was deteriorating.

In addition to being sealed properly, siding must also be nailed correctly to prevent curling and warping. Half-inch plywood has a nail pull-out strength of approximately 30 pounds, resinboards have a pull-out of about 20 pounds, and ¾-inch pine boards have a 65-pound pull-out. The diameter of the nail and the type of shank will affect pull-out strength.

Most siding producers recommend nailing into the studs a minimum of 1½ inches, which will take the worst-case pull-out force of about 100 pounds. The better the siding is sealed, the less the pull-out force will be due to less warping.

Warping and curling can also be restrained with proper nailing. The face of the stud is 1½ inches wide. To nail clapboards together at the ends requires nails ½ inch from the edges. Most will split unless predrilled. Many will split from the swelling of the wood (Figure 2). I have investigated failures where the nails were not long enough to penetrate the sheathing, resulting in curling and warping. Longer nails properly placed would have restrained the siding.

Half-inch plywood has a pull-out strength of about 30 pounds. Warping siding can exert up to 100 pounds.

Another cause of failure is uncoated or cheaply coated nails. The black stain around these nails is not all rust, it is also a chemical reaction that destroys the wood cell structure around the nails and eventually causes a siding failure (Figure 5).

Failures are also caused by ignoring the moisture content of the siding at the time of application. If very dry wood or hardboard siding is nailed tightly end to end, it will buckle when it absorbs moisture. The converse is also true. Nailed very wet, it will split and warp as it dries and shrinks.

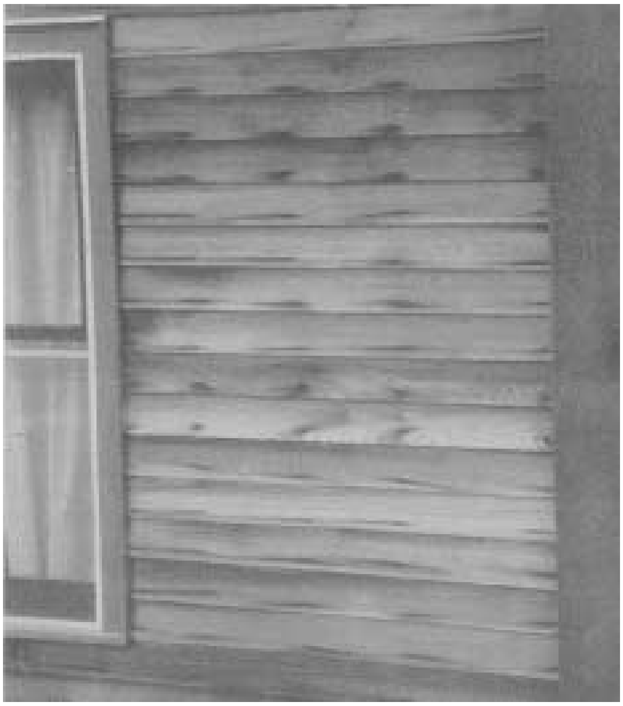


Figure 5. Uncoated or poorly coated nails look lousy when they bleed. The iron oxide also deteriorates the wood around the nail.

Figure 4. Here, siding that was perfectly good for 30 years is deteriorating from being cut into during renovations and left unsealed.

Figure 6. Gutters above might have prevented splashback from staining the siding where the lower shed roof connects.

includes proper nailing and painting, and using hard edge-grained wood. Use proper trim and corner boards, thick enough to protect the ends of the siding. Avoid details that splash rain up on the siding. This is very important on shed roofs going into a side wall (Figure 6). Use gutters and downspouts to protect from backsplash.

Wood Shingles

Water absorption, again, is the major cause of failure in wood shingles. They have the same characteristics as wood clapboards and must be properly sealed to prevent water absorption. Even older shingles fail if they are not maintained by periodic painting.

Figure 7 shows a five-year-old house that has been stained three times. The low-grade white-cedar shingles are badly curled and water is reaching the sheathing. Shortly after this photo was taken, it was vinyl-sided! Because the grain in shingles is vertical, it pulls dew and rain up by capillary action from the butt or bottom end. This area must be properly sealed.

Shingles exposed to the weather more than half of their length will curl unless they are dipped in a good paint or a good preservative *when dry.* We see many houses that have been renailed one inch or more up from the butt after they have curled. Many are split in the renailing. Usually on these houses we also see unpainted joints between the shingles indicating they were wet when painted, and they later dried and shrunk.

As with clapboards, water can penetrate a thin shingle and be absorbed in the back, causing curling. Shingles need the same care and attention used with wood clapboards. Don't overlook correct painting or sealing, proper nailing, using coated nails long enough to take the stresses and having overhangs to protect the paint and siding. Also consider the moisture content of the shingles at the time of application.

Figure 7. Despite being stained three times, these five-year-old white-cedar shingles are badly curled, and water is reaching the sheathing. Shortly after, the house was vinyl-sided.

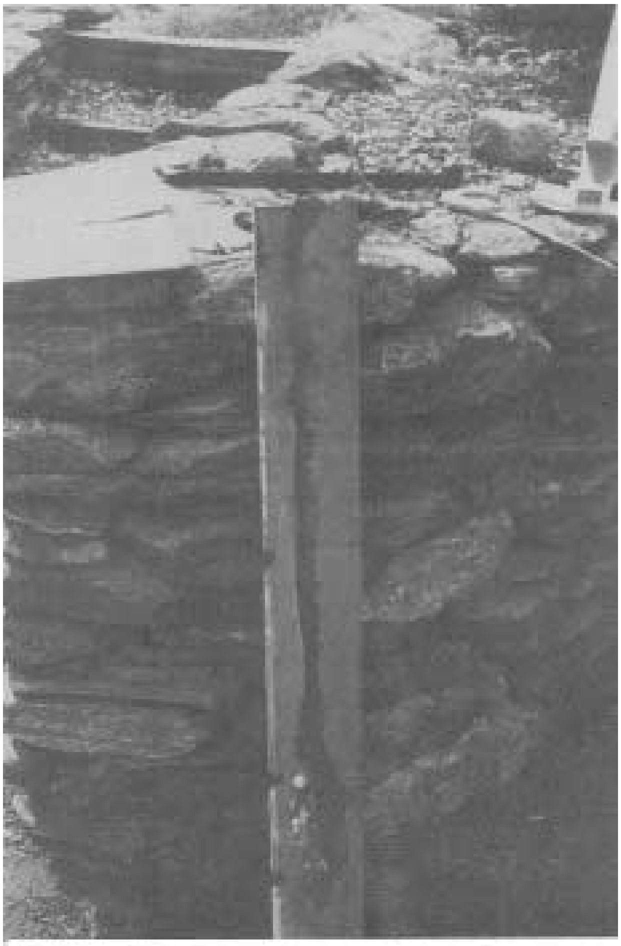
Unlike wood, hardboard does not have a cell structure and will absorb water with equal ease in any direction. Periodic painting is mandatory—more often than with wood siding. It is particularly vulnerable at the butt edges.

Hardboard Sidings

Some hardboard sidings have improved over the years with changes in technology. But the products vary in density and absorptivity from manufacturer to manufacturer.

Unlike wood, hardboard does not have a cell structure and will absorb water with equal ease in any direction. Hardboard also has greater expansion and contraction than wood due to both temperature and water absorption.

As with wood siding, the major cause of hardboard siding failures is exterior water absorption. Hardboard siding is very vulnerable at the butt (bottom exposed) edges. If not well painted here it will absorb rain and dew up several inches. This moisture will cause the



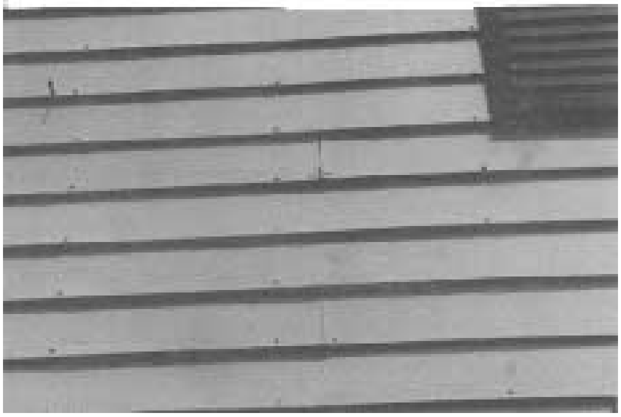


Figure 8. If unprotected, the bottom (butt) edge of hardboard siding will absorb rain and dew up several inches (center photo). Once wet, the material will expand over the nail heads (bottom photo) and sometimes delaminate.

material to expand, often over the nail heads (Figure 8), and delaminate, peeling off the outside layers.

The stresses generated can cause the siding to buckle, which can in turn actually push the studs out of alignment (Figure 9). The walls in this case moved easily due to another poor practice, face-nailing the studs through the plates rather than toe-nailing.

When you nail into wood you crush air pockets (cells). When you nail into hardboard, however, you displace solid material. Often the hardboard material displaced by the nail is forced up causing a dimple or anthill around each nail creating a wavy appearance. Water will enter at these bumps if not properly sealed. The cut edges of hardboard must also be watertight. The cornerboards and trim must be thick enough to extend beyond the siding. Figure 10 shows cornerboards that have not protected the siding and the siding is swelled and delaminating.

The methods of preventing water absorption are the same as with wood. But some areas are more critical due to hardboard's higher absorptivity and lack of cell structure. The sawn edges and the butt edges must be watertight.

Since hardboard expands and contracts at a greater rate than wood, also pay more attention to the temperature and moisture content at the rime of application. Tight end-to-end joints made in cold weather will cause buckling in hot weather. And if applied wet in hot weather, problems result in cold weather. Hardboard deterioration is not reversible. It is very important that this siding is always sealed from moisture (including the butt edge). Periodic painting is mandatory. It must be painted more often than wood sidings.

Vinyl

Some vinyl products have improved over the years due to changes in technology. Vinyl does not absorb water and is impervious to it. But vinyl has a much higher rate of expansion and contraction due to temperature than wood or hardboard. Vinyl's strength and durability are affected by temperature as well: The warmer it is, the softer it gets; the colder it is, the more brittle it gets. These characteristics must be taken into account when applying. Most vinyl siding failures occur due to careless nailing.

Vinyl siding is made with nailing slots and a lock joint at the top and a locking joint at the bottom. The bottom of each panel hooks to the top of the next lower panel. Vinyl should be hung on the nail, not pulled up tight (Figure 11). The nail must be in the center of the nailing slot.

The nails should be out about 1/8 inch to allow the siding to expand and contract as the temperature changes. The nail heads should be at least two times the width of the nailing slot to prevent pulling over the nail heads.

The nails have to be long enough to penetrate the sheathing under the old siding at least 3/4 inch or they may pull out. They should be no more than 18 inches apart and no more than 12 inches in high wind exposures. I have seen many houses with a large section of vinyl or aluminum missing due to the wind. This often occurs many years after it was applied. These blowoffs are caused by the wind getting behind the siding or by the negative pressure pulling or a combination of both. (Negative pressure is present on the downwind side of the building.)

When the siding is not pulled up correctly in the locking joints the wind can and does open it up. If the nails do not go into the sheathing but only into the old siding the wind can pull them out. If the nails are spaced too far apart, the nailing slots will elongate or break and pull over the nails. When the nails are driven too tight, the siding cannot move and will "oilcan" (buckle), and it may break the nailing slot. Similarly; the nailing slot can break if nails are placed at the ends of the nailing slots, rather than the center. These last two problems are often at fault when random panels hang off the house.

The expansion and strength of vinyl are affected by the color— that is, the darker the color, the more heat it will absorb, the more it will expand, and the softer it will get. The installer must consider temperature at the time of application to avoid problems later at the corners and window trim due to the thermal movement. Color fading has also been a problem: The darker the colors the quicker they fade. The more sun exposure, the bigger the problem is. Light colors also fade but they are not as noticeable.

Both vinyl and aluminum panels are impervious to water; but the joints between the panels are not. Due to the openings at joints and ends, and the nailing method, these sidings do not form a vapor barrier on the exterior of the structure. Wind moves the panels allowing air to flow behind them. A driving rain will sometimes also penetrate, but rarely enough to create any wood rot problems when used over old siding. When using vinyl or aluminum on new construction, a water barrier such as felt paper, perforated foil, or any other underlayment should be used over the sheathing behind the siding. Finally, always use aluminum nails with vinyl siding. Iron nails may rust and stain the siding.

Aluminum

Aluminum siding expands and contracts due to temperature changes slightly less than vinyl. It is also stronger than vinyl. Aluminum should be nailed 24 inches on-center maximum, 16 inches or less in high wind exposures.

The panels interlock like vinyl except that aluminum is pulled up and the nail holds it up, while vinyl is hung on the nail. The nails with both sidings must be straight (Figure 12).

The causes of failures are the same as with vinyl. The nailing considerations, except for those just mentioned, are the same. As with vinyl, color fading is a problem. While vinyl colors run all the way through, aluminum colors are surface-applied and have been known to peel, although this is a rare occurrence.

Aluminum coil stock is used for trim with both vinyl and aluminum sidings. Vinyl, due to its characteristics, is not practical to form on the job. The major problem with coil stock is that it is often face-nailed, not slotted. It cannot move with temperature changes and it buckles. The length of the sections and the temperature at application must be considered. Jobs done in cold weather may fail on a hot sunny summer day. The opposite is also true.

Avoid Callbacks

With all types of siding, 99 percent of the failures can be prevented with care, planning, and an understanding of the materials used. Questions are cheap, callbacks are expensive. ■

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Figure 9. Wet, expanded hardboard siding buckled this stud wall creating a wavy exterior and cracks and gaps on the interior.

Figure 10. Hardboard vertical edges will swell and delaminate if not protected by wide enough cornerboards.

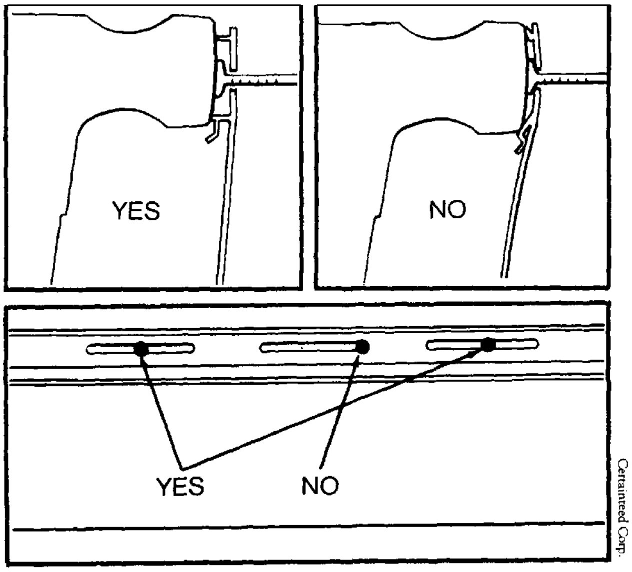

Figure 11. To allow for thermal movement, vinyl should be nailed loosely (top) and the nails should be centered in the slots (above).

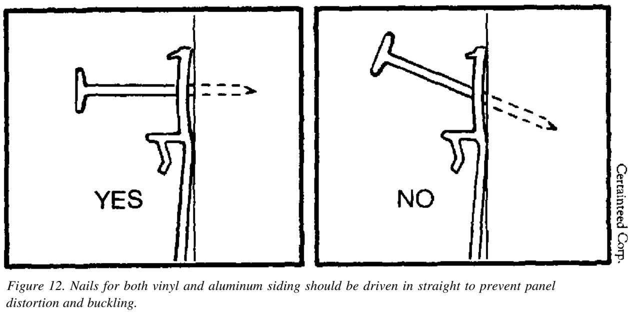

Figure 12. Nails for both vinyl and aluminum siding should be driven in straight to prevent panel distortion and buckling.