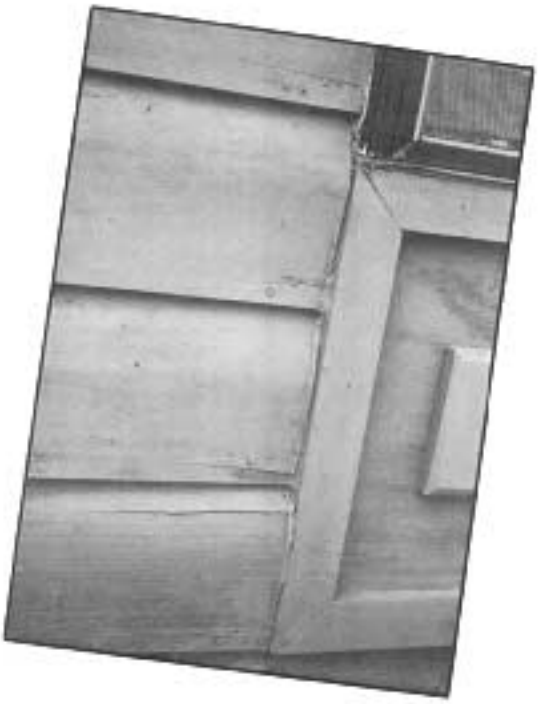


photos courtesy John Russo

Wood Siding Over Foam: An Update

Split siding, buckled boards and pulled nails can be avoided...maybe

Professor John Russo, Construction Engineering faculty member at Iowa State University in Ames, has served as a consultant on several cases involving the installation of wood siding over foam. We asked him to update us on the problem because he is one of the most knowledgeable and objective individuals in the U.S. concerning the issue. This report is based on Dr. Russo's three years of study and involvement.

by John Russo

Rigid plastic foam was developed in the 1930s as a flotation material, but it has found many other uses since. One recent and popular application is its use as an exterior sheathing material, primarily in the residential-construction market, because it provides good insulation at an attractive price.

It became a very popular material as energy costs increased rapidly through the late 1970s and into the 1980s. As early as 1976, however, some problems were noted with horizontal wood and hardboard applied over foam. Hardboard siding failed between nailing points, primarily because of expansion, which caused the boards to bow out. Wood siding, primarily redwood, failed because of cupping, which caused nails to be pulled out and boards to split.

Since 1976, other types of wood siding, such as cedar, Philippine mahogany, and cypress, have experienced similar problems. The vast majority of serious complaints have involved horizontal siding as opposed to four-foot-wide vertical siding.

What's the Cause?

Manufacturers of rigid plastic foams and wood sidings recognize that problems exist and are studying the situations involved. Their conclusions to date seem to identify installation deficiencies is the primary culprit. They also point out that failures do not occur in all installations, and that some failures have occurred over the years no matter *what* sheathing material was used.

While each of these conclusions has some merit, the fact remains that serious failures have occurred and are occurring throughout the United States. In many cases, installation is not a factor; nail type, length, location and installation are all appropriate.

In addition, while some minor failures have occurred with other types of sheathing for many years, failures of siding over rigid plastic foam sheathing are more numerous and much more severe. In some cases, the exterior of the structure has been totally destroyed.

The failure characteristics follow a fairly common pattern, however. For all types of siding, failure is most severe on the east and south exposures of a building. Fewer problems exist on the west, and almost none on the north exposure.

For hardboard siding, the failures occur between the nails as the fibers expand and the siding buckles, creating a bowed-out "wave" pattern between each nailing point. Wood sidings generally cup and split—severely enough at times to cause siding boards to actually fall off.

The overall problem cannot be attributed to any single cause. Several factors—including the characteristics of rigid plastic foam itself, the wood siding involved, the use of sealants, the type of nails and the method of installation—all seem to play a role.

The use of redwood siding and rigid plastic foam has spelled disaster for the owner of this home, which has been plagued with pulled-out nails and split and cupped siding. As evidenced by the double nails, some renailing has taken place to keep the boards in place.

Characteristics of Rigid Plastic Foams

The main characteristics of rigid plastic foams—their lightweight quality, softness and resistance to heat and moisture—make the material ideal for thermal insulation, but these same characteristics can cause problems when foams are used as a sheathing material under some wood sidings.

The softness of the foams increases the likelihood that the expansion and contraction of the wood, as well as the nailing of the siding, will dent the sheathing slightly and loosen the connection between the sheathing and the foam. This leaves larger gaps in which moisture can collect.

In addition, the foam provides less support for the nails. Thus, as the siding expands and contracts longitudinally, the nails loosen as they move back and forth.

The foam's resistance to heat and moisture also creates a moisture buildup between the foam and the siding. In fact, this moisture buildup on the back of the siding is considered the major contributor to the problem.

A series of wet and dry cycles, during which the moisture within the wood as well as from the air is driven to the back side of the siding, causes the wood to deform little by little with each cycle. At the same time that this moisture is being concentrated on the back side, the front of the siding is being dried by exposure to the sun and the air.

The more severe failures on east and south exposures result partially from the increased drying of the siding exterior by the sun, and also partially from the heat of the early morning sun, which heats the space between the sheathing and the siding. This causes dew points to be reached and thus moisture to collect on the back of the siding. Again, the foam's inability to give or take heat or moisture intensifies the situation.

Fiber or plywood sheathing, on the other hand, will absorb and "breathe" both heat and moisture, which tempers the effects of both heat and moisture on the siding.

Type & Size of Wood Siding

The type and size of the wood siding installed also affects the seriousness of the problem at the foam and siding interface.

Wood sidings that are thicker (greater than ½ inch) and narrower (six inches or less wide), for example, better resist the wet-dry cycles and the resulting cupping failures. And shorter boards (that is, less than six feet long) show less longitudinal expansion and contraction and thus cause less stress on nails.

In addition, the point at which a board was cut from a particular log may affect its tendency to shrink nonuniformly. Tangential cuts and boards cut from the so-called "juvenile" wood near the center of the tree can cause more serious shrinkage.

Finally, of course, wood siding should be at a stable moisture content before installation. This always is a major factor to consider for wood siding, whether it is installed over foam sheathing or not.

Four-foot-wide *vertical* sheet siding experiences fewer problems—and problems of a less serious nature—than horizontal sidings. Since sheet siding tends to be installed very close to the sheathing, few gaps exist in which moisture can accumulate. Likewise, better overall nailing support is spread throughout each sheet.

For hardboard siding, the most critical material-related factor appears to be its density. The most dense sidings tend to resist moisture breakdown better than the less dense ones.

Color & Sealants

Color and sealants also play a role in the problem. Darker colors attract more heat into siding and intensify the problem. The use of a lighter color can create a considerable difference in temperature.

It now is recommended that wood sidings be treated with sealants on all sides—but especially on the back—before installation. A sealant certainly will make any siding more resistant to moisture. Over time, however, sealants also will fail under continued intense heat and wet-dry cycling.

Proper sealing may be more important for hardboard sidings than for wood sidings, as unprotected hardboard is more vulnerable to moisture damage than unprotected wood.

Manufacturers recommend the use of galvanized or other types of nails with improved grip and the use of nails with a blunt point for wood siding. In addition, a 1½-inch penetration into the wood stud now is considered critical.

Nail Type & Size

The type and size of nails also can have an impact on the problem. Manufacturers recommend the use of galvanized or other types of nails with improved grip and the use of nails with a blunt point for wood siding.

In addition, a 1½-inch penetration into the wood stud now is considered critical. For hardboard, a needle-point nail will reduce ripping as it passes through the back of the siding. While secure nailing is important for hardboard siding, it is not as likely as wood siding to fail at nailing points, so it is not as critical an item.

Method of Installation

The actual installation of wood siding is perhaps the most obvious factor. Close adherence to manufacturers' recommendations certainly can reduce the severity of the problem. But following all installation precautions will not necessarily guarantee a successful installation: continued heat and wet-dry cycles still may cause the siding to fail.

Recommendations

To minimize the chance of failure when installing wood siding over foam, follow all of these recommendations:

Wood sidings that are at least ½ inch thick and no more than six inches wide better resist the wet-dry cycles and the resulting cupping failures. And boards that are less than six feet long cause less stress on nails.

- Drive nails carefully to avoid denting the foam;
- Use thicker, narrower and shorter siding pieces;
- Pay attention to the proper storage and stabilized moisture content of the wood;
- Select the proper type and size of nails;
- Apply sealants;
- Choose light-colored stains and paints;
- Choose proper locations for driving your nails; and
- Take care to achieve proper overall installation.

These recommendations, of course, treat the symptoms—moisture accumulation on the back of the siding—not the problem itself. The ultimate solution involves creating and venting a space between the sheathing and the siding *in addition to* following the above recommendations.

Furring strips to separate the foam sheathing and siding will allow the space to vent itself of heat and moisture and will reduce the heat and wet-dry cycles considerably. The space must be open at the top and bottom edge of the siding (insect screens are advised) to allow full movement of air.

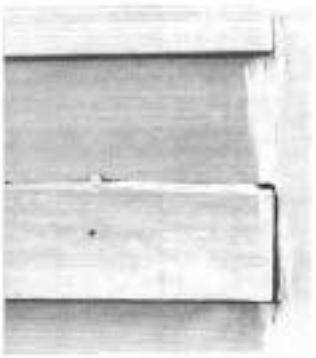
While much of what is presented in this article is not necessarily new, it does substantiate what has been reported in *NEB* in the past three years. It also verifies that the problems continue.

None of the individual products involved in the problem have been found defective or nonfunctional in any way. All stand by themselves as capable building materials, but when they are used together, their compatibility certainly can be questioned.

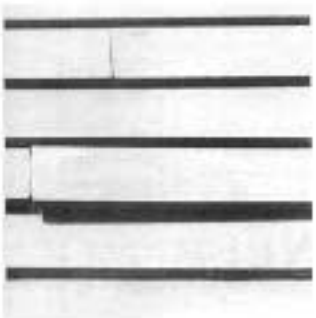
Although manufacturers are studying the issue, they are unwilling to admit that *their* products have anything to do with the problem. This raises the question of whether manufacturers have an obligation to make certain that their products are compatible with other products with which they come into contact. This is especially important for new products that are to be used with existing, long-standing products.

The lack of responsible action by manufacturers places the consequences directly on the consumer, the builder and the lumberyard. Information for builders, architects and owners concerning this problem currently is very sparse. The overall recommendation in the *NEB* article of July 1983 remains the same: "Hesitate before you insulate."

Following all the recommendations to ensure the successful installation of wood siding over rigid plastic foam sheathing adds considerably to the cost of a building's exterior finish. However, the cost in money and time when a failure occurs is much greater. When measuring the value of improved thermal insulation, therefore, builders and consumers should make their calculations with all the facts before them. ■



Another home with foam-related siding problems. In an effort to improve the appearance of the home's exterior, the edges have been sanded down where the boards have cupped and pulled away (above photo, right) in preparation for repainting.



photos courtesy Eric Canton