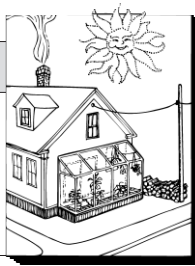


Housewrap and Air Leakage: New Studies

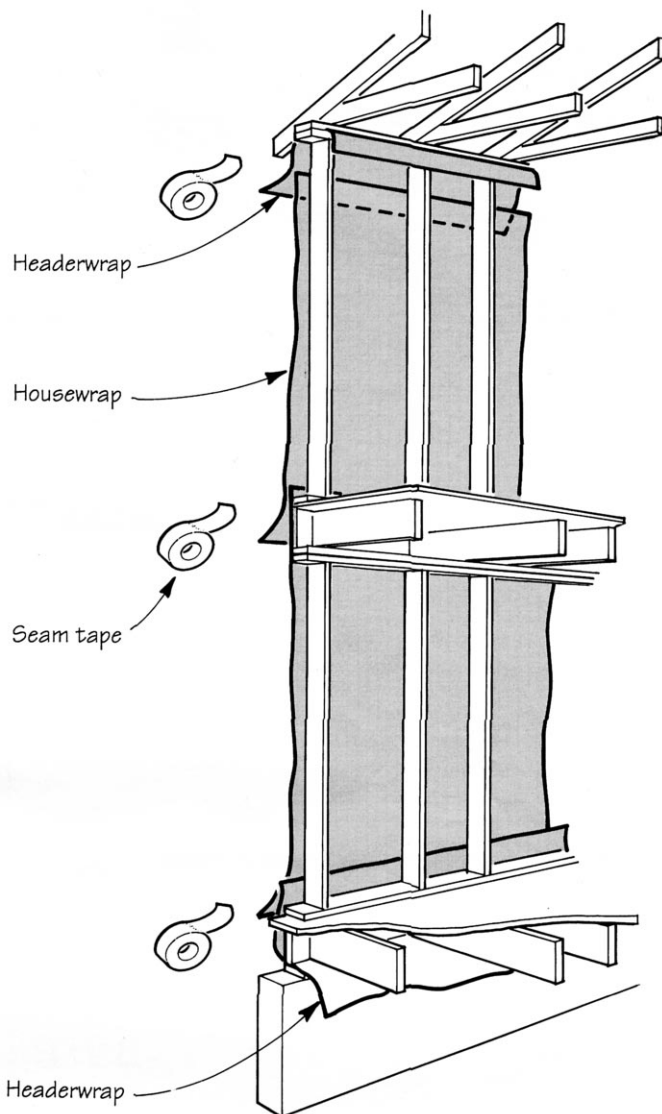
by Bruce Sullivan



If you read advertising, you may get the idea that a housewrap is all you need to protect a building from air leaks. Building scientists, on the other hand, have always been skeptical of the product's effectiveness as an air barrier. Unfortunately, both sides have been hampered by the fact that the energy-savings benefits of housewrap have never been accurately quantified. DuPont tried

to remedy the situation by sponsoring two research projects that aimed to nail down the value of its Tyvek brand and a half-dozen similar products. While the results indicate that a properly installed housewrap can bring real energy benefits, they also confirm most building scientists' commonsense evaluations (*Focus on Energy*, 10/91).

Installing Headerwrap



Field Tests

The first DuPont project involved a group of new homes being built in Charlottesville, Va. At the time of this writing, 18 houses have been tested, all of them equally sized, two-story Colonials. They were all built by the same contractor. Two sets of houses had identical floor plans. David Jones, the research engineer who conducted the tests, says that he hopes to test several more houses, so the following results are preliminary.

The houses fall into three groups. In the "control group" no housewrap or building paper was used. The "housewrap-only group" received the typical housewrap treatment — two 9-foot sheets rolled over the outside walls with no tape over the joints. The "full-wrap group" (see Figure 1) received top-to-bottom treatment in which strips of Tyvek Headerwrap were taped to the main sheets, and all joints were taped.

Headerwrap is housewrap cut into 18-inch rolls. It's designed to seal the exterior walls where they meet the roof and foundation. Because Headerwrap is sandwiched between the mudsill and the first floor band joist, as well as at the eaves between the two top plates, it must be installed during the framing stage.

The insulation contractor sealed the rough openings of all windows and doors. No special effort was made to caulk or seal other building penetrations.

A blower door was used to estimate the natural air leakage in air changes per hour, or ACH. As Figure 2 (next page) illustrates, doing nothing (the control group) yielded an air leakage rate of 0.52 ACH. Installing the 9-foot-wide sheets of untaped housewrap reduced it to 0.45 ACH. The full-wrap treatment — including headerwrap strips and taped joints — cut infiltration to 0.37 ACH. Although the sample size is too small to be "statistically significant," I'll venture some observations based on the results.

- The first is that housewrap helps reduce air leakage through outside walls when compared with doing nothing.
- The second is that if you want to get the most out of a housewrap, you'll need to invest considerable time installing the Headerwrap and taping the joints. Unfortunately, this is far from standard practice.
- The most important observation is that while housewrap is a perfectly good material for blocking air, it does not form a continuous air barrier of the type used in energy-efficient homes. Its typical location on the outside of the exterior walls leaves much of the house "unwrapped." Even

Figure 1. Both studies showed that if you want real benefits out of a housewrap, you'll have to take the time to install the Headerwrap and tape the seams. Unfortunately, most builders don't bother with these extra steps.

Air Leakage with Housewrap

Group	Air Changes per Hour	No. of Houses in Sample	Heating Cost*
Control	0.52	5	\$137
Housewrap only	0.45	6	\$118
Full-wrap	0.37	7	\$97

*Estimated annual cost to run an 80% efficient gas furnace in Boston, Mass., which has 5,634 heating degree-days.

Figure 2. This table illustrates the effect of using housewrap, both by itself and with Headerwrap. The results were obtained using a blower door.

the “full wrap” approach ignores leaks in ceilings, where much air leakage tends to occur. That means that air sealing is still needed on the inside.

Lab Tests

These conclusions were borne out by separate lab tests conducted at Holometrix Inc., an independent laboratory, using standard testing protocols. Researchers constructed an 8x9-foot wall sample that included wood studs and a rim joist. The wall was sheathed with 1/2-inch rigid insulation. There was no siding.

The aim was to test insulation performance and air leakage under various conditions. The researchers installed the wall assembly in a calibrated hot box that let them control the temperature and vary the air pressure to simulate wind blowing against the wall. After testing the base wall, each of seven housewrap products were added, one at a time. The walls were tested at various wind pressures using the typical treatment as well as with the full-wrap treatment. Variations on the base wall configu-

ration were then tested in the same way: One replaced the square-edged insulated sheathing with shiplap sheathing; another was air-sealed using the Airtight Drywall Approach, or ADA. Researchers then tested a final variation in which they replaced the housewrap with 15-lb. felt. The results included the following:

- Housewraps reduced leakage through the wall assembly by 40% to 93% when compared with walls without housewrap.
- The biggest leaks occurred between the bottom plate and subfloor. This implies that Headerwrap is probably the most valuable housewrap product.
- Air also leaked through the sheathing joints and around electrical boxes. Again, this confirmed the need for a continuous air barrier.
- The need for a continuous air barrier was confirmed by the fact that wind had very little effect on the ADA wall. In fact the ADA wall without housewrap performed better than the base wall with housewrap in all but two cases.
- The most significant finding was

the effect of wind penetration into wall insulation, called “wind washing”. With the interior surface of the wall sealed airtight, a 10-mph wind lowered the wall’s measured R-value from 14.1 to 11.5, due apparently to wind washing. When Tyvek housewrap was added, the R-value was restored to R-13.9.

The problem is that most builders don’t tape the seams, let alone install the Headerwrap strips. Without these extra steps, housewrap isn’t all that effective. A similar amount of cost and effort on the inside of the building with a caulking gun and a few cans of foam (to seal around windows, doors and other penetrations) could tighten the building as well or better. If you want to build a truly low-leakage house, you’ll be better served by putting the air barrier inside the house using the poly wrap method or the Airtight Drywall Approach.

In other words, there are good reasons to buy housewrap, such as protection against wind washing. But don’t think that housewrap alone will make a house “energy efficient”. “The whole house is a system that has to work together,” says Jones. “No one product can be expected to do everything.” Exactly. Air sealing is a technique, not a product. Just as a breakfast cereal can claim to be an “important part” of a balanced diet, housewraps are just one part of a complete air-sealing system. ■

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