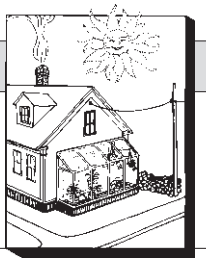

Is Housewrap A Good Investment?

by J.D. Ned Nisson

Once upon a time, a long time ago, a team of Dupont think-tankers pondered new uses for their spun-bonded sheet plastic known as Tyvek. Developed in the 1950s and first used as a bottom covering to hold the springs in furniture, Tyvek's greatest success at that time had been in envelopes, especially for overnight couriers like Federal Express. In its quest for new markets, Dupont began to explore other applications for Tyvek. What else would it be good for?

Why not use it to wrap houses? Since, unlike other sheet materials used in construction, Tyvek is permeable to water vapor, it would allow walls to "breathe" moisture while controlling air leakage. The idea seemed golden. And it was.

Tyvek brand housewrap dominated the new market and its familiar logo became a hallmark of energy-efficient construction. It wasn't long, however, before competition arrived in the marketplace — Parsec, Barricade, Typar, Amowrap and others.

Do Houses Need Housewrap?

What is remarkable about the phenomenal success of housewrap is that its energy-saving benefits have never been accurately documented or quantified. The only attempt I know of was a retrofit study performed by the NAHB Research Foundation (now called the National Research Center) for Dupont in 1982. In that test, the natural infiltration rate of a house was reduced between 1% and 5% after retrofitting with Tyvek.

The only other research data about housewrap come from laboratory studies on test panels and material samples. Those tests show that if you take a leaky wall panel and cover it with housewrap, the measured air leakage decreases considerably. No surprise there. They also show that taping the sheathing joints and window edges works just as well as wrapping the whole wall.

With this sparse background of research results, builders are faced with a few pointed questions: Is the added cost of housewrap over standard felt paper justified? Are some housewrap products more effective than others? How does one decide which to use? To answer these questions we need to combine some basic building science with a good dose of common sense.

Housewrap has two potential benefits with respect to energy performance. The first and most obvious is that it can reduce air infiltration into and out of a building. The second and more subtle benefit is that it can keep wind, or air intrusion, out of the wall insulation. Sometimes referred to as "wind washing," air intrusion causes loss of effective R-value even if the air doesn't pass completely through the insulation into the house. A third related benefit of housewrap is that it helps prevent condensation in the wall by keeping indoor air from leaking out through the walls (see Figure 1).

Unfortunately, these energy-saving benefits are difficult to quantify and may vary tremendously depending on type and quality of construction. This makes it nearly impossible to pinpoint the overall value and cost-effectiveness of housewrap for "typical" new construction. We can, however, make a few generalizations about the potential benefits of housewrap for specific applications.

On a leaky house in a cold climate, housewrap can probably earn its keep. But on tighter houses, or in more moderate climates, it's harder to justify based on energy savings alone.

Header Wrap Makes Sense

If there is one area where housewrap makes sense, it is at the band joist area. Studies clearly show that the floor-wall and floor-ceiling junctures are areas of major air leakage in platform-framed houses. Canadian researchers recognized this during the early days of "superinsulation" and devised techniques to wrap polyethylene around the band joist to keep it continuous between the first and second floors. However, that practice proved to be a nuisance on the job site, and in some cases created a "cold-side" vapor retarder.

A similar, but easier, technique *is* possible with housewrap. Since it does not trap water vapor, housewrap can be wrapped around the outside of joists without concern over condensation (Figure 2). Dupont sells special 3-foot-wide "Headerwrap" intended for this application. On two-story houses, the second-story floor joists are either wrapped or simply covered from the outside.

Header wrap definitely works but it is not always cost effective. If the joist area is already sealed using other techniques such as gaskets, caulk, or tape (as with the "airtight drywall approach"), the header wrap would be redundant and probably provide no benefit.

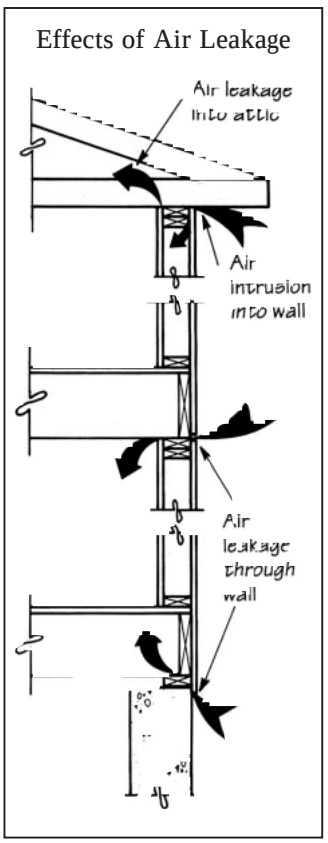

Figure 1. *Without a good air infiltration barrier, air leakage can degrade building thermal performance two ways: (1) air that passes into the conditioned space adds to the heating and cooling load; and (2) air intrusion into the insulation, even if it does not pass through the wall, can lower the effective R-value of the insulation.*

Top Plate Wrap

Wrapping top plates with housewrap creates an air barrier bridge between the exterior sheathing and ceiling gypsum board. Assuming that the ceiling gypsum board is properly taped and sealed to the wall gypsum board, this housewrap application provides no reduction in air infiltration. It does, however, reduce the potential for air intrusion from outdoors, and, perhaps more important, it also reduces air movement upward from the wall cavity into the attic space.

Wall Wrap Harder to Justify

Assuming that the joist areas and top plates are well-sealed against air leakage, the $300 question is whether it makes sense to wrap the rest of the wall with housewrap. In general, the answer is probably not — although there are exceptions.

The main value of wall wrap, assuming the joist area is already sealed, is to prevent air leakage around the sheathing, especially at

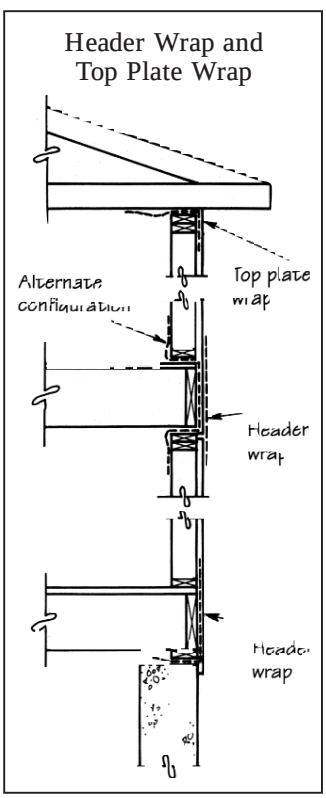

Figure 2. *Header wrap, when properly applied, should reduce the largest air leak in a platform-framed house. This is cost-effective in any climate unless the joist system is otherwise sealed using gaskets or adhesives.*

Top plate wrap is probably less effective in that it doesn't cut infiltration into the house. It does, however, reduce air leakage from the wall cavity into the attic.

the corners and around windows and doors where the widest gaps are likely to be. If there are significant gaps between sheathing and framing and if the house is located in a cold, windy climate, then housewrap might make sense to control air intrusion. Under more moderate climate conditions, however, there is no demonstrated justification for wall wrap, especially if the sheathing is tightly applied.

Air leakage around windows is also a potential problem, but housewrap doesn't do much to help. The main air leakage pathway is between the rough opening in the framing and the installed window. Since housewrap is typically wrapped around the rough opening, it does nothing to seal that leakage pathway. It does, however, cover the edge of the rough opening, preventing air intrusion into the wall insulation.

The Bottom Line

Housewrap is a quick, easy, and relatively inexpensive way to install an air barrier on a house. For conventional construction in which no special effort is made to prevent air leakage, header wrap and top plate wrap should always save enough energy to justify its extra cost. Wall wrap, however, is probably not cost-effective except over loosely applied sheathing.

For houses built with well-sealed air barriers (using sealed polyethylene, gaskets, or adhesive) and tight exterior sheathing, housewrap in any configuration is probably not worth the extra cost based on the energy it saves.

Which Brand Is Best?

Recent housewrap promotions have used the term *air penetration resistance* to rate competing products. Though not a precisely defined engineering term, air penetration resistance is analogous to R-value for insulation; it is determined by applying pressure to a sample of housewrap and measuring the rate at which air leaks through. The slower the air leakage, the higher the air resistance. When tested this way, Tyvek has a much higher air resistance than its two main competitors — Typar and Barricade.

While this sounds impressive, it's important to keep in mind that the air resistance of all three products is extremely good and the absolute difference in air leakage between products is insignificant. Using an insulation analogy, it would be like comparing R-100 walls with R-800 walls. The R-800 would be eight times better, but the R-100 is already so good that the net savings from using the "better" wall would only be pennies a year.

This point is best illustrated by comparing the predicted air leakage through a one-square-foot hole covered with each type of housewrap when exposed to a 20-mph wind. (A "typical" new house, built without any special air sealing techniques, has a total leakage area between 1 and 2 square feet.) The leakiest housewrap allowed only 0.5 cfm total air leakage — hardly anything to lose sleep over — while the tightest allowed about 0.05. The absolute difference between the two in terms of energy savings or comfort is trivial.

Regarding their effectiveness in stopping air leakage, there is no practical difference in the performance of any of the major brands of housewrap. ■

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