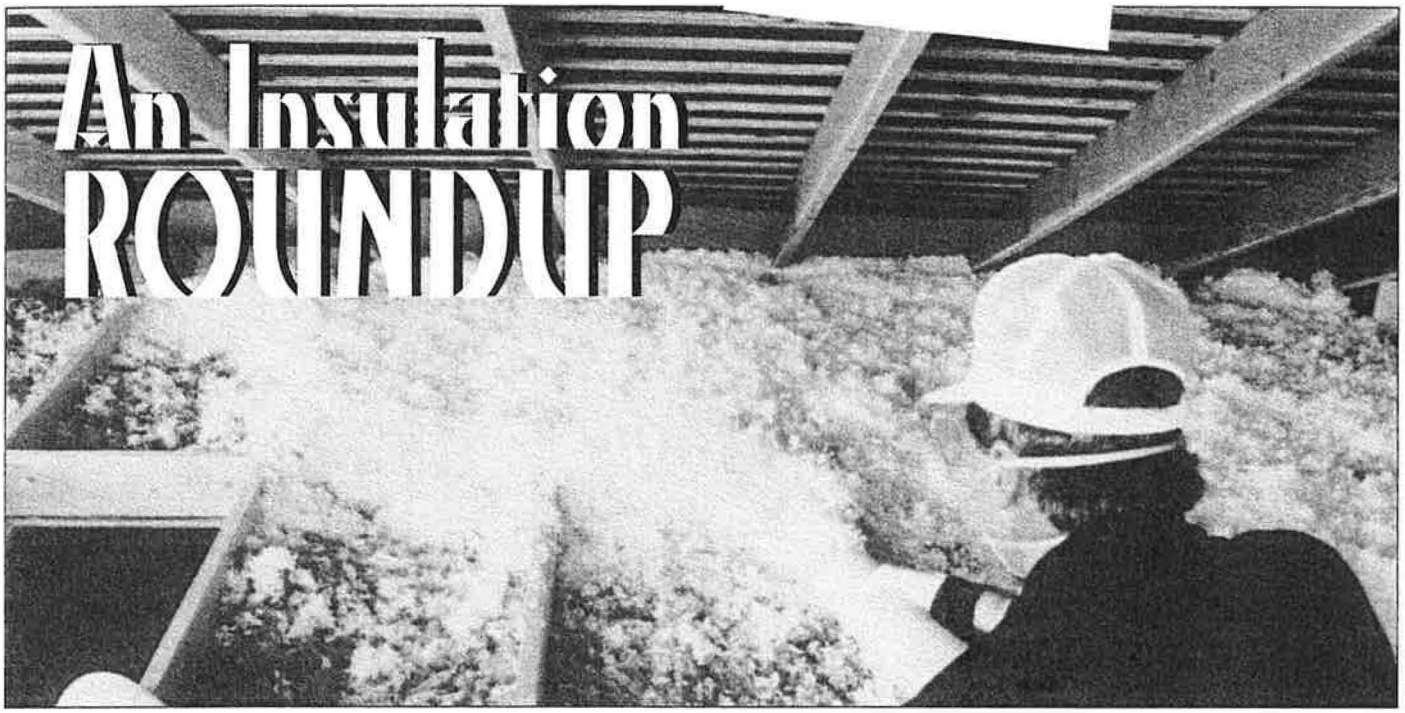
An Insulation ROUNDUP



HOME ENERGY

by David Kaufman

In the confusing world of insulation materials, telling the difference between fraudulent claims and the real thing is not easy.

In the last two decades there has been tremendous growth in the variety of insulation products for typical stud-wall construction, and in our understanding of these products. The underperformance problems that arise from typical installations of either fiberglass or cellulose have become widely known, as have methods to avoid these problems. Simultaneously, state-of-the-art cavity insulation products have emerged that can improve insulating performance substantially. However, this growth in insulation choices has been accompanied by a boost in fraudulent and near-fraudulent claims, such as that reflective foils are a good alternative to wall or ceiling insulation. In the following review, I try to separate the wheat from the chaff.

Fiberglass

Fiberglass insulation is the workhorse of the industry and the product most associated with the word "insulation." When precisely installed, the R-value, or resistance to heat flow, ranges from R-3.2 to R-4/inch for both batts and loose-fill installations. Properly installed in walls, fiberglass works well. However, if it is installed with any voids whatsoever, performance can decrease markedly.

One study with unfaced fiberglass batts installed in an irregularly shaped wall documented a 25% decline in R-value for a 6-inch cavity, and a 40% decline for a 10-inch cavity with a 50°F temperature difference between indoors and outdoors. At a 100°F temperature differential, the decline was 54% and 65%, respectively. In other words, in colder weather, the insulation's thermal resistance declined, because of the effect of gaps on convection. Even very small gaps of 0.5%–2% can decrease effectiveness.

It is critical that fiberglass completely fill any cavity in which it is installed. Adding rigid exterior insulation or building a double wall so that there are always at least two layers of insulation can ameliorate the effect of minor imperfections, and can also reduce thermal bridging through the wood studs. (Steel studs should not be employed for exterior walls because of poor energy performance, unless they are used with thermal breaks).

Fiberglass batts are available in different densities. For instance, 3.5-inch batts come in R-11, R-13, and R-15. Many R-19 batts are thicker than 6 inches. When installed in a 5.5-inch cavity, these batts provide only R-17.5. (Squish a R-19 batt into a 3½-inch cavity and you get R-15.) In a recent study conducted by Oak Ridge National Laboratory the measured whole-wall performance in a 2 x 6 wall with R-19 batts was only R-13.2 (see "Calculating Whole Wall R-values On the Net," *HE* Nov/Dec '99, p. 22). This was caused primarily by conduction through the wood framing and to a lesser degree by compression of the batts. Thermal bridging through framing will degrade the performance of any cavity insulation unless thermal breaks are properly specified and installed.

Many homeowners want to add insulation to existing batts in their attics. Blowing a layer of cellulose is probably the best strategy. Elsewhere, if installed perfectly, or in a redundantly insulated wall, batts on their own do work well. Large installation contractors can some-

times install fiberglass for even less than a small builder can buy it.

Cellulose

Cellulose has grown into an excellent insulation product when installed correcly. Cellulose can be installed in existing walls at a density insufficient to offset settling over time. A decade ago only densities of 3.5–4.4 lb/ft^3 (depending on test accuracy) were adequate to ensure that gaps do not form over time. New technology has produced more resilient cellulose, and much lower non-settling densities are now plausible, according to Dave Yarborough of Tennessee Technical College.

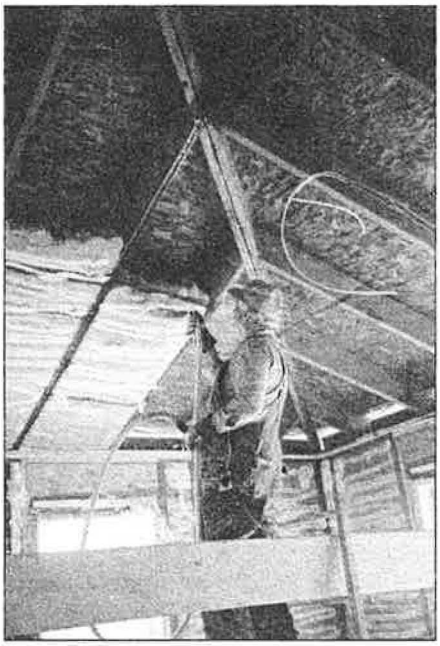
However, significant voids are often left when cellulose is blown into old walls that have undetected blocks or other irregularities. If installed at the proper density, cellulose will perform well and will also substantially decrease air leakage in an old house. "Dense-packing" is an installation system that uses a tube inserted into the cavity to blow the material and also to locate any hidden blockages. I always recommend using a contractor familiar with this method for retrofits, as it is superior in terms of reducing air leakage and enssuring full insulation of the walls.

Blown into an attic, substantial settling is common (see "Cheating—The Insulation Industry's Dirty Secret," p. 24). A written guarantee of settled depth, with markers installed to facilitate checking by the homeowner, should be specified.

In the Par-Pac system, cellulose is blown through a tough, cross-linked polyethylene material. This provides a good vapor barrier and makes it possible to visually confirm the absence of voids. A less expensive alternative is Regal Wall, a fishnet rather than polyethylene material, which is not a vapor barrier.

Spraying cellulose into open cavities with an adhesive binder is an attractive option. A small amount of water is typically added to activate the adhesive. Large manufacturers of cellulose increasingly offer this option. Nu-Wool is one of several good products. The cost and availability will depend on the proximity of an installation contractor.

Spraying cellulose with water added is also popular. This method can be messy, and problems can arise if guidelines for installation are not followed. It is especially important to follow the guidelines for maximum moisture content before drywall can be installed. Allowing sufficient drying can disrupt construction, and judgment on the proper degree of drying must be accurate. However, performance is excellent if these drawbacks are not a barrier to use.



PALMER INDUSTRIES INC.

A contractor is insulating this ceiling with Airkrete.

Blown-in-Blanket

The Blown-in-Blanket (BIB) system was developed as a way to create form-fitted batts within wall cavities, avoiding voids, settling, and the imperfect filling of irregularly shaped cavities. A machine mixes the loose insulation with a latex binder and sprays the material into a cavity covered with netting. Originally this system was used with both cellulose and various forms of fiberglass. The company now allows only the fiberglass products Optima, Insul-Safe IV, and Climate Pro to be certified as a BIB system. Installed at densities two to three times greater than fiberglass batts, the BIB system provides R-23 for a 5.5-inch cavity, or about R-4.2/inch. The catch is expense, but installed performance is superior. The BIB system also provides excellent sound attenuation compared to standard batts.

Guardian UltraFit DS

A recent venture by a fiberglass manufacturer, the Guardian UltraFit DS system is similar to—and designed to compete with—the BIB system. Fiberglass mixed with powdered glue is sprayed into a wall cavity along with water, which activates the glue, a synthetic latex. No netting is required, though the stud surfaces must be cleaned after installation. Installed density is double that of standard batts. It is available through lumberyards that have joined the Guardian program.

Fiberiffic

Developed by the inventor of the BIB system, Fiberiffic was only recently introduced in America. It has been in Europe and Asia since 1992. There are still only a limited number of installers nationwide, but most of the country's 400-plus BIB dealers could also install the product. Fiberiffic is currently made to be spray applied onto both smooth and rough surfaces, such as a metal roof or a concrete basement wall. It has a shaving cream consistency, which can be troweled smooth or textured as desired. Fiberiffic can employ a variety of base materials: cellulose, fiberglass, cotton, even coconut. It need not be covered with sheetrock, since it has a class A rating (zero flame spread). It can be applied around the perimeter of a stud bay containing fiberglass batt—the so-called "soft mold" system. Fiberiffic is not recommended as a cavity insulation for wood stud walls because of its high initial moisture content, although a skim coat is sometimes employed to decrease sound transmission due to resonance. It is more often used to insulate ducts, pipes, and rim joists.

Airkrete

As the name implies, Airkrete is a lightweight cementitious material with the decidedly unconcretelike R-value of 3.9/inch. Composed only of magnesium oxide (derived from sea water), calcium, and silicate, it is essentially just a mineral with no petrochemicals. It can be cut with a saw once cured. On the market

since 1982, there are now more than 50 dealers nationwide. The manufacturer claims that it has proven safe to retrofit into the air cavity behind old brick walls. Larry Kinney of E source had it installed in a one-inch space between a brick double wall and the lath for a plaster interior in a 5,000 ft² house in Syracuse built in 1865—it is now a 3.5 Btu/ft²/HDD house.

It can also be used in new construction: The open cavity is covered with screening and Airkrete is pumped in. Like the other cavity insulations, it is not a vapor barrier. It is, however, virtually fireproof, and it is occasionally specified for its fire-retarding characteristics.

Urethane

There are a variety of urethane products, with different densities, installation methods, and base chemistry. There are many trade names for basically the same product. Some foams are installed with a slightly nasty blowing agent, such as pentane. Much of the blowing agent remains trapped in the insulation for quite some time, resulting in a very high initial R-value (of more than R-7/inch), declining to about R-6 after a decade. The final R-value is controversial but certainly not less than R-5. Urethanes may be installed in either open or closed cavities. They are expensive, but they provide unmatched air sealing and R-value. One option is to specify a thin layer of urethane for air sealing and then to fill the remainder of the cavity with fiberglass batts. Beware of very high-performance claims, such as R-20 for a 2 x 4 stud wall. These estimates tend to heavily discount the deleterious effect of the 20–30% of the wall that is solid wood framing. There are numerous installers for competing urethane products.

Icynene

This is a foam product providing good air sealing for both new and retrofit applications. A water-based urethane variant, Icynene uses CO_2 as a blowing agent and has zero measurable VOCs after 14 to 30 days. R-value in new construction is R-3.6/inch; R-4/inch in a closed-cavity retrofit. For new construction, consider hybrid foam/batt combinations to cut cost. Demilec is a similar product.

David Kaufman is an energy consultant in Waldoboro, Maine.

For more information:

Residential Building Design and Construction Workbook, Cutter Information Corp., p. 256–277.

Par-Pac System: Tel: (800) 228-0024

Regal Wall: Tel: (800) 848-9687

Nu-Wool: Tel: (800) 968-9866

Blown-in-Blanket (BIB) system: Tel: (800) 525-8992

Guardian UltraFit DS: Tel: (800) 245-5784;

Fiberiffic: Tel: (800) 525-8990

Airkrete Palmer Industries: Tel: (800) 545-7383; (301) 898-7848

Icynene: Tel: (800) 758-7325

Demilec: Tel: (972) 647-0561