GETTING THE MOST FOR YOUR INSULATION DOLLAR

by Pat Dundon

Batts, blown insulation, and spray foam all have their strengths. Use each where it works best.

Insulation has a big effect on a home's lifetime operating expenses. And once in place, it cannot be cost-effectively altered, so it's important to install it right the first time. Builders should not settle for mediocrity in insulation.

There are two keys to a quality insulation job: choosing the right material for the situation and installing it properly. The details of correctly supporting and protecting each material are important. Let's take a look at the main products I handle — fiberglass, cellulose, and spray-applied low-density expanding foam — and discuss where and how to use each one to best advantage.

Fiberglass Batts

Cheap to buy, fiberglass batts are also quick and easy to install, particularly in walls. But adequate performance depends on a number of installation details.

First of all, each cavity has to be *completely* filled with insulation. Empty spaces reduce the effective R-value. By one estimate, a 5% void area in a wall cuts the wall's R-value by 20%.

Getting a good fit is tricky. Each irregular cavity, triangle, or radiused opening presents its own problem (see Figure 1). Off-center framing that causes stud bays to vary in width often makes a tight fit impossible.

Installers have to be trained to take care in fitting fiberglass. I give every new hire at my company a chance to insulate a typical wall section — unsupervised — with unfaced fiberglass batts. After about half an hour, I ask the new guy to step back across the room and look at his work. Invariably, there are several places where the insulation is not up to the top or down to the bottom of the stud cavities. Usually there are voids around electrical boxes and pipes. When I ask if the new worker split the batts to insulate behind and in front of wires, I usually hear, "What are you talking about?"

It's not too hard to train a person to install batts well, but motivating the individual is another matter. If your insulation contractor pays installers as piece workers on a per-foot basis, the installer's motivation is volume, not precision installation.

Another limitation of fiberglass batts is their permeability. Air and moisture move easily through fiberglass, so you must also install a good air barrier and a good vapor barrier (see "Air and Vapor Barriers," below).

Don't forget to fluff. Fiberglass batts are compressed in the package. Batts may not naturally spring back to full thickness, so the installer should fluff the batt up to full thickness if it seems too thin.

Fiberglass is not the best material for insulating floors. The protection from air movement that fiberglass needs is tough to achieve in floor assemblies. Also, fiberglass may leave voids, and it tends to sag over time. I usually recommend low-density foam for floors, because it seals everything up tight, leaves no voids, and stays in place.

Blown Fiberglass and Cellulose

I often blow cellulose or fiberglass into attics, and as a retrofit into the walls of existing homes. The biggest concerns are getting full coverage and avoiding settling.

Unlike batts, blown products will fill up odd-shaped spaces and voids larger than 2 inches. Smaller voids, however, have to be dealt with differently, so the builder should try to avoid creating them. When I see situations where a builder has created small spaces — by installing wires and pipes in narrow cavities, for instance — I recommend expanding foam as the solution.

Loose-fill fiberglass is blown into open attics at densities of around 0.6 lb./cu. ft. That's not enough density to block air movement, so loose-fill fiberglass in attics, like batt insulation in walls, requires very careful air-barrier detailing. Loose-fill cellulose, which generally is less expensive than fiberglass, offers somewhat more resistance to air movement. But it still requires a good air bar-

Air and Vapor Barriers

Fiberglass insulation is only effective if installed with an air barrier and a vapor barrier. And although cellulose is an air barrier material itself if installed densely enough, it still should be protected by a vapor barrier.

Installing good air and vapor barriers sounds much simpler than it is. I have never installed a perfect vapor retarder or air barrier using fiberglass or cellulose, polyethylene, and housewrap. Unlike housewrap, which is usually installed by the carpenters when the siding is applied, the vapor barrier is often the insulation contractor's responsibility; but most builders I deal with will not pay enough for us to take the time to caulk all the joints in our poly and all the wood-to-wood junctures. And I have never seen a builder install a strip of poly through a rim or band joist or between partitions and trusses, or partitions and outside walls, like all those neat textbook pictures show.

Luckily, such imperfections are really okay. The vapor barrier is supposed to block vapor diffusion, and diffusion is such a slow transport mechanism for moisture movement that the vapor barrier does not have to be perfect.

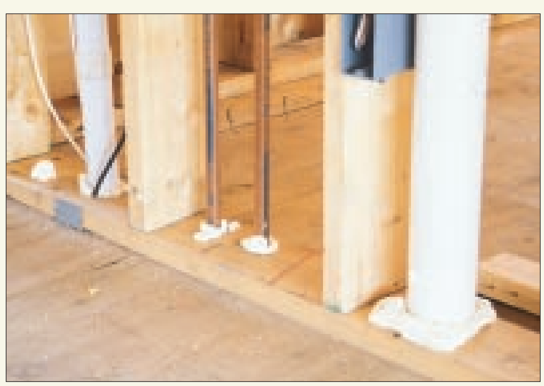
The air barrier is another story, however. To function at all, it must be as complete as possible.

When I say air barrier, I don't mean housewrap. While housewrap is usually stapled over plywood or OSB, both of which are great air barriers anyway, it does not cover the top plate of the wall. Wind wash over the top plate and into wall cavities through wiring and plumbing penetrations negates much of its effectiveness.

To stop uncontrolled air from entering the house, those leaks have to be plugged independently. One method is to use aerosol foam and acoustical caulk to seal all the penetrations of outside walls, and all openings into the attic or floor on both partition and exterior walls (see photo below). This work is tedious, but necessary.

My company used to seal all penetrations through wall plates with aerosol foam in a can. Now, however, I prefer to spray low-density expanding foam into the entire band joist and soffit area, which insulates that difficult spot effectively and also plugs the air leaks perfectly. This costs the customer about $1.50 per linear foot of band joist, a competitive price for a superior job.

— P.D.



Every hole to the outside should be plugged. Wall penetrations can be sealed with caulk or aerosol foam.

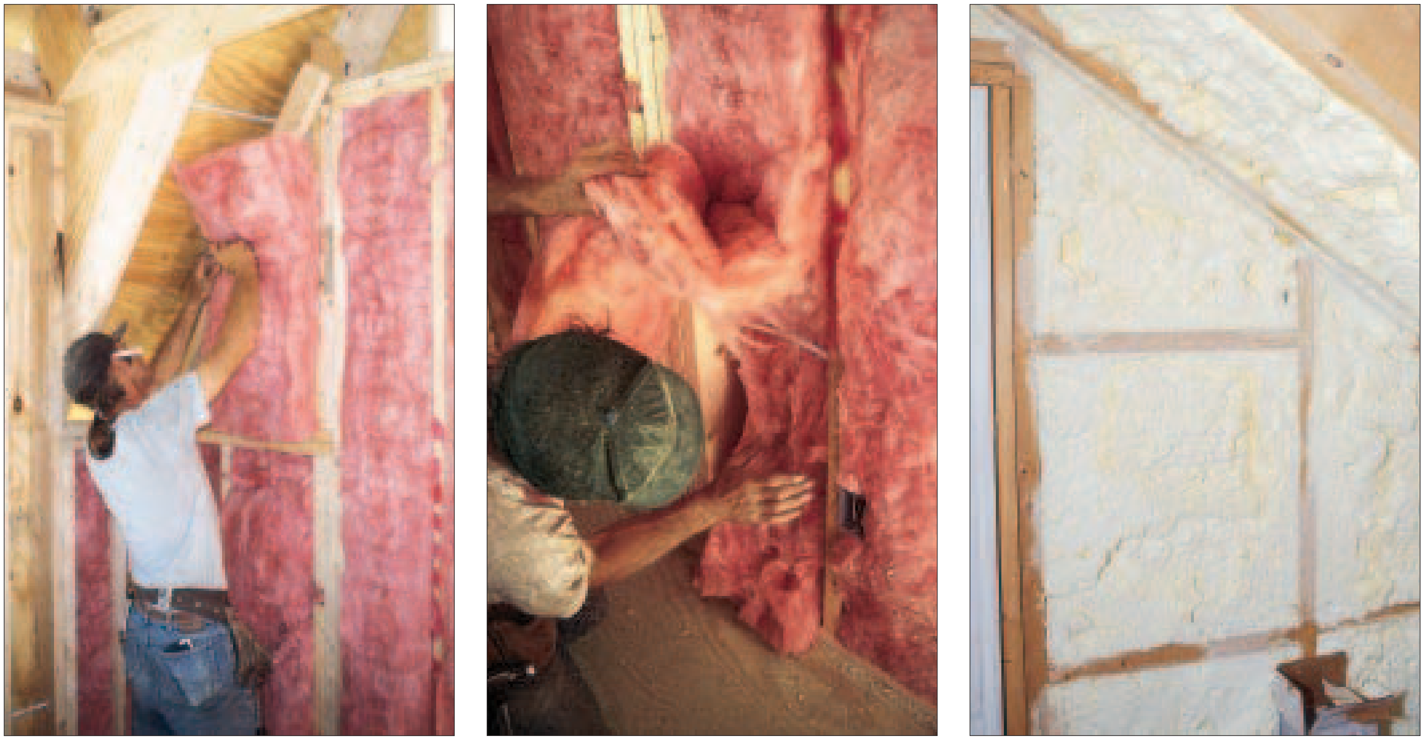


Figure 1. *Angles and curves present problems for the fiberglass installer (left). Batts should be split to go around wires, and carefully cut in around electrical boxes (center). Where the budget permits, the author recommends spray-applied foam for insulating odd-shaped cavities (right).*

rier and vapor barrier in the ceiling.

Cellulose has to be installed at sufficient depth to allow for settling over time. As a rule of thumb, cellulose will usually settle about 20% by volume. To be accurate, use the number of bags per 100 square feet as listed on the bag label. Some manufacturers also give a figure for "initially installed depth."

For instance, if a job calls for R-38 in the attic, we need to install the material 12 inches deep, because it will settle to $10\frac{1}{2}$ inches. A 4/12-pitch truss roof, however, poses a problem. At the top plate of the wall along the soffit there is only about 4 inches of space available for insulating (Figure 2). The first place where it is possible to install 12 inches is 3 feet in from the outside wall. So in the ceiling of a typical 24-foot-wide ranch house, 25% of the attic will have less than the desired R-value. A better choice is for the builder to use raised-heel trusses that leave room for insulation over the top plate.

Settling in walls. Settling of blown insulation is a concern in walls as well as in attics. Installers can control this, but it takes some familiarity with the product and the equipment.

To avoid settling, you have to blow cellulose in at a density of at least 3.5 lb./cu. ft. One way I gauge whether I'm getting this density is by looking at the bag count, but the calculations are complicated — you have to convert the numbers the manufacturer provides for attic applications to the higher-density wall situation.

Let's assume you're insulating a 2x6 wall. The bag labels give you the settled density and depth for an R-19 ceiling job — typically, around 1.6 lb./cu. ft. at $5\frac{1}{2}$ inches deep. Since you want a density of 3.5 lb./cu. ft., you divide 3.5 by

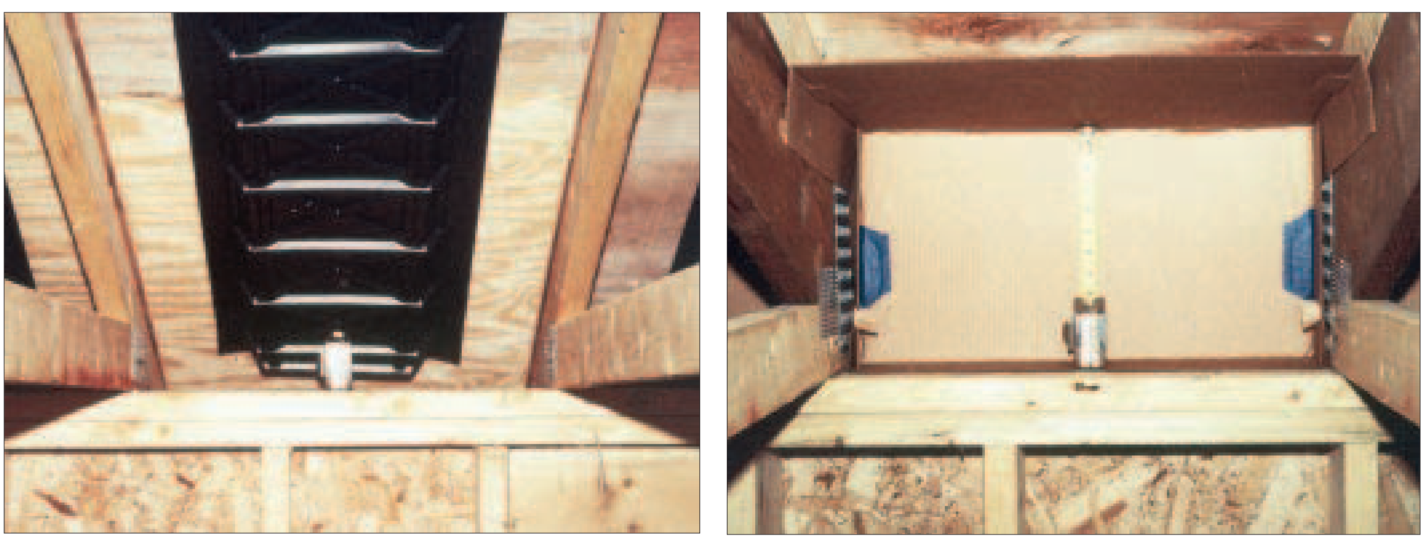


Figure 2. *Standard trusses (left) don't allow loose-fill insulation to be installed at full depth. The author recommends raised-heel trusses (right), which leave room for correct insulation coverage.*

Figure 3. *Some situations just can't be handled with fiberglass. Here, wires and ductwork are clogging up the end of a joist bay, making a good fit and good air-seal practically impossible. The author recommends spray foam for such problems.*

C. BATES

Figure 4. A *mix-and-match strategy sometimes provides the builder's best insulation buy. Here, a contractor has used foam to seal up joist bays, window perimeters, and narrow stud bays, while filling most of the wall cavities with spray cellulose.*

1.6 to get a multiplier of 2.2. Then you multiply that by the manufacturer's recommended number of bags per 1,000 square feet of attic. Now you know how many bags to blow into 1,000 square feet of wall. Calculate the wall area you're insulating — allowing for windows and excess framing — and you can figure out roughly how many bags it will take to get the required density.

Low-Density Expanding Foam

For three years, I've been installing Icynene-brand spray-applied low-density foam (LDF), although recently I've switched to another supplier. Of the materials I handle, LDF is the premium product. It's an open-cell polyurethane that is blown without the use of any ozone-endangering chemicals. Expanding into cracks as small as 1/4 inch, it gives an R-value of 3.5 per inch and provides an effective air seal.

With more new brands of LDF on the market, spray foam is likely to get cheaper and more readily available. I'd advise any builder who is serious about insulation quality to take a close look at foam.

I've used LDF to solve problems nothing but foam could solve. Have your framers ever boxed in headers or corner posts without insulating them? If you drill a 1/2-inch hole into the void, I can insulate it by injecting foam.

Have you ever had a callback due to a frozen pipe? Most frozen pipe problems are brought on by frigid air penetrating the insulation and freezing the pipe. Get your plumber to run pipes as close to the warm side of a chase as possible, and have LDF installed between the pipe and the cold. You will never have a frozen pipe again.

Alternatively, have you ever had a callback for a cold floor over a garage or exposed area? This can be caused by sloppy installation of fiberglass, or by settling of blown insulation. Insulate those areas with LDF — it won't settle, because it glues itself to the floor.

LDF is about double the cost of fiberglass, installed. But that doesn't take into consideration the cost of carefully installed housewrap, vapor barriers, and careful air sealing that proper fiberglass batt installation requires. LDF does the work usually done by the insulation, the vapor barrier, the air barrier, and all the labor involved with a careful installation. When those associated costs are backed out, the up-charge for LDF is much smaller. And no matter how good a job your installer does with fiberglass, the final product can't approach LDF's effectiveness.

There are some drawbacks to LDF. It releases steam, carbon dioxide, and ammonia gas during installation, and afterward, some amine gases continue to be released. Most of the off-gassing occurs in the first week, though, and after 30 days there are no detectable emissions.

The foam sticks to anything and does not come off. You have to take precautions to avoid damaging windows, plumbing fixtures, or other people's tools. Before I learned this, I damaged cement porch finishes, eyeglasses, and metal fixtures with overspray.

Also, the equipment used to apply LDF is complex and sensitive. Occasional equipment failure may result in delays at the job.

When all the pros and cons are added up, though, the fact remains that there are several situations in every home where foam is the only satisfactory insulation (Figure 3).

Where the budget won't allow LDF, we often install cellulose or fiberglass. But I frequently recommend a "mix-and-match" strategy that combines all three (Figure 4). By understanding where and how to use each of the materials in my bag of tricks, I can give customers the best buy for the available money. For instance, I can install fiberglass batts in the walls, blown cellulose in the attic, and LDF in particular problem areas — band joists, soffits, narrow cavities, behind kneewalls, and so on. In spots like those, the expanding foam is the only material that will really work. After they see how well foam works, many builders decide to insulate the whole house with it next time. ■

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