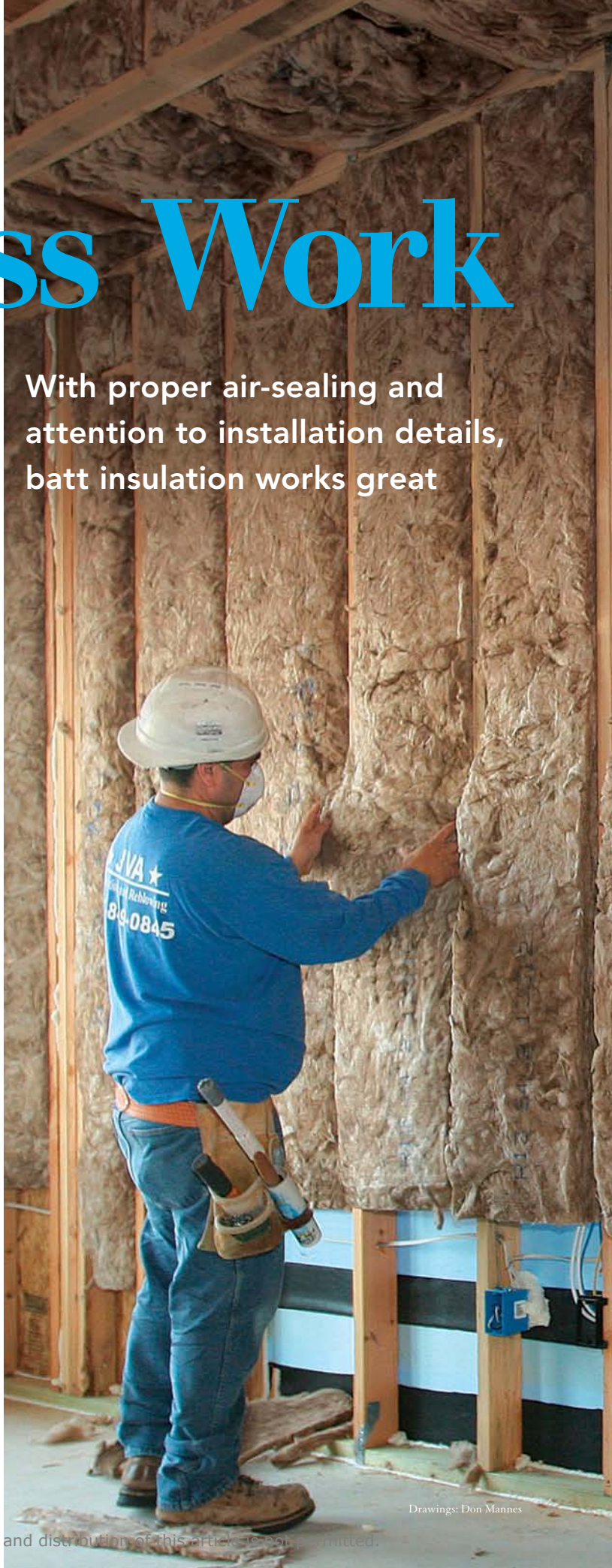
Making Fiberglass Work

BY LEE KURTAS

With proper air-sealing and attention to installation details, batt insulation works great



When building science and home efficiency really took off in the mid-1990s, insulation contractors started hearing regularly about how the type of insulation used affects a building's energy efficiency. Blower-door testing and thermal imaging of existing homes proved that fiberglass—as it's typically installed—didn't perform as well as other types of insulation, especially spray foam. As a result, builders and architects doing projects with energy-performance benchmarks started specifying spray foam as a way to ensure better airtightness and thermal resistance.

These builders and architects liked spray foam because it seals around penetrations such as pipes, ducts, and wires, and because it fills odd-shaped cavities quickly and easily. But spray foam does have a significant downside: cost. Insulating a typical new home with spray foam in my area costs two to three times what it costs to use fiberglass. Because of its low cost, fiberglass insulation is easily the most popular building insulation here in Houston and in the rest of the country. For example, fiberglass makes up 85% of my company's insulation business, while spray foam represents only 10%. The rest is cellulose.

Provided it is installed according to the highest standards, fiberglass performs very well. My company has developed a cost-effective and quality approach you can adapt to meet the same standards.

Installed right, fiberglass works

For fiberglass to be effective, its installation must involve three factors. First, the building must have a durable and continuous air barrier such as taped sheathing. Second, any gaps and mechanical penetrations must be fully air-sealed with durable tape or sealant. Finally, the batts must be fit and placed with care and minimal compression.

When these three factors are present, fiberglass performs as well as other insulation types. And that's not just my opinion. Summarizing their recent findings in a multiyear head-to-head test of six insulation types, researchers at Building Science Corporation (BSC) said, "When walls are constructed with the same R-value in the stud space, and are air-sealed both inside and outside, they exhibit essentially the same thermal performance regardless of the type of insulation material used."

The important caveat in that quote—"and are air-sealed both inside and outside"—refers to the air barrier that separates interior and exterior air. Creating a good air barrier and detailing penetrations prop-

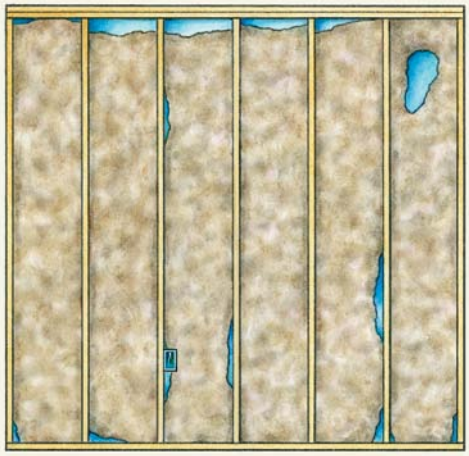
Drawings: Don Mannes

Making the grade

Inspectors from Residential Energy Services Network (RESNET) give batt-insulation installations a rating of Grade I, II, or III. The grades describe the quality of the installation and the completeness of the air barrier. Grades I and II assume a durable and continuous air barrier. Installations without an adequate air barrier are automatically downgraded to Grade III or "uninsulated."

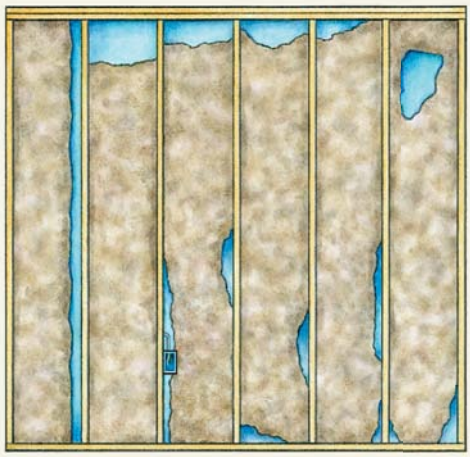
Grade I

This is the best possible job, one in which the batts fill each cavity without voids or compression. The batts are cut to fit tightly around penetrations. The insulation is in full contact with framing and sheathing. Occasional very small gaps are allowed.



Grade II

Moderate to frequent defects such as gaps and compressed edges are present in this installation. The compressed areas (up to 30% compression) can be no more than 10% of the insulated surface area. Insulation can't be missing from more than 2% of the surface area.



Grade III

In this installation, more than 2% but less than 5% of the total surface area is compressed or missing. This rating also includes insulation that isn't in substantial contact with the sheathing or that lacks sheathing or another air barrier. Insulation that's installed worse than Grade III is described as uninsulated.

AIR-SEAL BEFORE INSULATING

Before the insulation is installed, all gaps in the sheathing (or other air barrier) must be sealed with spray foam, caulk, or durable air-sealing tape. The same is true with mechanical penetrations.

Before insulating, an air-sealing crew seals all holes with canned spray foam. They also seal any gaps between the sheathing and the framing. After this work is checked by a foreman for completeness, the batts can be installed.

The air-sealing crew offers spray-applied caulk for air-sealing as an upgrade. The caulk shown here, from Knauf, stays flexible to better accommodate seasonal movement. Owens-Corning offers a similar product.

erly are essential to getting the maximum energy performance from fiberglass batts.

What is an air barrier?

It can be helpful to think of a home's air barrier as an air-filled balloon. The balloon's skin, which represents the air barrier, separates inside air from outside air. For the balloon to hold air, the skin must be sturdy enough and continuous enough to resist the air pressure inside the balloon. It's an apt analogy, because a balloon, like a home's air barrier, is not perfectly airtight. Even the most stringent building-performance programs allow some air leakage. The goal is to make the air barrier as complete and free of leaks as possible.

On most homes, the air barrier is the exterior sheathing. In Texas, we see both foam and OSB sheathing. In places where there is no sheathing, such as attic kneewalls, builders use an inexpensive fiberboard material on the back of the studs. Called Thermo-ply, this material stops air movement in these locations. Builders also use it behind fiberglass tubs and showers.

Get better or lose business

About the same time we started hearing about air barriers and blower doors in the mid-1990s, a visionary group of Houston energy raters and production builders realized that boosting a home's energy efficiency produces a higher quality, more comfortable home. This led to greater homeowner satisfaction and ultimately increased sales.

One strategy for improving efficiency was to install fiberglass insulation with greater care. As insulation contractors, we now had to pass third-party insulation inspections conducted by certified energy raters every time we finished insulating a new home.

At first, we didn't have trouble meeting the requirements, but as home-performance programs such as Energy Star got traction in the new-home market, the focus on the building envelope became more important. As a result, the scrutiny with which the raters evaluated fiberglass installations increased greatly. We started getting failed-inspection calls almost overnight.

Working with the raters, we retrained our installers so that we could meet the new Residential Energy Services Network (RESNET) Grade I standards. Fast forward 20 years: Most of the mid-range and high-end new homes in our market are now insulated to Grade I (see "Making the grade," p. 69).

Even though getting to Grade I is hard to achieve, it's worth the extra effort. The builders we work with build very efficient homes. They have optimally sized heating-and-cooling systems that require a good thermal envelope for peak efficiency.

Proper insulation and air-sealing also make a home that's more durable. In our humid climate, poorly insulated areas can become condensing surfaces that lead to rot and mold. Insulating to Grade I also pays lifelong dividends to the homeowner in the form of greater comfort and lower utility bills.

Achieving Grade I

Most of the builders in our market build a limited number of designs in their large developments, so we get a chance to insulate a given design many times. When the rater identifies a consistent air-barrier or insulation problem, the rater, the builder, and I meet to come up with a way to achieve Grade I. Sometimes we have to get the framer or mechanical contractor involved. Sometimes the framer can modify problem spots to make insulating easier. Similarly, the plumber or HVAC tech might be able to run pipes and ducts in different spots.

These efforts are necessary because failed insulation inspections mean returning to completed jobs to fix things, which in turn creates scheduling problems for us, the builder, and other tradespeople.

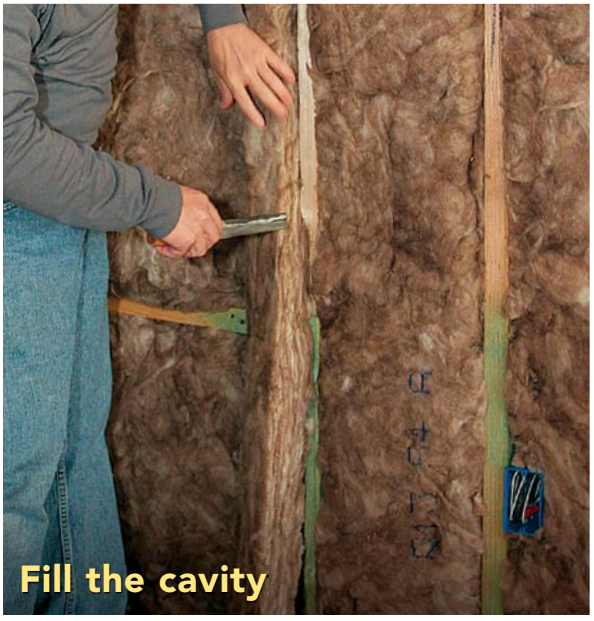
Installing fiberglass to the highest standards costs more than doing a poor job because it takes longer and you have to pay someone who's more skilled to do the

FIT, FILL, FLUFF

Properly installing batt insulation starts with a piece of insulation that fills the cavity and is in full contact with the framing and the sheathing or other air barrier behind the insulation.

A better batt knife. *The author's installers lengthen their square-point knives with PVC pipe. The duct-taped end makes it easier to grab from a tool belt.*

With the batt tight to the top plate, an installer cuts the batts to length and width in place using a batt knife. When the cavity is longer than the batt, a piece is added to the bottom.



Once the batt is sized, it's inserted carefully into the cavity. The installer uses his batt knife to push the sides, top, and bottom flush to the sheathing. If you're careful, you can do this without compressing the batt.

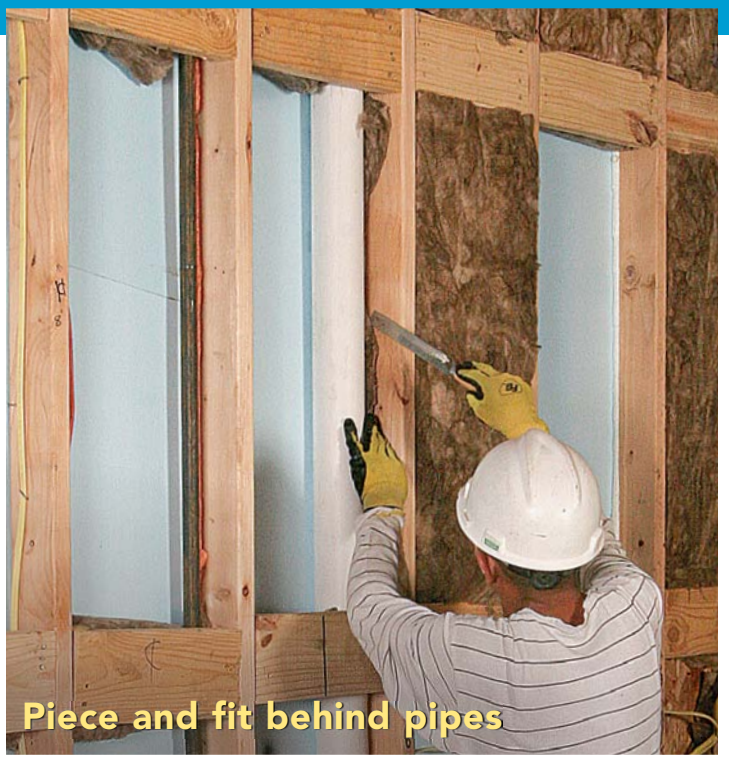
Once the batt is in place, any compressed areas are fluffed out with the batt knife. For out-of-reach sections, a long pole with a spike in the end places and fluffs the insulation.

Work with a net

On garage walls and other places where there will be drywall on both sides, the crew staples 24-in.-wide fiber mesh to the stud faces. This holds the insulation in place until the drywall is installed.

SLOW DOWN FOR OBSTACLES

Blocking, odd-size cavities, and penetrations make installing insulation much harder than it would be without them. Getting to Grade I requires careful fitting and piecing in these problem areas.



Piece and fit behind pipes

Raters always look around large waste lines because insulating behind them is slow and tedious. Small scraps should be tucked behind the pipe with a batt knife.

Fill around refrigeration lines

When possible, installers split the insulation so that the pipe is between layers. This is easier with small-diameter tubing. The larger, insulated tubing often requires piecing around the pipe.

Split around wires

Cables are generally run in the center of the wall, so installers split the batt in half and pull the rear section behind the cable. The front half is laid on top.

Use scraps when necessary

Switch boxes and other spots with multiple pipes or wires generally have to be pieced together with scraps. Raters pay special attention to these areas, so it's important to fill every void.

work. Before the 1990s, an experienced installer could handle 5000 sq. ft. of batts per day. Under Grade I requirements, installing 3000 sq. ft.—a 40% drop—is difficult.

To deal with the slower pace, we had to raise our prices somewhat, but we couldn't raise them by 40%. To compensate, we only keep the best installers (and we pay them above the average). With their help, we've developed systems that make a Grade I job go as efficiently as possible.

A day in our life

At least a day or two before we begin a job, our three-person air-sealing crew fills gaps between the framing and sheathing with canned spray foam. They seal around penetrations, doors and windows, and anywhere else the air barrier is compromised.

When the three people on the insulation crew get to the job, they distribute the material throughout the house. Through experience, they know how much insulation will be required in which places.

One crew member starts with the upper parts of the wall on the top floor. He makes sure each batt is tight to the top plate and works his way down the stud cavity carefully, making sure not to compress the edges. He also installs any ceiling insulation he can reach as he moves along in a rolling scaffold. He carries both types of insulation on the scaffold with him.

Every installer carries a long-bladed batt knife that he routinely resharpens on a concrete slab. The installers use this knife to cut the batts in place. They also use the knife's blunt tip to fluff up any insulation compressed during fitting. The insulation should be touching the back side of the drywall once it's installed.

When the installer on the scaffold has a sufficient head start, another installer does the lower parts of the wall. He begins by finishing the batt started by the guy on the scaffold. If the batt isn't long enough, he cuts a piece for the bottom and carefully fits that, too. The third installer works on the rest of the ceiling and on any other high areas. Sometimes he wears stilts to reach the ceiling.

All the installers are trained to split the insulation around small-diameter pipes and wires. The batt is pulled apart near the middle, then one-half is slipped behind the pipe or wire and the other half placed on top.

When splitting is impossible, the installers place scraps around the obstruction, being careful to fill every part of the cavity. Electrical boxes get special scrutiny from raters, so the installers either insulate behind them with canned spray foam or fit small pieces of fiberglass behind them. At the end of the job, they gather the scraps and the packaging for disposal.

This isn't going away

Installing fiberglass to Grade I might seem like a lot of work compared to how most fiberglass is installed, but judging from the continued focus on insulation in each IRC update, I don't think Grade I requirements are going away.

In addition, insulation is one of the few aspects of a house that are nearly impossible to upgrade once the drywall is up. This makes it even more important to get it right the first time. □

Lee Kurtas is the insulation products manager at Perfection Supply in Houston. Photos by Patrick McCombe.

Five facts about fiberglass

1 Fiberglass is the most popular building insulation in the country. The manufacturing process for fiberglass looks a lot like how cotton candy is made at a summer fair. Molten glass is fed into a spinning drum with small holes. The liquid glass, which can be up to 50% recycled content, is forced out of the drum into long fibers. The loose fibers are then bound together into large billets with an acrylic adhesive. The billets are cut into various sizes and packaged for transport and sale.

2 Fiberglass insulation starts out white. The insulation shown here is brown because the corn-based binder holding the white fibers together is brown. In the past, manufacturers used formaldahyde-based binders, but the modern adhesives are said to be more environmentally friendly and less irritating. Even the pink insulation starts out white and is made pink with red dye.

3 Fiberglass can be manufactured with or without a kraft-paper facing. The facing is a vapor retarder meant to slow moisture accumulation resulting from water vapor diffusing through the drywall. In cold climates, the vapor retarder faces the living space, opposite the sheathing. In hot climates, it faces the exterior, against the sheathing. However, building scientists now generally advise using unfaced insulation in all but the very coldest climates because vapor retarders can hamper seasonal drying.

4 Different parts of the country have different insulation requirements for walls, floors, and ceilings. The specific requirements can be found in table N1102.1.1 of the International Residential Code (IRC). Some manufacturers label their products "for walls" or "for floors and ceilings," indicating where they should be used. This can be helpful for less-savvy consumers, but to satisfy code, you must insulate to the R-values specified by the IRC. You can't assume that the product bearing a label for a particular application will meet code requirements.

5 Fiberglass can irritate the lungs and skin. When installing fiberglass, wear a N95 particle respirator to prevent inhaling glass fibers, and wear long pants, a long-sleeve shirt, gloves, and a hat to prevent skin irritation.

—Patrick McCombe, associate editor