GETTING QUALITY FROM Fiberglass Insulation

My company specializes in high-quality insulation work, in both new construction and retrofit applications. We also provide energy consulting and energy audits that include testing with a blower door, duct blaster, infrared camera, and other diagnostic tools.

by Michael Uniacke

To ensure high performance from fiberglass batts, provide support and cut to fit

Experience has convinced us that blown-in insulation products are the way to go if quality is the top priority. Correctly done, a blown-in job has inherent quality control, making it the simplest and best way to eliminate heat-wasting gaps or voids in exterior walls (see "Insulating With Spray Cellulose," 10/01). But blown-in insulation products cost more than fiberglass batts, so most walls today are insulated with batts.

Unfortunately, most fiberglass installers don't give much thought to quality. That's not surprising — batts are the budget choice to begin with, and when the job goes to the lowest bidder, the only way the installer can make money is to rush through the work. But the results are bad news for the home's thermal performance. The more complicated the wall assembly, the harder it is to get a good fit (see Figure 1). A 6-inch batt may have a measured R-value of 19 at the factory, but a poor installation in an exterior 2x6 wall can degrade the R-value by as much as 40%.

It doesn't have to be that way. Given a realistic budget to work with, we've found that we can do high-quality work with fiberglass and still make a profit. The keys are coordination between trades, quality control, and knowing the right details.

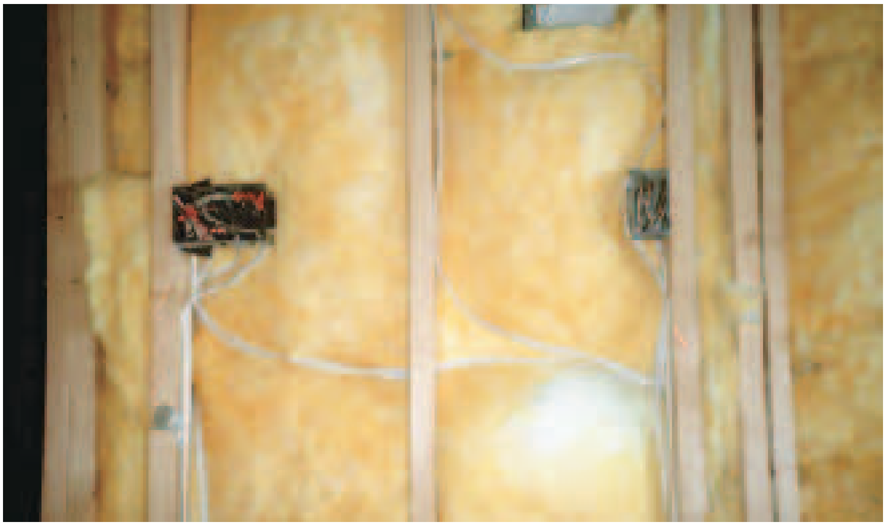


Figure 1. Irregular stud cavities, wiring, and other obstructions in a wall like this make it harder to cut and fit fiberglass accurately. Dark lines and visible stud shoulders in this wall indicate a hurried job.

How Insulation Works

Fiberglass itself has little resistance to heat flow. The actual insulator is the air trapped in the tiny spaces between glass fibers. The tiny air voids slow conductive heat movement, while the glass fibers reduce radiant losses and impede air movement to block convective heat flow.

Don't be fooled by so-called dead air spaces. Small air voids slow heat flow, but large voids don't. A dead air space is one in which air does not move — once a gap gets larger than 3/4 inch, convection kicks in and overrides the insulating effect. Even though they contain air, uninsulated framing cavities have little or no R-value.

Making contact. That understanding should govern the way batts are installed in the field. They should make good contact with wall and ceiling and nestle snugly against the subfloor within floor cavities. If the batts don't touch the inside face of the drywall or subfloor, convection coupled with air leakage will seriously undermine their thermal performance. We use only unfaced batts in exterior walls, because we've found that inset-stapled kraft-faced batts tend to create gaps between the insulation and the drywall. (Using unfaced batts also prevents the drywallers from complaining about the presence of stapling flanges on the surface of the framing.)

In other words, even though shoving batts into a stud cavity may seem like a no-brainer, doing it right takes some care. If a batt is simply jammed into place, its edges tend to drag along the sides of the studs on either side, which often prevents the rear corners of the batt from coming into contact with the exterior sheathing. To avoid this problem, I teach my crews to push each batt into its cavity, then pull it out flush with the face of the framing (Figure 2, next page).

Fiberglass needs protection. Fiberglass batts insulate properly only if they can trap still air; they aren't an air barrier material themselves. Wind or even stack pressure in a heated house can readily push air through unprotected batts. So framing cavities need to be closed in with cardboard or plastic baffles, rigid foam, caulking, and the like, and walls should be protected with housewrap or something similar. I recommend an inch of rigid insulation on the exterior of buildings in addition to the fiberglass in the wall cavities.

In addition to keeping wind pressure from pushing air through or around the batts themselves, the rigid foam also cuts conductive heat loss. Fiberglass batts have an R-value of R-3 to R-4 per inch, but wood framing —

Figure 2. To achieve the required tight fit, batts are trimmed to the required height and width in place. Each batt is pushed tight to the sheathing, then pulled forward until it's flush with the stud faces. On inspection tours, the author checks for exposed stud shoulders and makes sure batts have been split around wires as needed.

which makes up at least 20% to 30% of an exterior wall — has an R-value of 1 per inch, allowing heat to bypass the insulation by flowing through studs, plates, and headers. The added inch of rigid foam can reduce this bypass heat loss by half, significantly boosting the performance of the whole assembly. You'll see the difference in equipment sizing and utility bills.

Quality Control

The market seldom rewards or demands much in the way of professionalism from insulation contractors. Bad work gets rocked over within days or hours, and unlike plumbing, roofing, and electrical defects, sloppy insulation rarely comes back to haunt a builder.

Most installers get paid piece-rate, which rewards quantity, not quality. Around here they get two or three cents a square foot. Can you blame them for blasting through a job to get a bigger check? With piecework, it's practically impossible to see that the job is done right. I pay my men hourly, and even then it's essential to inspect the work and make sure that

Figure 3. Framers often leave spaces blocked off that are hard or impossible to insulate. Left, the intersection between an interior and an exterior wall can be reached only through a small gap. Above, a wood I-joist has been hung out over the top plate to serve as a nailer for the ceiling drywall, completely blocking access to the band joist. (For the correct detail in this area, see Figure 6.) In both photos, the kraft-faced batts have been jammed into place with no effort to achieve a proper fit.

any errors are fixed before the walls are closed in.

Seams and shoulders. When I walk onto a fiberglass job, I immediately begin looking for dark seams or shadow lines that indicate where an improperly cut batt stops short of the framing. Another detail I look for is the shoulder or side of the stud. I want to see only the edge or the face of the framing, not the side. If I see a lot of shoulder, I know the batts have been compressed from hasty installation. I also lift up batts adjacent to electrical receptacles and plumbing fixtures to make sure they have been split around wires and pipes.

Working with subs. Good batt installation requires the cooperation of the builder, framers, plumbers, and other subs, because framing, plumbing, and other details can create large inaccessible areas that often don't get insulated during assembly.

In infrared camera images, those empty voids show up clearly as hot spots or cold spots on a wall. It's common to find inaccessible voids framed

Figure 4. Batts behind manufactured fireplaces are strapped in place so they won't sag or droop. Kraft-faced batts aren't used because the facings are combustible.

Insulating Flat-Framed Assemblies

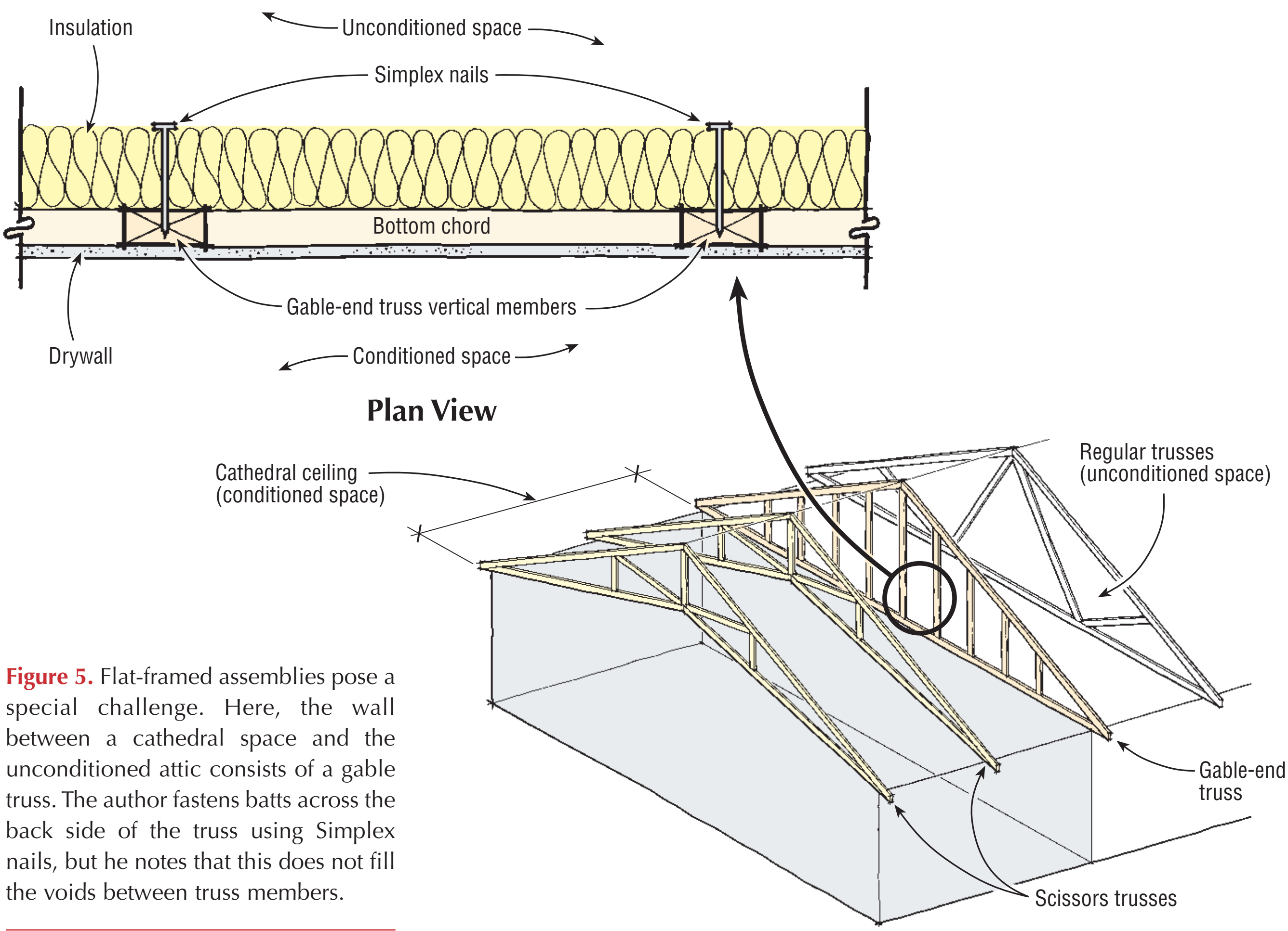


Figure 5. Flat-framed assemblies pose a special challenge. Here, the wall between a cathedral space and the unconditioned attic consists of a gable truss. The author fastens batts across the back side of the truss using Simplex nails, but he notes that this does not fill the voids between truss members.

into arched window headers, outside corners, wall intersections, and rim joist areas (Figure 3, previous page). Draft stops are often missed, and many builders mistakenly think that simply laying a batt over a chase will be adequate.

When a house has big built-in voids that the insulators can't reach, it doesn't much matter how careful you are everywhere else. Ideally, the plans should call out good framing and insulation details to ensure that no major thermal defects will be built into the structure.

I advise builders to let us come out to a job and insulate before they seal up cantilevers, install metal fireplaces, set fiberglass tub enclosures, run ductwork, or do anything else that will make the installation of batts more complicated later. When we insulate behind metal fireplaces, for example, we strap up the batts so they are supported for the life of the building (Figure 4, previous page). Unfaced batts that are not strapped or wired off might slip or sag over time. For the sake of fire safety, we don't use kraft-faced batts in those areas. If timing is an issue, we encourage our GCs to take some fiberglass from our warehouse so they can insulate special details themselves.

Kneewalls & Skylights

The framing at skylights, kneewalls, and ceiling transitions doesn't always lend itself to batt installation. We often have to insulate a structure that is framed on the flat, or that incorporates a truss. In such places, drywall faces the conditioned space and the flat-framed back of the assembly is exposed to the unconditioned attic. There's really no way to fit batts between those flat 2x members. We usually end up fastening batts over the entire assembly, framing and all, but that does not fill the $1^1/2$-inch-thick voids between framing members.

Here's how we make do: On skylight wells I recommend using a 5-inch Simplex nail (Figure 5). The head of this nail will hold the batt in place, and the large nail won't overly compress it.

Insulating Rim Joist Cavities

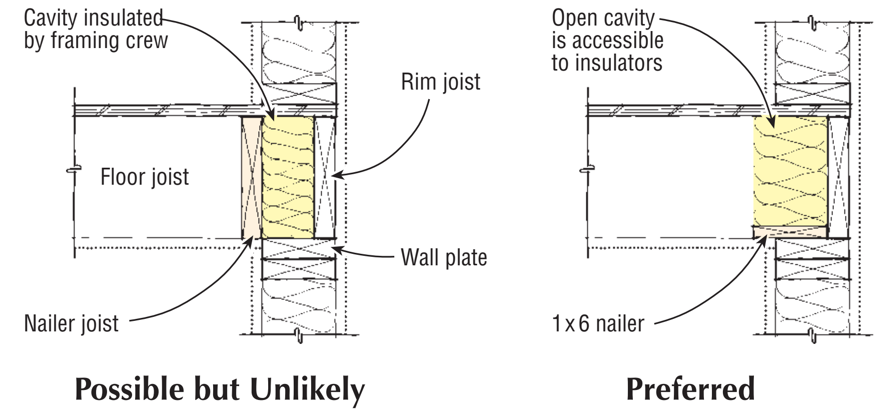
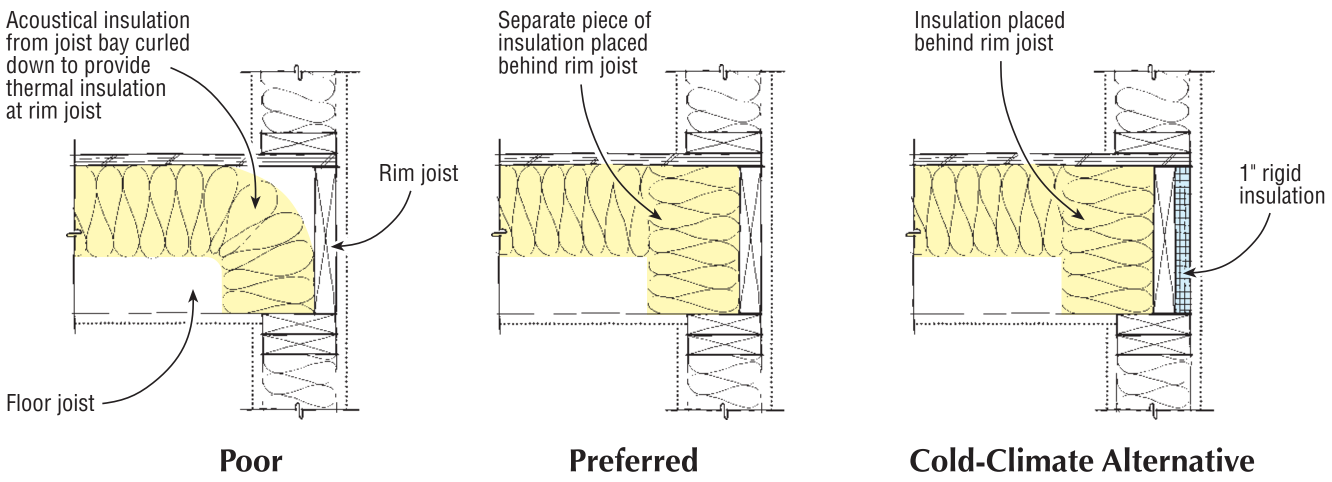


Figure 6. Because band joist cavities are often framed in a way that makes them inaccessible to insulation crews, the author makes insulation available to his customers so they can insulate those areas during the framing phase of the job (left). A better option is to nail a one-by board flat on top of the wall plate to provide a drywall nailer that leaves the floor cavity accessible (right). Where batts are placed in a conditioned floor for sound control, a separate piece of insulation should be cut and fitted at the band joist (below).



I don't think a 5/16-inch staple provides enough insurance. Staples also compress the batts.

On conventionally framed kneewalls with full-depth voids between studs, I think the best detail is a face-stapled kraft-faced batt. Inset-stapled batts can lead to cold air leaking down from the attic between the drywall and kraft paper. A face-stapled batt is more likely to withstand the test of time.

Rim Joists & Cantilevers

A quality fiberglass job in an exterior wall is straightforward, and everyone can see it until the drywall is hung. Miss a stud bay, and someone will likely say something, but rim joists and cantilevers are easy to overlook. A small cantilever may need to be insulated before my crew arrives in order to keep the stucco contractor on schedule. These little details are important, because even a small uninsulated area can have a huge impact on overall R-value.

Framers often create big problems at rim joists. They place a truss joist on the exterior of a top plate and then hang another out over the edge of the top plate on the inside for a nailer (Figure 6). This is a disheartening detail to deal with. It would be better to nail a piece of one-by stock flat as a drywall backer, leaving us access for insulation. When the rim joist is open, I cut pieces to fit and install them separately.

Where batts are placed between conditioned floors for sound control, I don't let my men curl down the batt end when they come to the end of the joist bay, even though it's fast. At the wall, a tight fit is required for effective R-value, so the crew must cut small pieces to fit.

In extremely cold climates, I recommend that builders inset the rim joist an inch so they can get an inch of rigid insulation over the exterior side of the band joist. Details like this will reduce the potential for condensation.

Figure 7. Low "Santa Fe" attics like this one don't leave room for blown-in products. Instead, carefully fitted batts are installed between the bottom truss chords.

Attics

We install batts in attics only if access problems make it impossible to blow in insulation (Figure 7). For one thing, it costs much less to blow in attic insulation than to install batts. But we can also do a better job blowing in loose fill, because the blown-in fibers conform closely to elements like recessed cans, ductwork, truss ties, and plumbing, electrical, sprinkler, security, and audio systems, all of which create trouble when you're trying to fit a batt.

Like most installers, we use "toros" — telescoping poles with pronged heads — to manipulate batts overhead (Figure 8). These tools are a real convenience, but because they require you to work at a distance, they can lead to sloppiness if you're not careful, especially if you have to split batts around wires and other obstructions. I expect my men to climb up on ladders where needed to get the difficult details by hand.

Soffits and dropped ceilings. On our jobs, we place the batt in contact with the drywall if at all possible. In many higher-end custom homes, however, we see dropped ceilings and soffits with ductwork running through them, which forces us to run the batts at the

Figure 8. The author's crew uses toro poles with pronged ends to place batts in high ceilings (left). To reduce convection and infiltration losses, batts should be pulled down to make contact with the ceiling drywall (above).

Figure 9. When a dropped ceiling or soffit sits lower than the trusses, the author's crew runs straps between the bottom truss chords to hold the batts in place. This is preferable to a foil or paper support that could fail and let the batts sag, exposing the dropped ceiling to hot or cold air from the unconditioned attic.

Figure 10. This example of a low-pitch cathedralized attic roof shows how the ductwork is brought within the conditioned space. Batts fit neatly into the roof-plane cavities, avoiding the need to make complicated cuts and fits around the can lights and other ceiling penetrations.

level of the trusses.

In that situation, we support the batts with plastic strapping or wire (Figure 9). We don't want the batt to drop or get knocked down, because that would expose the uninsulated kneewalls and ceiling to ambient air.

"Cathedralized" attics. A new detail we call a cathedralized attic is catching on in our area as a way to deal with halogen lights, wires, truss ties, and other systems that run through attics. The insulation is installed underneath the roof sheathing, and the attic is not vented, making this approach well suited to low-profile attics.

The advantage is apparent in a lot of the Santa Fe–style houses we insulate, where the roof plane is only 3 to 4 feet above the drywall. Besides eliminating conflicts with recessed cans, wires, and plumbing, this technique brings the ductwork inside the thermal and pressure envelope, which makes a huge increase in energy efficiency (Figure 10).

The 10-inch or 13-inch batts we use for cathedralized roofs tend to slip out from the truss bays formed by the 2x6 top chords. To hold the batts tight to the roof sheathing, we drive nails into the flat faces of the truss webs at the proper distance below the roof sheathing, then run wires from nail to nail parallel to the bays to support the batts. We run additional wires at right angles to the trusses for extra support.

This doubles our labor cost for the job and compresses the batts slightly, but the benefits outweigh the disadvantages. In Phoenix, where attic temperatures can be as high as 140°F, we think it's worth it. In other climates, it may not be appropriate or may need to be modified. Before you use this detail, consult local code officials and study the *Builder's Guide* for your climate, which you can purchase from the Energy & Environmental Building Association website (www.eeba.org).

Conventional Cathedral Ceilings

Cathedral ceilings framed with lumber or wood I-joists are subject to a serious thermal defect at the ridge. Unless the ends of the batts are plumb-cut to match the rafters, a big gap is created where the square-cut batts meet the ridge board (Figure 11, next page). This is an area that's difficult to inspect without a ladder or scaffold, so we make sure to cut the batt at the plumb angle or else install a piece of scrap fiberglass in that spot in advance.

Tall recessed-can lights are another common problem in cathedral ceilings, especially where the roof is framed with 2x8 or 2x10 rafters. That leaves little room for insulation between the roof sheathing and top of the can. About all you can do there is install rigid insulation in the gap and hope for the best. It's better to design the detail differently to begin with.

Crawlspaces

Building science supports the idea that crawlspaces should remain unvented and insulated at the exterior walls. But because the codes haven't caught up with current research, we still have to insulate floors over vented crawlspaces. As in other areas, it's important to make sure the batts make good contact with

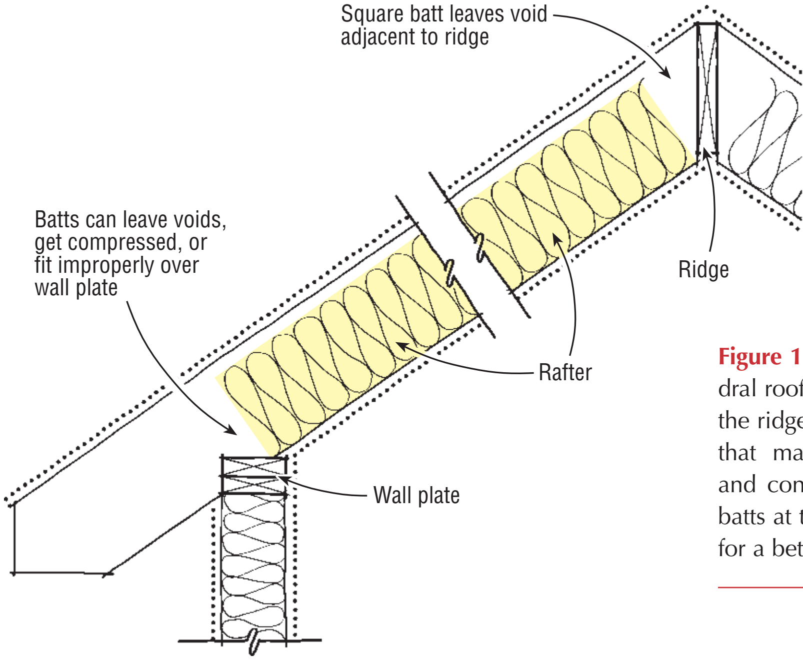


Figure 11. In rafter-framed cathedral roofs, batts often fit poorly at the ridge and plate, leaving voids that may cause thermal losses and condensation. Trimming the batts at the required angle makes for a better job.

Figure 12. The author uses 16-inch-wide commercial batts to insulate engineered floors. He recommends wire batt hangers (left) to hold the batts tight to the floor sheathing. Standard-width batts don't fit snugly between the thin webs of wood I-joists (below).

the adjoining sheet material — in this case, the underside of the subfloor.

A lot of new homes have floors framed with engineered lumber. Because of the wider distance between the webs of engineered lumber (15$^3/_8$ inches as opposed to 14$^1/_2$ inches between sawn lumber joists), we use commercial batts that are a full 16 inches wide (Figure 12). This is a simple detail, but some insulation contractors still use 15-inch-wide batts on the bottom web of a wood I-joist, which is a major installation flaw.

We also use a larger wire batt hanger on I-joist floors. Wire batt hangers are pieces of wire with sharpened ends that wedge in between floor joists to hold the batt in place. They compress the batts slightly and some R-value is lost, but I think the benefit of supporting the batt firmly against the floor sheathing outweighs the loss in R-value from compression.

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