Improving a house's thermal efficiency starts with using the right materials and methods in an unfinished attic.

Insulation from the Top

By Noelle Lord

PETER LORD

Friends tease us a lot about what it must cost to heat our 225-year-old, Federal-style home, not because their teeth chatter while they sit in our parlor, but because old houses are notorious for drafts and escaping heat. While it's true that our house has plenty of air circulation, my husband Peter and I are comfortable throughout our Maine winters (and our fuel bills are not that bad), because we have taken steps to address energy drains while protecting the historic elements that give our house the character we love so much. One way we did it was by adding insulation in our attic.

Ideally, all areas in a house that are susceptible to heat transfer should be insulated for maximum energy efficiency, but that's a luxury when you're working on a finished building, especially an old house with many idiosyncrasies. Though adding insulation to an unfinished attic is one of

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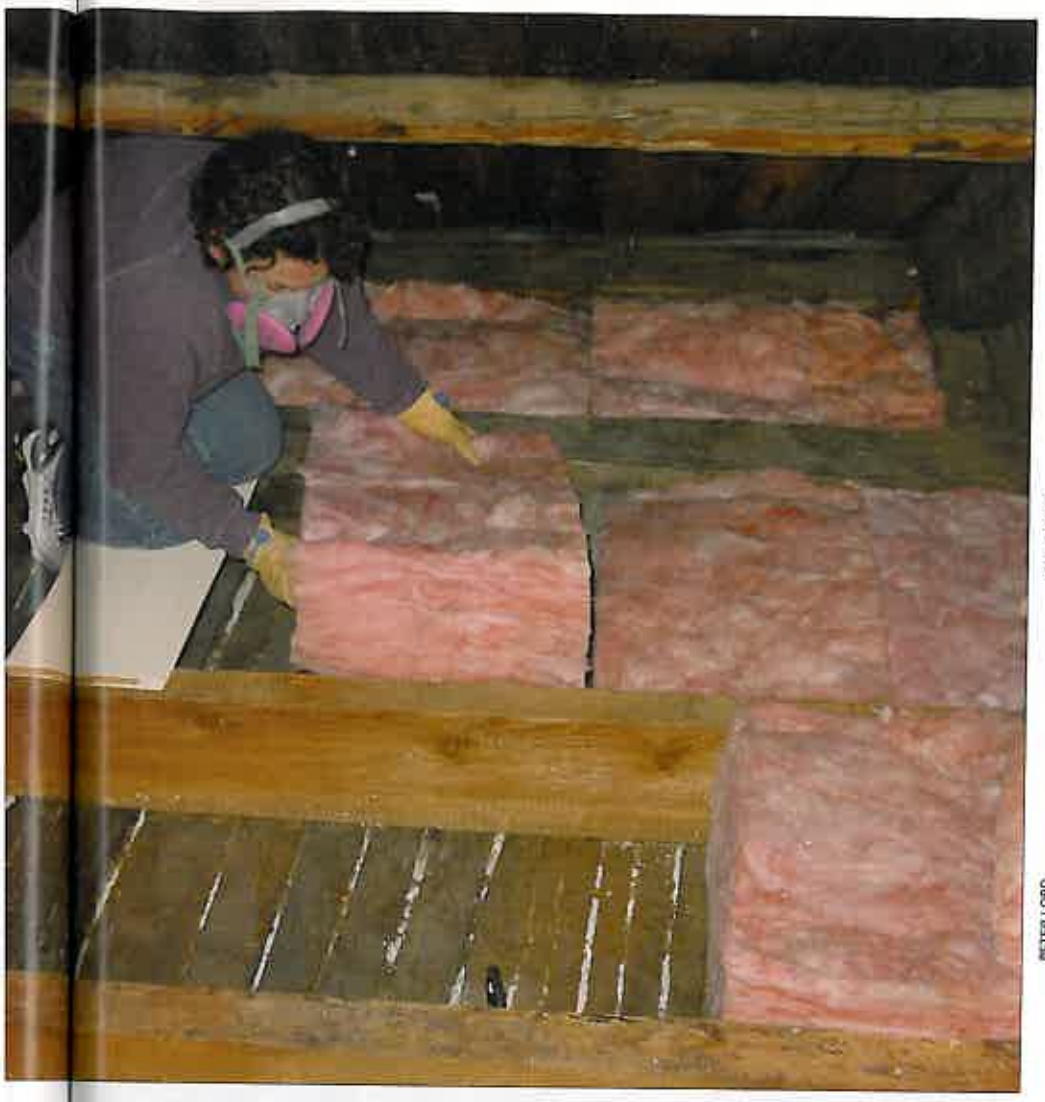
The dimensions of the bays (voids) between joists usually determine the amount of attic insulation, but it's possible to add more by raising the floor on furring.



Left: Insulating an unfinished attic floor is a low-tech and relatively simple process, but for best results it's critical to understand the principles, materials, and your house before you dive in.

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Top: Never bury lights or old wiring under insulation. Above: We saved the hand-wrought nails from our attic floor for reuse.

the most popular home improvements, installing it incorrectly or using inappropriate materials can have adverse consequences because insulation changes the way heat and moisture behave in a house. Before jumping on the attic insulation bandwagon, take the time to select the right products and install them under the right conditions so that you get the results you want without unexpected consequences.

The Right Stuffing

Before buying any attic insulation, assess your needs. First, measure the depth of the floor joist space. That depth determines not only the thickness of the insulation you can accommodate but, more importantly, its R-value—that is, the material's thermal resistance or insulating ability. Different insulating products with the same thicknesses can have different R-values and be different to work with. You want insulation that fits the joist space snuggly and has the highest possible thermal resistance. Experts recommend using insulation that ranges from R-38 to R-60 for attic floors, but that may not be possible in an old house. In our case, the joist space measured about 9" deep, which only allowed us an R-value of 30 for an 8"-thick fiberglass blanket roll, unless we wanted to raise the floor.

When we installed insulation in our attic recently, our first task was to pull up the 200-year-old, ship-lapped, wide pine floorboards so that we could access the joist bays underneath and evaluate the project. We began by carefully removing the nails using various hand tools, such as a flat bar, cat's paw, hammer, and nail puller. Lift the nail a little bit at a time so that you don't damage the wood. Sometimes, a particularly stubborn nail requires that you pry the board through the nail, but try to avoid that. When the nails are out, lift up the floorboards and begin planning your installation.

While you can add to existing attic floor insulation, it pays to carefully inspect what's there first because it may make more sense to clean out entire cavities and install new insulation. To block heat flow, insulation must capture air, so any matted material is probably ineffective. Previous work on wiring or other mechanical systems also can leave the insulation coverage inconsistent, and nesting pests can ruin entire areas.

All thermal insulating products operate on the same principle: They resist the transfer of heat as it moves from warmer to colder areas either by circulating air or by conduction through solid materials. In unfinished attics, fiberglass blanket rolls work well because they are flexible, easily

molded, and sized to accommodate standard rafter, floor joist, and stud wall spacings, which is why we chose it for our project. To be effective however, fiberglass must keep its pillowy loft and not be exposed to high-moisture conditions such as a damp basement where the material will become compacted if it gets wet, negating its insulating value.

Other insulation types suitable for attics are more purpose-specific. Rigid board foam insulation is designed for use where space is at a premium and you need the greatest possible R–value per inch. Though relatively expensive, this material is popular for insulating below grade or in moist conditions. We added rigid foam insulation to new plaster walls and ceilings when there was not enough depth (or ceiling height) for fiberglass, and to an attic trap door to prevent heat from escaping.

Small or drafty areas may be candidates for spray foam insulation, which is primarily intended for use around utility service holes or plumbing, and for closing any gaps where boards or foundation materials meet. There is a commercial spray foam insulation that can be applied to large areas—for instance, replacing fiberglass in stud-wall cavities. Spray foam is fairly permanent, so don't spray it on unless you're sure of the location.

In the past, blown-in insulation was the type most associated with old houses for the simple reason that it could be installed without opening up walls beyond a few strategic holes, but it is not without shortcomings. The problem is that blown-in insulation was designed for modern buildings with predictable, 16" on-center 2x4 framing, whereas old houses often have unpredictable and odd-sized spaces in wall framing, making it difficult to direct the insulation where it needs to go. For example, the large, open cavities and cross-members of timber-frame construction or even early "stick built" framing, along with the haphazard placement of fire stops (blocking) and the potential for back plastering (a second coat of rough plaster inside walls), produce too many potential impediments for a good installation. These building-specific construction methods also don't facilitate consistent coverage, which means an installation with unpredictable R-values. As a result, you may not be getting what you paid for.

Even in the best of installations, blown-in insulation eventually settles into the larger cavities, leaving no insulation higher up in the walls where heat tends to escape most. The bulk of the insulation then becomes compressed on lower portions of the wall, changing the dew point of the moist air as it leaves the building (see illustration below). The condensation that results from this change in dew point further compresses the insulation, trapping moisture, which can lead to rotting wood. If you think you need blown-in insulation, discuss your house's structural design with an installer experienced in working on old houses.

Keeping Moisture in Mind

Whether you're insulating an unfinished attic or an entire house, insulation and ventilation go hand in hand. Daily activities, such as showers, laundry, cooking, and even watering plants, pump moisture into indoor air, and wherever you insulate you are at risk of trapping that moisture, which can lead to rotting wood and peeling paint. Two ways to deal with these potential problems are 1) limiting as much as possible the amount of moisture that

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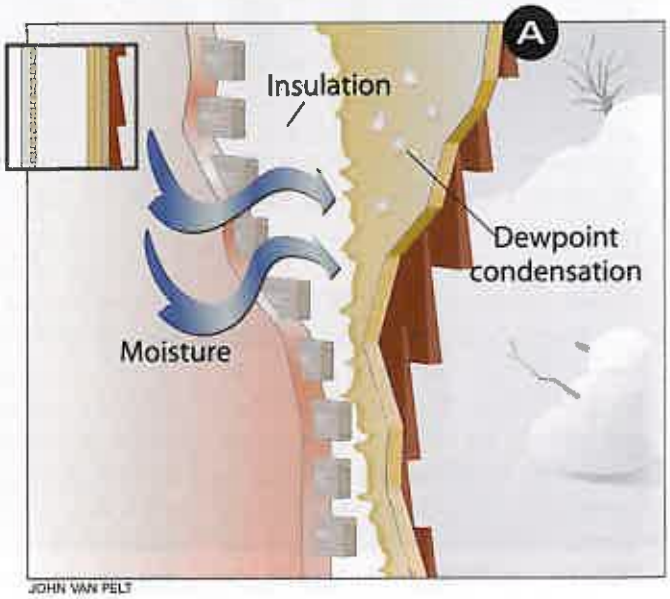
The Value of Vapor Retarders

Adding only insulation to a wall (A) keeps the exterior sheathing colder than the living space. As it migrates through the wall, moist air reaches its dew point—the point at which vapor turns to water—and condenses on the sheathing. Including a vapor retarder (B) limits moisture migration, while a vented void exhausts any moist air that sneaks through.



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Because the old loose-fill insulation was compacted and of little value, we carefully removed it using proper safety gear. Some materials that were used in the past, such as vermiculite, can contain asbestos.

Below: Spray foam insulation from cans worked well for sealing gaps in the building, as well as around pipes, thereby blocking both air flow and heat transfer.

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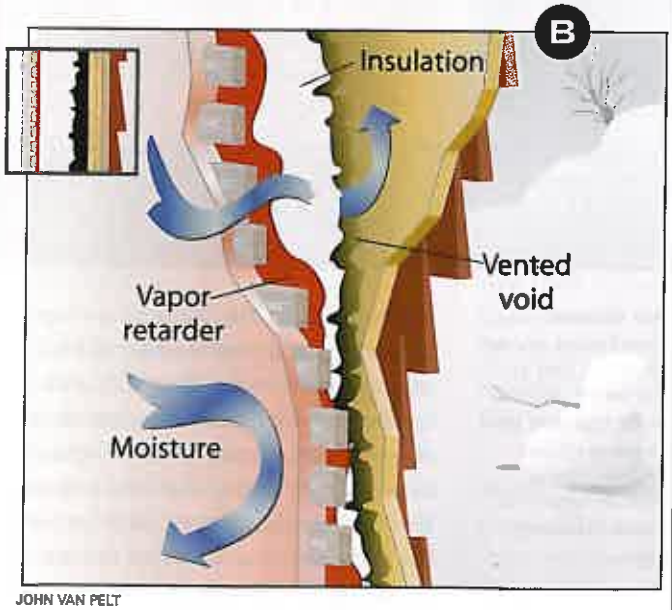

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can enter insulation from the living-space side and 2) ventilating the non-living-space side of the insulation so that moisture has a path out of the building.

Unfinished attics are key areas for ventilation. Of course, you want to prevent heat from escaping into your attic—that's why you're insulating it—but you also want to provide the warm air and the moisture it carries with a way to get out. These days, this goal is accomplished by creating a path with a combination of eave/soffit vents at the lowest edges of the roof and a continuous ridge vent along the top of the roof (see illustration on page 77). Gable vents installed in the peaks of the gable ends will also work if sized properly. As you insulate an unfinished attic, it is critical to never block this path by clogging the tight spots where rafters meet the

Above: Cut fiberglass batts with a razor knife and a straight edge by working from the vapor retarder side if there is one (we used unfaced insulation).

A Guide to Insulation Terminology

Insulation has its own vocabulary, particularly for the different types of materials available. Here's a brief description of each one.

ANDY OLENICK

Fiberglass blanket rolls, the most common type of insulation, are fine strands of glass layered in fluffy batts that trap air. With an average R-value of R-3 per inch, fiberglass blankets come in various thicknesses as well as widths that accommodate spacings for rafters, floor joists, and stud walls.

ANDY OLENICK

Rigid foam insulation is air-entrained plastic formed into sheets, with values ranging from R-3 to R-7.2 per inch. Because of its density and hardness, the insulation has a higher R-value per inch, making it more resistant to air and water vapor, but it also costs more than fiberglass.

ANDY OLENICK

Spray foam insulation comes in a can with a straw applicator so that you can reach into crevices. Easy to work with (although it expands quickly), the foam cures once it is sprayed in place to become a closed-cell system that air can't penetrate. Spray foam has an average R-value of R-5 per inch, higher than fiberglass or cellulose products.

ANDY OLENICK

Blown-in insulation is loose material installed with professional air blowers through injection holes, usually from a building's exterior. At one time, insulation consisted of loose vermiculite, a naturally occurring mineral that frequently contains a form of asbestos. Today's installers use fiberglass or cellulose particles with R-values of R-2.5 to R-3 per inch, which are comparable to fiberglass rolls.

Vapor retarders are treated papers, plastic sheets, and metallic foils that inhibit the passage of water vapor and are used to keep moisture from migrating into insulation and associated parts of the building.

walls with insulation. One way to avoid this problem is to add rafter vents, foam or plastic air spacers shaped like a W that fit between insulation and roof decking to ensure a ventilation path away from your soffit vents. In our house, we used foam.

The way to limit moisture migration in the first place is to incorporate some sort of vapor retarder (see illustration on page 74). Fiberglass batts and rolls, as well as rigid foam insulation, can be purchased with a vapor barrier on one side, or you can buy it separately. Vapor barriers must be installed facing the heated part of the house and never sandwiched between insulation layers or they will trap moisture. Barriers should be continuous, with no holes or open seams, to work properly.

When insulating an unfinished attic floor, you won't have the option of using a vapor retarder if you are covering an existing fiberglass blanket or layer of loose-fill

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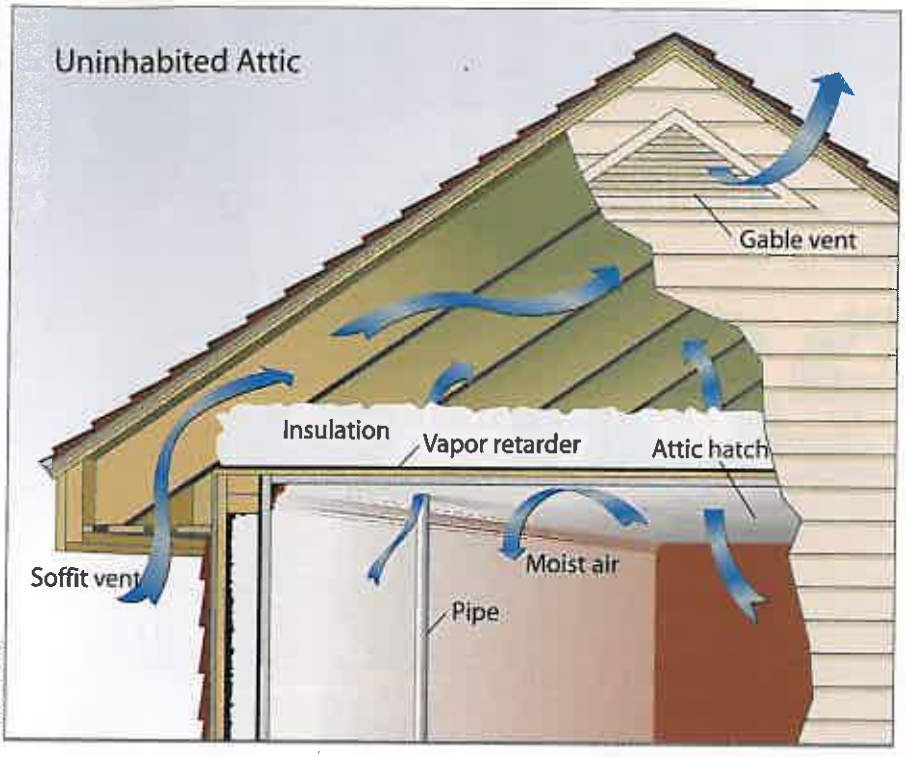
JOHN VAN PEET

The finished installation shows how we had to cut batts neatly to fit the odd joist spacing of our timber-frame attic in order to avoid creating gaps.

insulation, but you can use a vapor retarder if you are removing the old insulation or none exists. The good news is that the most continuous vapor retarder in any old house is usually the multiple layers of paint covering the walls and ceilings. Low-permeability paints, such as oil-based primers, and wallpaper that has a plastic layer work best. In our attic, we chose not to include a vapor barrier



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The key points for insulating an attic floor are 1) maintaining a ventilation path in from the eaves and out through the roof ridge or gable, making sure not to block the tight spot atop the wall, and 2) blocking all moisture paths into the attic.

For a list of SUPPLIERS, see page 100.

because the timbers and gaps made it impossible to achieve a continuous seal. Instead, we are depending on our painted ceilings to retard vapor movement.

As a general rule, when installing a vapor retarder experts recommend one square foot of free vent area per 300 square feet above the floor area. When no vapor barrier is present, the recommendation is one square foot of free vent area for every 150 square feet of attic floor.

As you install new fiberglass insulation, don't crush or cram it into a space because that reduces its effectiveness. The insulation we worked with was precut to fit nicely into standard 16" on-center modern framing joists. Of course, that didn't apply to our old house, which is timber-framed, so we cut pieces to fit with a utility knife. Use a guide against the joists as you custom-fit pieces.

Because an unfinished attic ready for insulation will have everything open and visible, it's a good opportunity to update any wiring; you should never insulate over wiring that is frayed or has worn-out coverings. If the wiring runs through joists perpendicularly, cut the insulation to fit around it. In our case, the wiring in our house was installed so that the insulation could go over and up against the ceiling light fixture with no problem.

There should be a metal fire stop around the chimney at its entrance to the attic. If none exists, have a mason install one. Building codes and insurance companies require wood to be 2" away from masonry. Fire stops are usually L-shaped, and the fiberglass should be laid up to the vertical part of the L.

Once the installation is complete, fasten your floorboards back into place. If the boards are tongue-and-groove or shiplapped, you can lay them down un-nailed for easy access in the future or secure them with power screws. Our final step was to install rafter vents from the soffits up 5' or so, with rigid foam over them to minimize the problems we'd had with ice damming. We are also building an insulated trap door that will seal off the top of the full stairway that leads to the attic. Even though we couldn't attain ideal R-value standards, we are thrilled that the ice damming on the roofline is gone and our house is noticeably warmer.

Noelle Lord operates Old House C.P.R., Inc. (www.oldhousecpr.com) with her husband, Peter, and specializes in restoring historic surfaces. She writes from her own old house in Limington, Maine.

Plug It Up

Persistent drafts only undermine efforts to insulate a house. You can plug up the leaks in several ways by 1) installing storm doors and windows and then weather-stripping around them, 2) sealing gaps in structural and foundation materials with caulking or spray foam, and 3) limiting draw from chimneys and attic access. Windy days are the best time to evaluate leaks. One easy method for detecting them is to light an incense stick and hold it in front of various areas and openings. Drifting smoke indicates that there's a draft.

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