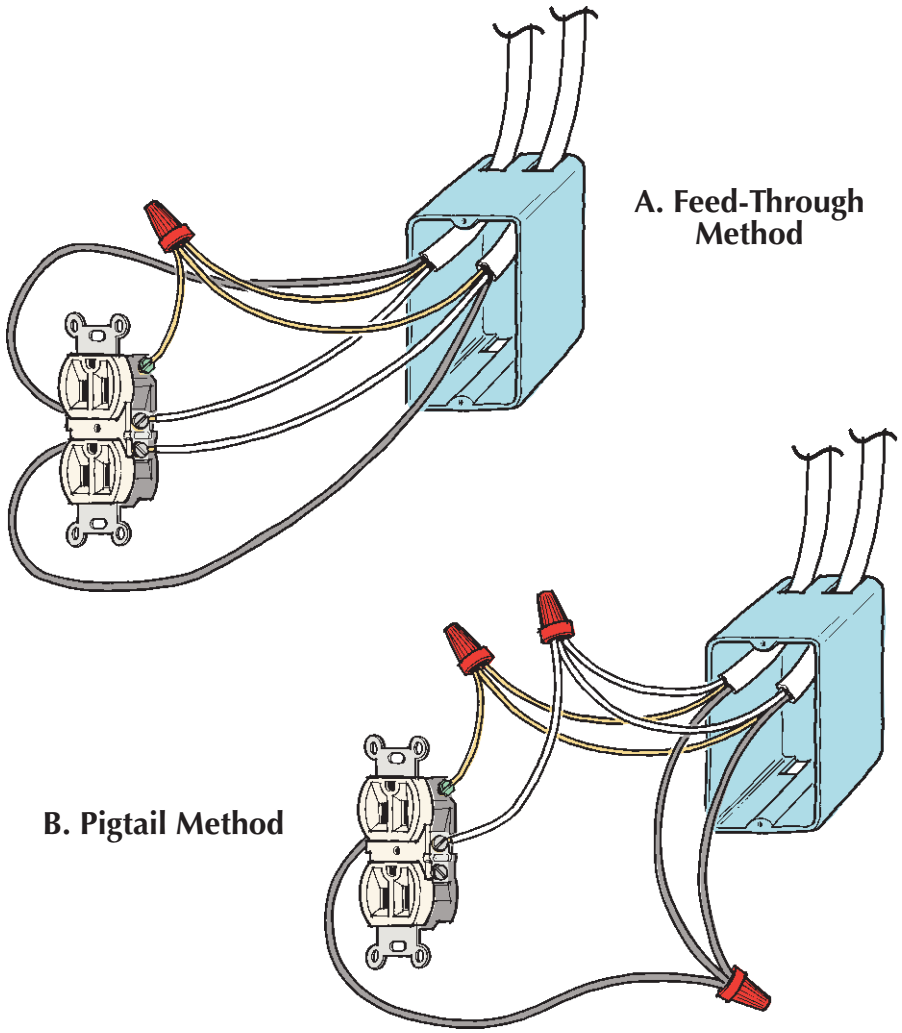
To Pigtail or Not to Pigtail?

Q. *I have always thought that the best way to wire a receptacle is to use a pigtail lead from the supply wires to the receptacle. My electrician prefers to run the supply wires, and also the wires to the downstream receptacles, to the screw terminals at the back of the receptacle. When receptacles are wired his way, with the feed-through current going through the receptacle, can downstream electrical loads overheat the receptacle?*

A. *Steve Campolo, vice president for engineering at Leviton, responds:* UL specifically tests receptacles for the ability to safely carry downstream current. This testing is usually conducted at 20 amps, since a 15-amp receptacle can be wired on a 20-amp circuit and thus carry the 20-amp feed-through current. As long as the receptacle is rated and UL-listed for feed-through wiring, as well as properly installed, it should be safe as intended by UL's Standard for Safety (UL 498), which covers receptacles.

The pigtail method transfers the connection point from the receptacle to a wire nut. So instead of the feed-through current going through the receptacle, it goes through the wire nut. Which junction is better? It's hard to say; it depends on the skill of the installer. The methods should work equally well as long as the installation is properly made in accordance with the manufacturer's instructions, and in compliance with all provisions of the *National Electrical Code* and any UL listing requirements that may apply.

Wiring a Receptacle



Hickory Flooring Over Radiant Heat

Q. *A customer wants me to install hickory flooring over radiant heat. Does hickory present any unusual problems in this application, compared to other species?*

A. *Bonnie Holmes, director of education at the National Wood Flooring Association, responds:* Hickory, which is a little more dimensionally stable than red oak, does not present any unusual problems over radiant heat. As with any installation of solid wood flooring over radiant heat, the National Wood Flooring Association recommends that only narrow boards ($3\frac{1}{4}$ inches wide or less) be used. For additional dimensional stability, it is preferable for the wood to be quarter-sawn or rift sawn.

Choosing Cellulose Insulation

Q. *What are the advantages and disadvantages of dense-pack cellulose versus damp-spray cellulose insulation?*

A. *Bill Rock Smith, building consultant and former contractor, responds:* The thermal performance and installed costs for dense-pack cellulose and damp-spray cellulose are similar. With both methods, the quality of the job is considered "installer sensitive," since cellulose needs to be installed at the correct density to avoid settling.

The disadvantage to damp-spray cellulose is the addition of moisture to the

wall. Because of this added moisture, cellulose manufacturers recommend waiting at least three days before hanging the drywall. Since dense-pack cellulose is installed dry behind a netting or reinforced polyethylene, the drywall can be installed immediately. However, since it takes extra time to install the netting or poly, the total time required for a dense-pack installation can be about the same as a damp-spray job with the drying period.

Dense-pack cellulose is prone to creeping onto the face of the framing or pushing the netting or poly beyond the face of wall, which can make drywall installation difficult. This is rarely a problem with damp-spray, since the excess material is scraped flush with the framing face using a scrubber.

Staggered Rafters

Q. *I am framing a gable roof with common rafters attached to a 2x12 non-structural ridge board. Must the rafters on either side of the ridge line up, or can they be staggered along the ridge board?*

A. *Christopher DeBlois, a structural engineer with Palmer Engineering Co. in Tucker, Ga., responds:* Rafters can be safely staggered across a ridge board in most situations. Section 802 of the *CABO One & Two Family Dwelling Code*, "Roof Framing," does not explicitly require alignment of rafters on opposite sides of a ridge board. There are certain advantages to aligning the rafters, however, and unless you have a compelling reason not to, I recommend that you line them up. Not only does it make framing ceilings and collar ties easier, the roof framing simply looks more professional when the rafters align. Having said that, in many cases staggering the rafters does not create excessive stresses in the ridge board.

To satisfy myself that the ridge board will not be overstressed, I analyzed a somewhat conservative scenario. I chose a gable roof at a 6:12 pitch with 2x10 rafters spanning 16 feet from exterior walls to a 2x12 ridge board, to carry design loads of 30 pounds per square foot (psf) live load, and 15 psf dead load. In this scenario the unbraced rafter spans are relatively long, the design loads relatively high, and the roof pitch relatively shallow. I assumed that the ridge board is #3 southern yellow pine, the weakest grade available. Finally, I framed my sample roof with the maximum possible offset; each rafter is 8 inches from the two nearest rafters on the opposite side of the ridge. In spite of all of these conservative assumptions, I found that the 2x12 ridge is not overstressed in shear or in bending, and that predicted deflections are negligible.

Whenever you must splice the ridge board, line up rafters from both sides centered on the splice so that 3/4 inch of rafter material pushes on the ridge on each side of the break. As a rule of thumb, don't offset rafters under any of the following circumstances:

- when rafter spacing exceeds 16 inches
- when the roof live load exceeds 30 psf
- when the roof pitch is 4:12 or lower
- when using a 1x ridge board, as permitted by *CABO*.

Optimal Insulation Thickness

Q. *In a heating climate (central New York), I would like to know how to determine whether adding more insulation results in diminishing returns in terms of energy savings. Is there any reason to include more than R-50 insulation in an attic, assuming the access is good?*

A. *Energy and sustainable design consultant Andy Shapiro responds:* Every inch of insulation you add to an attic results in less savings than the previous inch you added. That's just the way the physics works out. The good news is that adding another inch of insulation in an attic costs very little, if any, in added labor, so it's mostly added material costs. For a house in central New York (6,700 degree days) with typical efficiency oil heat (75%) and oil at $1.25/gallon, the cost for the heat lost through the insulation in a 1,200-sq.-ft. attic for a typical year is summarized in the table below.

Local codes usually dictate the minimum acceptable level of attic insulation. What kind of savings can a homeowner expect when they upgrade from R-30 to R-40? It would be worth another $20 in the first year. If the homeowner expects a simple 10-year payback, then up to $200 could be spent on the upgrade to R-40, and still be worth it. The added cost for R-38 unfaced batts over R-30 (retail at my lumber yard) is $0.12/sq.ft., or about $150 for the attic, so that looks like a good deal for the owner.

How about R-50? To get R-50, you'd probably add R-19 to the R-30 batts, at a cost of $0.24/sq.ft. over the R-38 batts alone, or about $290 for the whole attic. The first-year savings is $12, so with a 10-year payback, it's worth $120. That doesn't look like a great deal for the owner. It gets worse for more insulation: it would cost another $280 to go to R-60 over R-50, with a 10-year savings of $80.

This is why R-38 batts are so common in attics in heating climates. It's usually the right price point for the owner. If you are blowing in cellulose (my favorite, as it fills all the odd-shaped places well and is a recycled material), the incremental costs are a little different. All this said, I've never heard of an owner who was sorry that they put in too much insulation.

Reusing Brick

Q. *When rebuilding a chimney above the roofline, is it okay to reuse the existing bricks? I have heard that mortar does not stick as well to reused bricks as it does to new bricks. Is this true?*

A. *Richard Allen, Jr., staff engineer at the Brick Industry Association, responds:* You are correct — salvaged brick normally develop low bond strength when used in new construction. When a new brick is placed in mortar, the pores of the brick absorb the water in the mortar, drawing the cementitious material into the brick. Once the mortar has cured, the cementitious material that has been absorbed into the pores of the brick will bond the brick to the mortar, creating a solid wall.

In salvaged brick, the pores of the brick are, in essence, clogged by the hardened mortar materials, preventing salvaged brick construction from developing the same bond strength as con-

struction using new brick. So, I would be extremely cautious in using salvaged brick. For more information on salvaged brick, you can access Technical Note 15 at www.brickinfo.org.

Particleboard Under Tile

Q. *We will be installing ceramic tile flooring in the kitchen of an existing house. The subfloor consists of 1/2-inch plywood over 3/4-inch particleboard (not OSB). The joists are spaced 16-inches on-center. My plan is to install 1/2-inch cementitious backerboard on the plywood and then install the tile. Will this be adequate?*

A. *Chip O'Rear, assistant executive director of the National Tile Contractors Association, responds:* Particleboard, which easily absorbs moisture and is dimensionally unstable, shouldn't be included anywhere as part of a tile substrate. In this case, the existing plywood and particleboard subfloor layers will have to be removed and a new subfloor installed on the joists.

The best subfloor for a backerboard and tile installation is 3/4-inch plywood, glued with subfloor adhesive and mechanically fastened every 8 to 12 inches in the field, and every 6 inches on the edges. Leave a 1/8-inch gap between plywood sheets for expansion relief. Then install your 1/2-inch backerboard in a freshly combed bed of thinset (to give uniform support), fastening the backerboard with corrosion-resistant fasteners. Since installation requirements vary depending on the backerboard manufacturer, always verify a manufacturer's requirements before proceeding.

Fuel Cost vs. Attic Insulation R-Value

(6,700-degree-day climate, 1,200-sq.-ft. attic)

Attic insulation R-value	Annual fuel cost for attic heat loss	Annual savings for each R-10 increment of insulation added
10	$235	—
20	$118	$117
30	$79	$39
40	$59	$20
50	$47	$12
60	$39	$8

GOT A QUESTION? Send it to On the House, *JLC*, 186 Allen Brook Ln., Williston, VT 05495; or e-mail to *jlc@bginet.com*.