Notches & Holes in Joists

Q. *What's the largest hole I can drill in a 2x8 joist? What about notching? Also, how close to a bearing point can I drill a hole?*

A. *Corresponding editor Paul Fisette responds:* The rule that most codes use is that holes can't be any closer than 2 inches from the top or bottom of the joist, and cannot be within 2 inches of any other hole. If the joist is notched, you can't drill the hole within 2 inches of the notch. The hole's diameter can't exceed one-third of the joist depth. So in your case, the largest hole would be 2$^3/_8$ inches.

Notches in the top or bottom of a joist can't exceed one-sixth the depth of the joist and can't be longer than one-third the joist depth. Notches must not be made in the middle third of the span. If a notch is made at the very end of the joist, it can't exceed one-quarter the joist depth.

As always, check your local code to make sure it's in keeping with the norm.

Ceiling Vapor Barrier — Yes or No?

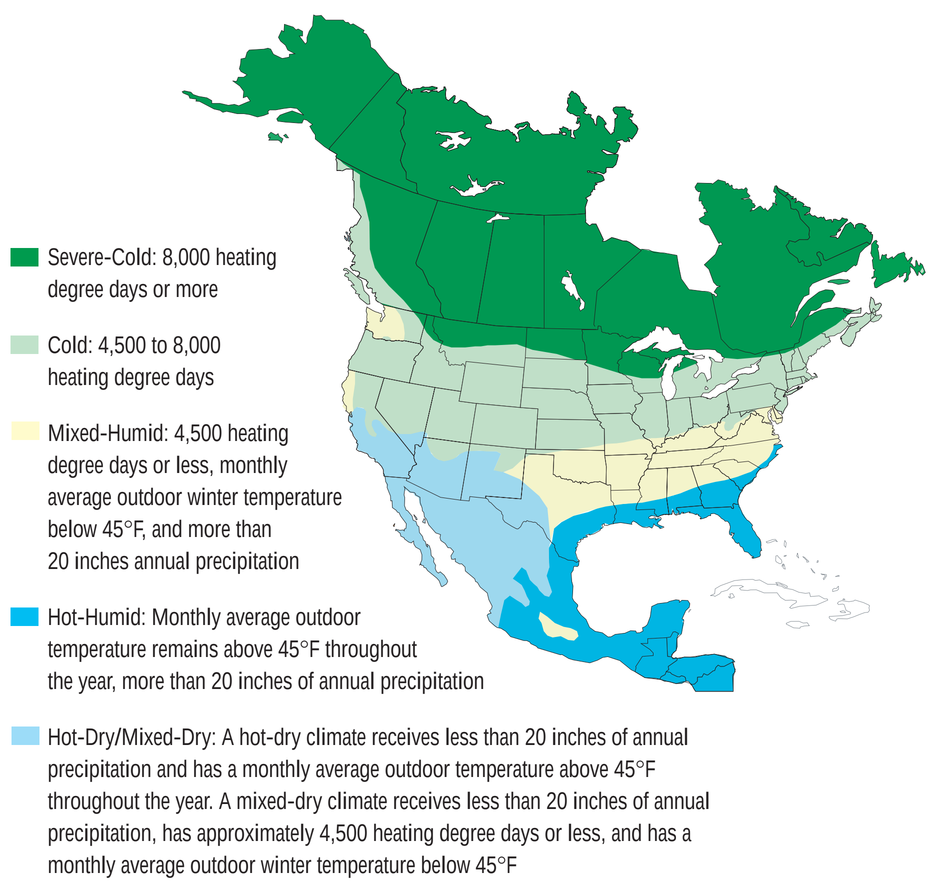
Q. *Should you put a vapor barrier in an insulated ceiling or not? I build in a cold climate, where many longtime builders swear that you shouldn't put a ceiling vapor barrier in. The reasons go something like, "Because you have to let the moisture escape," or "Because the house has to breathe out the top." What do the experts say?*

A. *Joe Lstiburek responds:* To heck with the experts — here's my answer. Plastic *vapor barriers* should only be installed in vented attics in climates with more than 8,000 heating degree days. You can forego the plastic and use a *vapor retarder* (kraft-faced insulation or latex ceiling paint) in all other climates except hot-humid or hot-dry climates. In hot-humid climates, attics should not be vented and vapor retarders should not be installed on the interior of assemblies. In hot-dry climates a vapor retarder should also not be installed, but attics can be vented. *All* attics — vented or unvented — should have an *air barrier* (a properly detailed airtight drywall ceiling, for example) regardless of climate.

Omitting a ceiling vapor barrier by arguing that "you have to let the moisture escape" or "because the house has to breathe out the top" is actually correct, in a way. It's also incorrect, in a way. Now, I'm a real fan (ha, ha) of controlled mechanical ventilation to limit interior moisture levels in cold and mixed climates, as well as to limit other interior contaminants in all climates. In other words, all houses require controlled mechanical ventilation in order to "breathe." It is also my view that this necessary air change should *not* happen because of a leaky attic ceiling, attic vents, or even leaky walls. Hence the requirement for an air barrier and controlled mechanical ventilation in all houses regardless of climate.

Having said that, I do not have a problem with relieving some of the moisture load in the house via diffusion. This can be achieved through a roof assembly designed to handle it, such as a vented attic in a moderately cold or mixed climate. It's important to understand that this is a *climate-specific* recommendation. In a well insulated attic in a very cold climate (more than 8,000 heating degree days), there is not enough heat loss into an attic from the house to allow for much moisture removal through ventilation. That's because attic ventilation requires heat loss to remove moisture from attics. Cold air can't hold much moisture. So ventilating a heavily insu-

Moisture & Temperature Regions



lated attic with outside air when it is really cold does not remove moisture. We do not want any moisture to get into an attic in a severely cold climate for this reason. As you move south into regions where it is not so miserably cold, this changes: Hence, the recommendation for a vapor *barrier* in a severely cold climate but only a vapor *retarder* in most other locations.

In the old days in severely cold climates, where attics were poorly insulated, it was okay to omit a plastic ceiling vapor barrier. The heat loss from the house warmed the attic sufficiently to allow attic ventilation to remove moisture from the attic. Cold outside air was brought into the attic and warmed up by the escaping heat loss, giving this air the capacity to pick up moisture from the attic and carry it to the exterior. This worked well until we added large quantities of attic insulation. With the added insulation, the attic stayed cold and so did the ventilating air from outside, which was now unable to effectively remove attic moisture. Hence the need to reduce moisture flow into the attic and the need for a vapor barrier.

There's one other important qualification: Vapor moves in two ways, by diffusion through materials, and by air leakage through gaps and holes in building assemblies. Between the two, air leakage moves far more moisture than vapor diffusion. A vapor barrier in an attic assembly in a severely cold climate with the absence of an air barrier will likely be ineffective. On the other hand, an air barrier (a properly detailed air-tight drywall ceiling, for example) in the absence of a vapor barrier *can* be effective, since it stops the flow of vapor-laden air. You can't just install plastic in a ceiling and assume it is also an air barrier. For plastic to be an air barrier, it needs to be continuous, meaning all joints and penetrations must be taped or caulked.

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Performance of Wood vs. Steel Beams in a Fire

Q. *Is it true that a wood beam is safer than a steel beam in a fire? I've heard that metal twists and deflects in the presence of heat, while a wood beam will withstand the heat and a great deal of fire before burning through enough to collapse.*

A. *Brad Douglas, director of engineering at the American Forest & Paper Association, responds:* Large solid-sawn and glulam timbers provide a substantial degree of fire endurance. The superior fire performance of large timbers can be attributed to the charring effect of wood. As wood members are exposed to fire, an insulating char layer is formed that protects the core. Thus, beams and columns can be designed so that a sufficient cross-section of wood remains to sustain the design loads for the required duration of fire exposure.

A fire test conducted in 1961 at the Southwest Research Institute compared the fire endurance of a 7x21-inch glulam timber with a W16x40 steel beam. Both beams spanned approximately 43.5 feet and were loaded to full design load (approximately 12,450 lb.). After about 30 minutes, the steel beam deflected more than 35 inches and collapsed into the test furnace, ending the test. The wood beam deflected $2\frac{1}{4}$ inches with more than 75% of the original wood section undamaged. Calculation procedures provided in a new publication available from the American Wood Council, entitled *Technical Report 10: Calculating the Fire Resistance of Exposed Wood Members,* estimates that the failure time of the 7x21-inch wood beam would have exceeded 65 minutes if the test had not ended at 30 minutes.

For additional information on the fire performance of wood, contact the American Wood Council at 202/463-4713 or www.awc.org.

GOT A QUESTION? Send it to On the House, *JLC*, 932 West Main St., Richmond, VT 05477; or e-mail to *jlc@bginet.com*.