Venting Details for Cathedral Ceilings

by Robert Hatch

Practical work-arounds for venting hips, valleys, and other tricky intersections in cathedral roofs

As a builder in the Northeast, where cold, snow, and ice are the main course on the winter menu, roof ventilation is one of my top concerns. The primary reason is that without good ventilation, most roofs in snowy climates will suffer from destructive ice dams.

I've chipped away at my share of ice dams, and in my experience the cause is always the same: Hot air is all dressed up and has no place to go. Every house ever built has heat loss through the roof. When air in a rafter bay is warmed, it's natural for it to rise. If it can't escape, it's going to well up, transfer its heat to the roof deck, and cause the snow on the roof to melt. The melted snow trickles down the roof slope and refreezes as an ice dam at the eaves. The result: Water backs up behind the ice dam and leaks into the roof.

To protect the roof against this backed-up water, I always apply a 3-foot width of bituminous membrane continuously along eaves and valleys. That's the industry standard, but I can say from experience that the membrane by itself is not always enough. It makes more sense to attack the source of the problem — the melting — than to wrestle with a subsequent refreezing and water backup.

Venting allows you to get the warm air out of your roof system before it starts melting the snow. Consider each rafter bay as a chimney that allows warm air to rise, drawing cold air in from below. Build these mini-chimneys so that they are continuous from soffit to peak, and you've got it licked. On a simple attic roof, it's no sweat to install soffit and ridge vents, and additional gable vents where appropriate. But start with a cathedral roof and add details like skylights, a clerestory, hips, valleys,

Venting a Hip or Valley

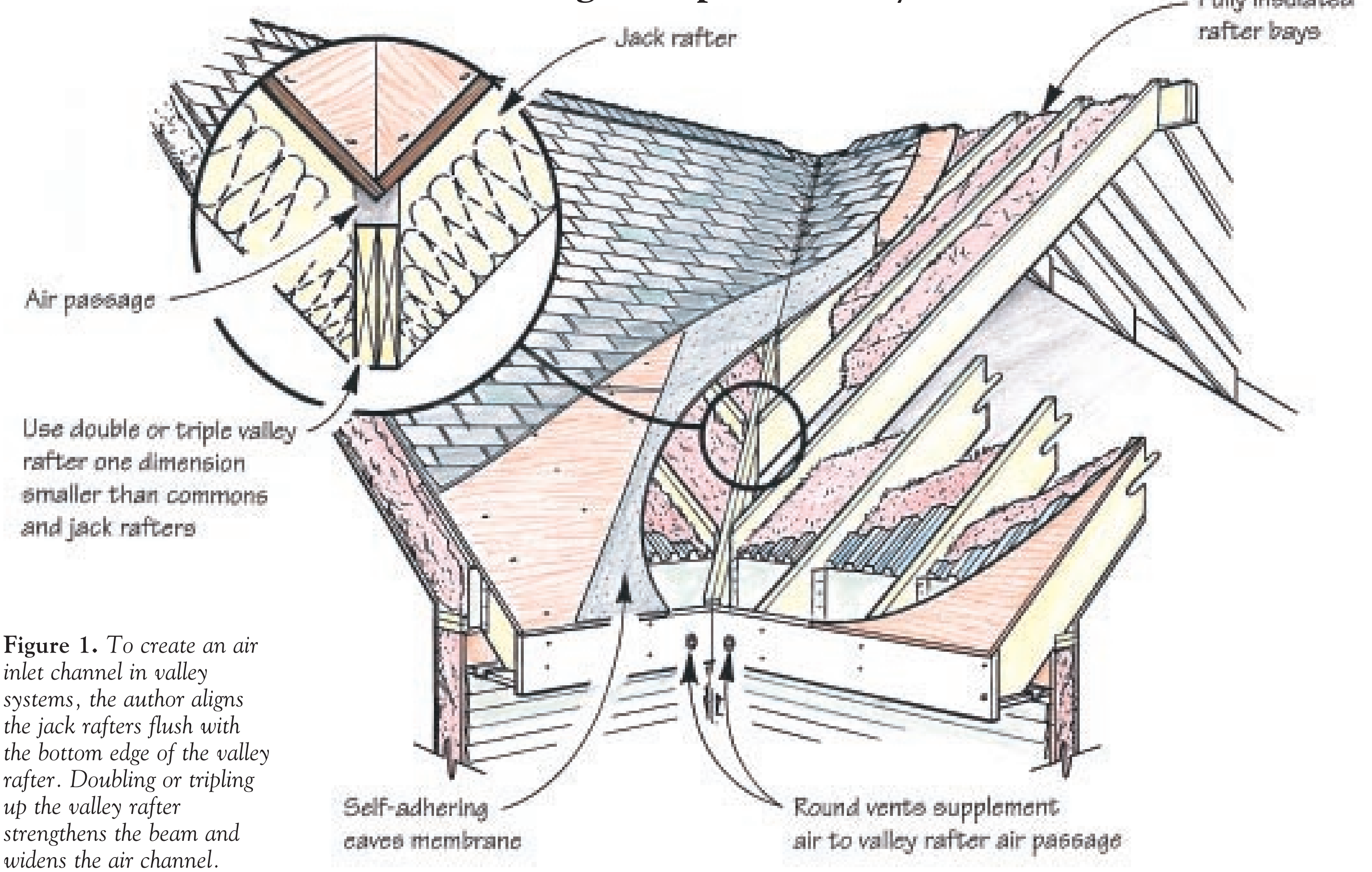

Figure 1. *To create an air inlet channel in valley systems, the author aligns the jack rafters flush with the bottom edge of the valley rafter. Doubling or tripling up the valley rafter strengthens the beam and widens the air channel.*

and dormers, and you've got to get creative. Terminate a cathedral roof against a wall, or join it to an upper roof of a different pitch, and you've got another set of problems. Dealing with tricky spots like those is the focus of this article.

Hips and Valleys

Cathedral hips and valleys commonly create a venting puzzle. With valleys, the problem is giving air a way in at the bottom; with hips, it's giving it a way out at the top. The solution varies from case to case, but here are a few techniques that have worked for me.

On traditional textbook valleys and hips, the plumb cuts on jack and common rafters will always be longer than the width of the valley or hip rafter. If you align the hip or valley rafter with the bottom edge of the jacks and ridge (see Figure 1), you will create an air passage the length of the valley or hip, and allow each subsequent bay to breathe.

On roof pitches of 8/12 or greater, this will create a trough at least $1^1/_2$x$1^1/_2$ inches — the minimum air passage I would allow for a hip or valley. On roofs pitched less than 8/12, the space is smaller. For these applications, I either install a smaller-depth hip or valley rafter or double up the hip or valley rafter to provide a wider air passage. On shallow pitches (under 4/12), I'll do both.

On roofs where a valley is created on top of a run of common rafters, the process is much the same. Make sure that the plate the jack rafters rest on is narrower than the seat cut of the jacks, and cut away or hold up the sheathing on the main roof deck to allow airflow to enter these bays (Figure 2). On a remodel, make this vent cut on the main roof's sheathing before the valley jacks are installed; otherwise, the tails of the seat cuts will get in the way and make cutting out the sheathing awkward.

At the eaves end of hip and valley rafters, I try to supplement the soffit vent if possible. If I'm running strip vent or ventilated drip-edge and I can sneak in a few round louver vents on the fascia adjacent to a hip or valley, I will. These narrow passages are asked to feed and vent a number of rafter bays, and they need all the airflow they can get.

On steep-pitched hips, I hold back the sheathing and install shingle ridge vent, just as I would on a ridge — except that the lower 3 feet is for aesthetics only. It's not a good idea to carry a hip vent all the way to the eaves, where an ice dam may be lurking later on in the season. Instead, I install bituminous membrane along the eaves and over the lower portion of the hip to safeguard against a possible backup.

Skylights

Any time you install a header in a rafter bay, you effectively block the vent and allow a hot spot to develop. This is true for most skylights and chimney openings, as well as at dormers that project through the roof. I routinely notch the tops of rafters above and below such openings to allow airflow into adjacent unrestricted bays (Figure 3). I cut these notches on an angle that expedites upward airflow.

In my area, we routinely use 2x10 or 2x12 rafters for the sake of installing R-30 batt insulation, even when 2x6 or 2x8 rafters would be adequate for the span. So a 1x6 notch on the top

"California" Valley

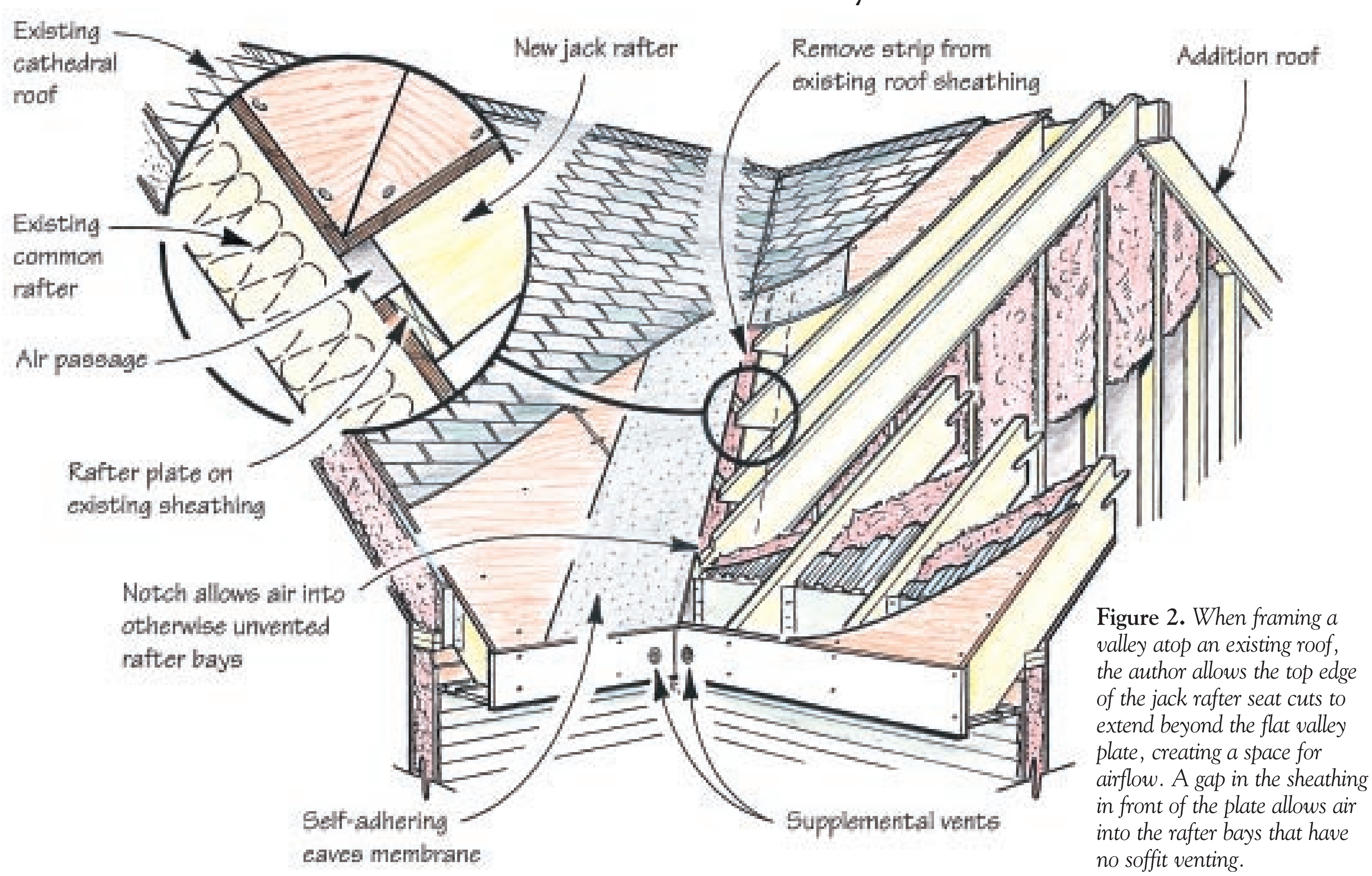

Figure 2. *When framing a valley atop an existing roof, the author allows the top edge of the jack rafter seat cuts to extend beyond the flat valley plate, creating a space for airflow. A gap in the sheathing in front of the plate allows air into the rafter bays that have no soffit venting.*

Venting Around Skylights

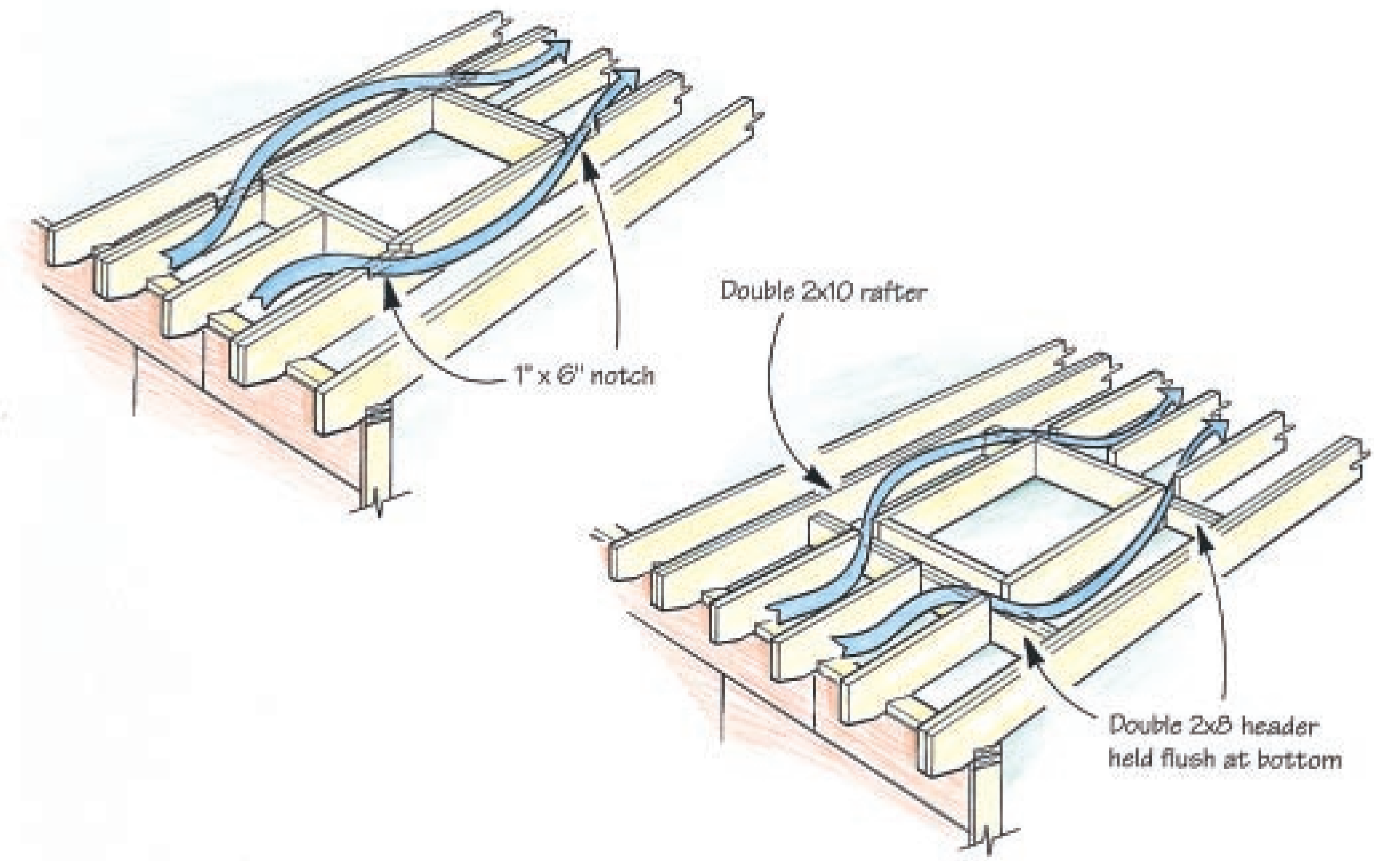

Figure 3. *To allow ventilation of the rafter bays above and below a skylight, the author sometimes notches the top edge of rafters around the rough opening (left). Check with your building official before you do this to be sure the remaining rafter is strong enough to meet code. If you can't notch the rafters, use narrower lumber for the headers, doubling or tripling as necessary. Install the rafters flush to the bottom edges of the headers (right).*

edge of a 2x12 doesn't jeopardize the structural integrity of that portion of the rafter required by code — I'm substantially overframing to begin with. Since my purpose is to enable air to flow for venting, I have yet to encounter a building inspector who wouldn't give his blessing to this procedure. But technically, it could be considered a code violation, so always check first, and never notch a rafter unless it is significantly wider than required for the span. If you're not certain, don't cut it.

Also, watch out for knots in the area of the notch. Under accepted lumber grading rules, knots near the edge of a board will disqualify the piece for joist and rafter structural grades, because the knots weaken the wood. However, boards are allowed to have knots as large as $1^1/_2$ inches in diameter towards the centerline, where the stresses aren't as great. If notching your rafter would bring the edge close to one of those big knots, don't make the cut.

If you can't notch the rafters, here's another technique, similar in principle to the method of using smaller-dimension stock for hip rafters. When you head off above and below the skylight, use stock a size smaller than the rafters, doubling or tripling the headers as needed for strength. Hold the headers flush with the bottom edge of the rafters, not the top. The 2-inch space between the header and the sheathing will allow air to move through.

Compound Roofs

Wherever a low-pitched roof merges with a higher-pitched roof, as with shed dormers and some porch or room additions, look for water to back up at the intersection line. Because this configuration commonly occurs as an add-on, there is likely to be a lot of difference in thermal and moisture protection between the upper and lower roof sections. For example, the lower roof may cover an uninsulated porch, or it may be well insulated and merge with an uninsulated attic.

When working on this kind of configuration, I insist that the lower roof be continuously vented into the upper roof (Figure 4). If the design or budget won't allow that, I won't guarantee the roof — I've repaired too many leaks on roofs of this shape, and a few out of my own pocket.

I prefer that the rafter layout be the same between the upper and lower roof. On a retrofit, we cut a slot in the roof deck of the main frame to pick up the venting of the lower roof. If it's a full cathedral we're tying into, and there's no room in the rafter bays to perfect a vent, then we strap the upper roof section and resheathe it to create the vent chase, like the way we treat cathedral roofs. It doesn't matter if the lower roof covers an uninsulated porch — it should still vent to the upper roof.

Venting Compound Slopes

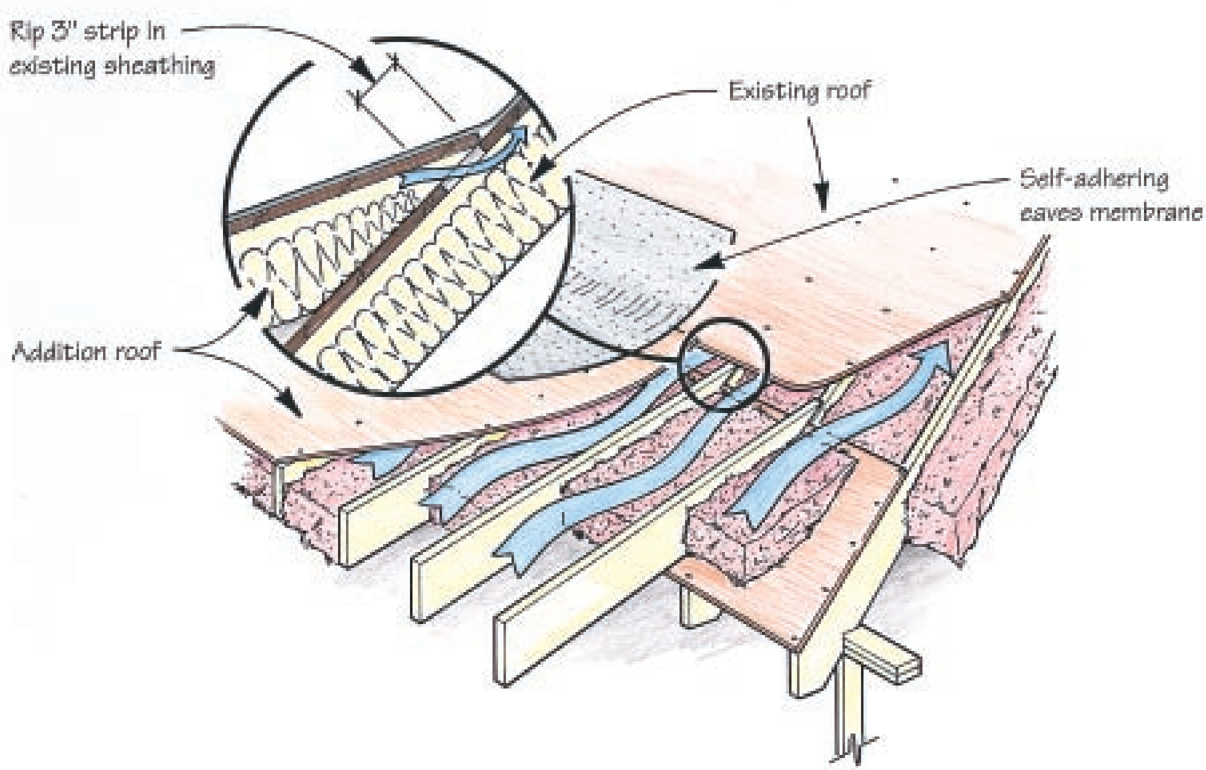

Figure 4. *Where a low-pitched roof below adjoins a higher-pitched roof above, the author removes a 3-inch strip of sheathing from the upper roof and connects the vent channels in the lower system to those in the upper system, allowing free airflow through the entire roof assembly. Even with the venting, he applies a 6-foot width of bituminous membrane, 3 feet above and 3 feet below the joint, to protect against backed-up ice and water.*

As further insurance, I always apply a 6-foot row of bituminous membrane at the intersection of these two roof sections (3 feet above the joint and 3 feet below). Even with correct venting, I've seen a few cases where in the spring there was a good layer of snow on such a roof, followed by a heavy spring rain, and the lower roof become saturated and backed up at the juncture.

Venting Over Foam Roof Decks

Many New England vacation homes feature a cathedral ceiling framed with exposed timbers, 3 to 4 feet on-center, with 2x6 tongue-and-groove sheathing, a 2-inch layer of foam insulation, and shingles installed with 3-inch roofing nails. If no vent is provided, there's trouble brewing. I get to see a lot of these roofs, because they leak like sieves.

For a retrofit, we strip the roof to the decking to inspect it for soundness and allow it to dry. Then we install a double layer of 2-inch rigid foil-faced insulation,

Venting Over Foam Insulation

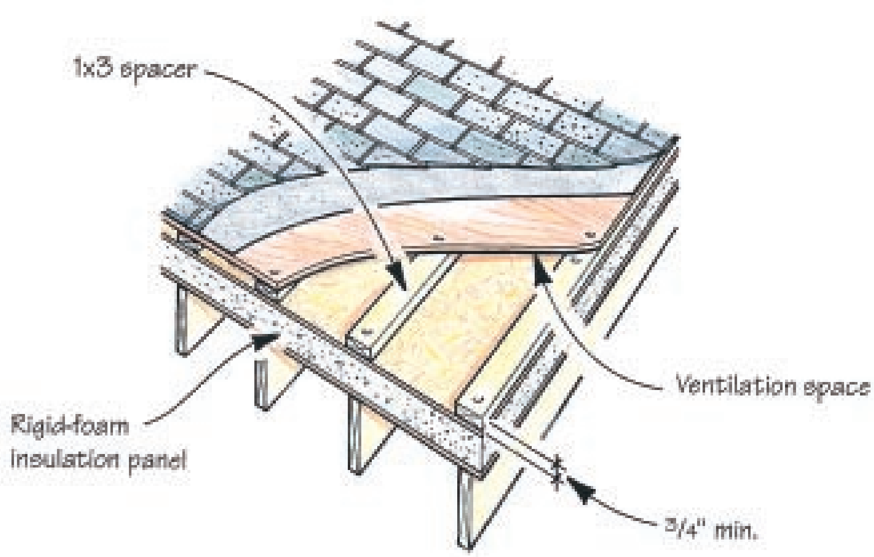

Figure 5. *The author ventilates foam-insulated cathedral roofs by attaching strapping through the foam into the deck below, 16 inches on-center, using 6-inch screws. With structural foam panels, shown here, the strapping can be installed directly to the panel's OSB face. Sheathing nailed to the strapping forms a $^3/_4$-inch-thick vent channel.*

Where Roof Meets Wall

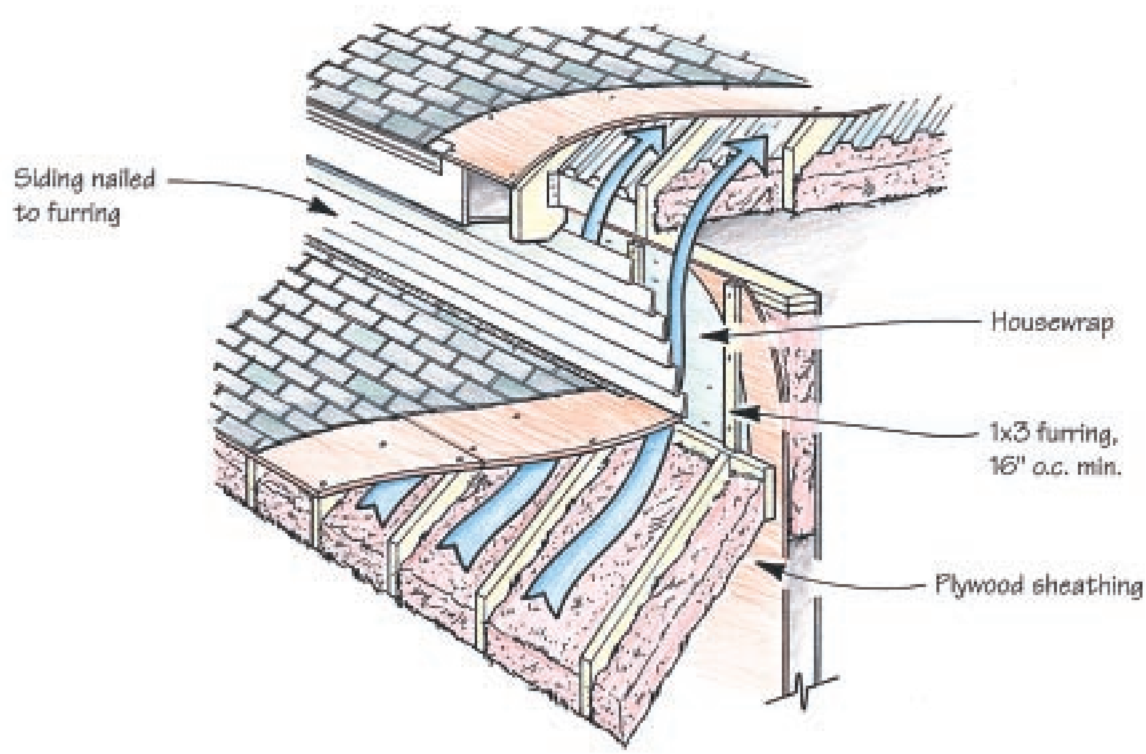

Figure 6. *To vent roofs that terminate against a wall at the top, the author prefers to connect the roof venting channel to a vent channel in the wall, which he forms by nailing strapping to the wall studs. The wall vent system allows air to move up into the upper roof system and exit the building via the upper ridge and gable vents.*

staggering the joints to provide half-laps on these panels. All roof projections or penetrations are tightly sealed with spray foam. Next, we apply 1x3 strapping in vertical rows 16 inches on-center, securing it with 6-inch screws through the insulation and into the decking. We then nail 1/2-inch plywood to the strapping to create 3/4x14-inch continuous vents (Figure 5). At the eaves, we install a vented drip-edge over a band of bituminous membrane. Then we shingle the roof and apply a vented ridge cap. With 4 inches of foam running continuously, there is little opportunity for thermal bridging or the transfer of heat to the roof deck. Even in the worst of winters, I've yet to see any significant ice dams occur on this type of roof system.

On a remodel, this system requires that the fascia be supplemented or replaced with wider trim to cover the raw edge of the built-up insulation. On a budget, the end caps of commercial metal roofing will work as well, and you can pick a color to match the rest of the building.

Roof-Wall Junctures

The juncture of a roofline and a sidewall is a likely spot for warm air and moisture to become trapped. I typically use one of two methods to provide venting to these roofs (Figure 6). On new construction, if the sidewall above isn't too cluttered with window openings, the trick is to apply lengths of strapping to the outside edge of the dormer or clerestory stud wall before sheathing is applied. This creates a 3/4-inch vent chase at the top plate of the dormer for venting to continue into the upper roof. If there is a window or two in the sidewall, I strap the perimeter of the rough opening. The vertical strapping applied to cripple studs below any openings are held short about 6 inches from the sills to allow lower rafter bays to vent up and around window openings.

The other method I've used is to leave a 2-inch gap in the sheathing of the lower roof deck where it butts into the sidewall. I split lengths of rigid ridge vent and install it across this gap, then cover the ridge vent with a bend of roll flashing that is incorporated into the sidewall. Commercially made metal sidewall flashing will do the same, but most lumber companies don't stock it. Rather than deal with special orders and lead time, I find it simpler to make up the vent as I've described. (Also, the ridge vent/flashing system offers the opportunity to create a wider drip cap than is provided by the commercial vents I've seen. This reduces the chance that backup or wind-driven rain will enter the vent.)

On an addition or retrofit, it's more practical to use the second method. Where possible, though, I prefer the furring method because it provides sealed venting and vents the dormer or clerestory sidewall as well as the roof. Otherwise, snow lying where the roof meets the wall melts and gets drawn into the wood of the sidewall, causing the wood to rot and paint to blister and peel. Venting the sidewall goes a long way toward remedying this problem. ■

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