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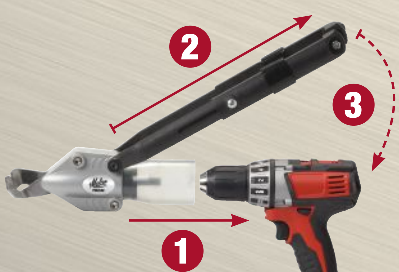

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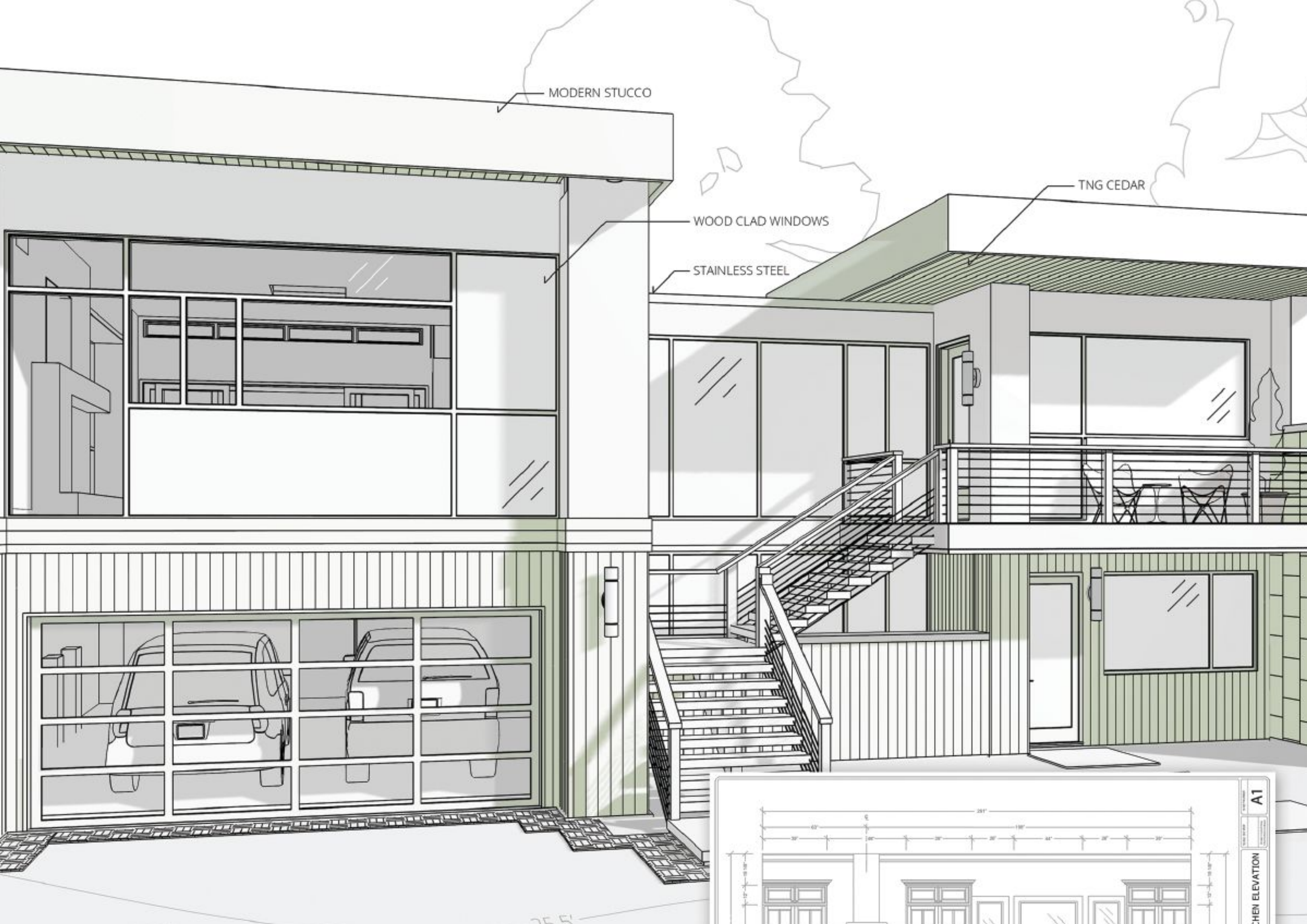

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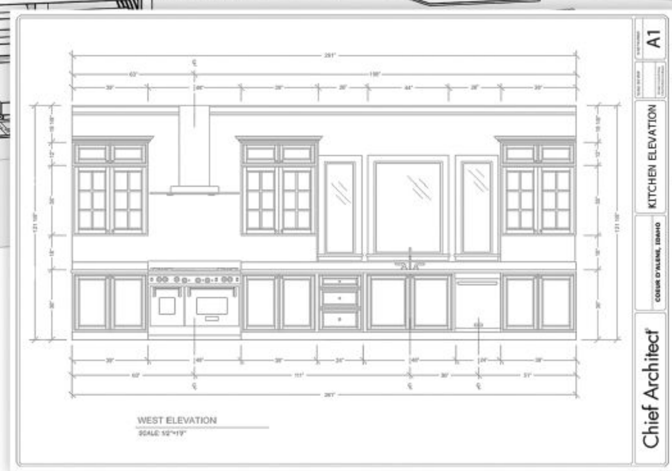

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On the cover: Emanuel Silva of Silva Lightning Builders, in North Andover, Mass., installs solid blocking to stiffen the new joists in an old, sagging floor. Photo by Carter Silva.

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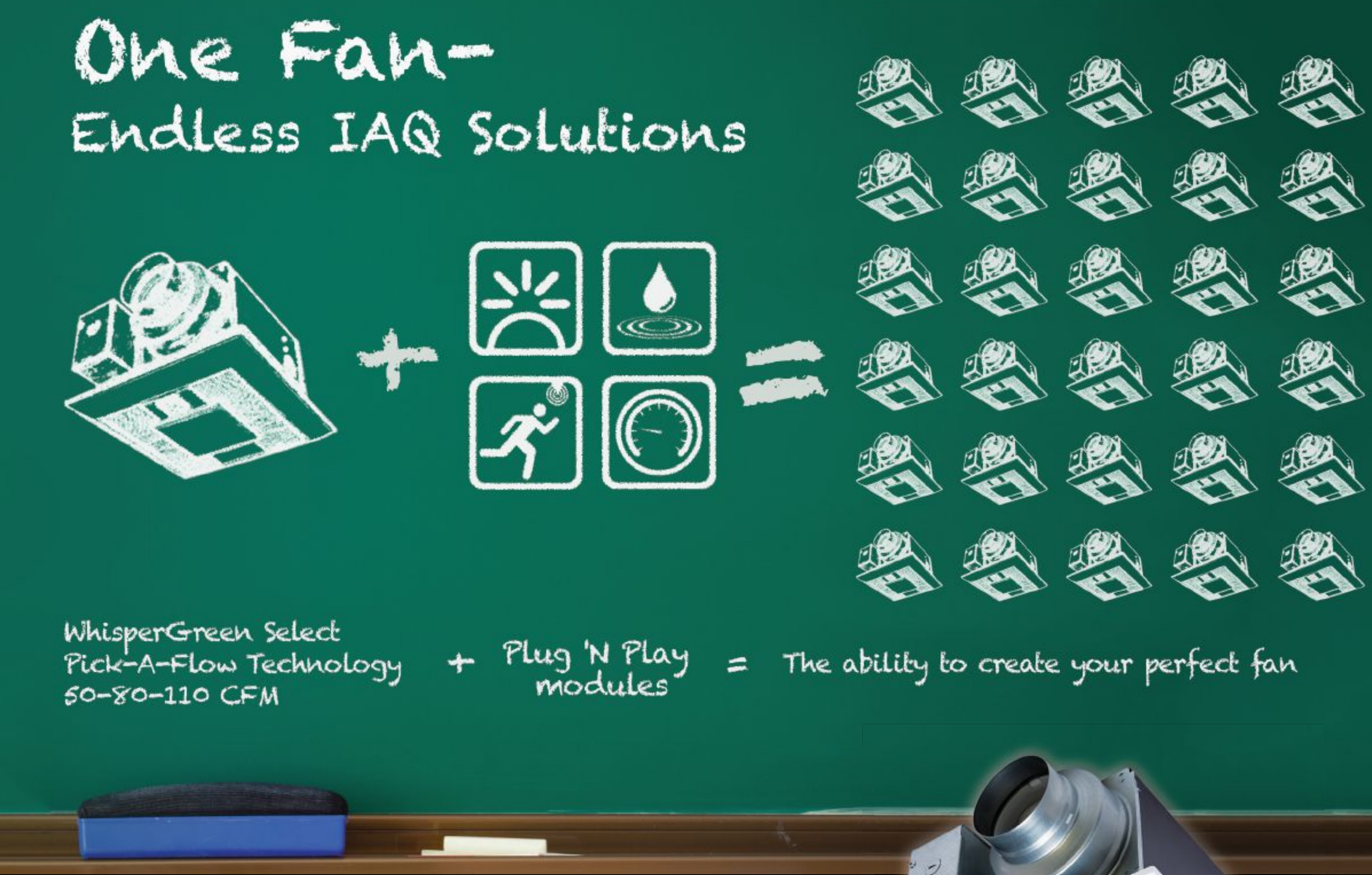

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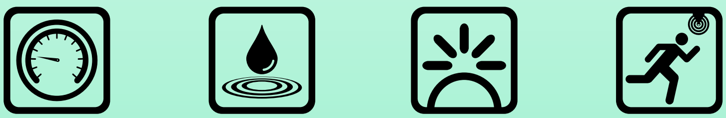

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"Above-Code Wall Systems," by Ted Cushman (Dec/13)

I read "Above-Code Wall Systems" with great interest. It's great to see the wealth of ideas that the push for a higher-performance building envelope is generating. However, I feel that there hasn't been a proper assessment of the long-term robustness of these assemblies from a building science perspective. There seems to be an assumption in some of these assemblies that normal rules of moisture management and vapor diffusion don't apply—as if they were above the code in the sense of being above the law. Vapor drive in our cold northern climate is mostly from the inside to the outside as warm air and vapor from the heated interior try to equalize to the exterior. In a southern cooling climate, vapor drive is reversed. As the saying goes, "The south sucks and the north blows."

Even more important than managing vapor diffusion is inhibiting moisture-laden air from getting into the wall assembly from the interior. Therefore, the vapor control layer and air barrier need to be toward the interior in our northern climate and be vapor-open to the outside. I would be concerned about wrapping the exterior of a house with Grace Ice & Water Shield (without any vapor closed foam on the exterior to bring the dew point in) as on the Norwich, Vt., house, making it vapor-closed to the outside. Also, there was no clearly defined air barrier. It also appears that the Belfast, Maine, Co-Housing unit has an unvented roof, which would make it vapor-closed to the outside—unless wood shingles were used.

I am aware that the sellers of Intello are telling everyone that it solves all moisture-management issues, which seems at least debatable. Moisture-management issues are actually more important in a super-insulated shell because the exterior surface of the wall will be colder and therefore more prone to condensation than in a code-built house.

I would also like to see builders and architects take global warming potential into consideration when choosing insulation materials. I feel bad for the organic farmers living in a box of petrochemical foam. I'm sure that if they knew more about it, they wouldn't have chosen those materials (considering an organic farmer's commitment to protecting the environment).

I would like to see a thorough building-science-based assessment of the risks involved in "above-code" assemblies, stressing the importance of moisture management as a supplement to these valuable case studies in a future issue. If even one of these super-airtight, super-insulated assemblies fails due to improper moisture/mold risk analysis, it will cast doubt on the rest of us who are building Passive Houses or any "above-code" houses.

Great article, great magazine! *—Indigo Ruth-Davis, Certified Passive House Consultant, Montpelier Construction, Montpelier, Vt.*

"Building a Double Winder Stair," by Dave Holbrook (Dec/13)

I enjoyed the double-winder-stair article. While the "Winder Options" drawing on page 59 is only presented as a hypothetical (since it is not how the author built his stairs), it does contain an error that readers should keep in mind. The caption states:

"... it also requires three common treads (instead of two) with a rough depth of 9 ½ inches, which, with a minimum nosing of ¾ inch, would meet the code minimum depth (10 inches)."

This statement and the associated drawing are incorrect. The IRC and IBC have always measured the horizontal depth of the stair tread from the end of the nosing projection to the end of the next nosing projection (the foremost projection). You cannot add the distance of the nosing projection to the tread depth, because the next nosing (on the next tread up) will extend over the top of the tread distance below. Essentially, with a minimum 10-inch distance (nosing to nosing) and a minimum nosing of ¾ inch, you can never have less than 10 ¾ inches of "foot placement area." *—Glenn Mathewson, MCP, Westminster, Colo.*

"Top 10 Building Science Secrets," by Allison Bailes (Oct/13)

JLC *Online comment:* In [building science secret] #4, the author writes that the 1% uninsulated area of a 1,000-square-foot attic floor yields a 27% decrease in overall performance of the attic insulation area. Please show the calculations and explain the thermodynamics of this. I believe it but want to understand better how and why it works. *—dogdad*

JLC *editors respond:* Allison Bailes, addresses the thermodynamics of this kind of problem in detail in his Energy Vanguard (energyvanguard.com) blog post "Flat or Lumpy—How Would You Like Your Insulation?" and he goes into detail about the specific issue of the reduced insulation area from pull-down stairs in the post “Attic Stairs—A Mind-Blowing Hole in Your Building Envelope.”

In a nutshell, you can’t just average the R-values (resistance to heat flow). You can, however, average the heat flow (which is U, the inverse of R). Heat takes a path of least resistance; it flows more where there is less resistance (less insulation) than where there is more resistance (more insulation).

The average U-factor of a building assembly is calculated using this equation:

$$\text{Average U} = \frac{U1A1 + U2A2 + \ldots}{\text{Total Area}}$$

The number of U’s and A’s in the equation varies depending on the number of different materials in a building assembly.

Bailes simplifies this case by ignoring all the ceiling framing and finishes, and boiling it down to just two materials—the insulation and the stairs—since these are the two things he is comparing. He has a 1,000-square-foot Total Area, composed of 990 square feet of R-38 insulation, and 10 square feet of attic pull-down stairs, which he assigns an R-value of 1. Since heat flow (U factor) is the inverse of R-value, he gets: $U1 = \frac{1}{38} = 0.026$, and $U2 = \frac{1}{1} = 1$. Therefore, he has 990 square feet at U-0.026 and 10 square feet at U-1. Plugging these values into the equation, we get:

$$\text{Average U} = \frac{(0.026 \times 990) + (1 \times 10)}{1{,}000}$$

$$= \frac{35.74}{1{,}000} = 0.036$$

Now let’s convert that back to an R-value: It’s the inverse of 0.036, or 1 ÷ 0.036, which equals R-27.8. This reduced R-value is 73% of R-38, or, as stated originally, 27% less.

The following comment refers to the same article as the comment and response above:

The points about ductwork made in “Top 10 Building Science Secrets” are especially salient—many production builders do a terrible job with HVAC. Often it amounts to a tangle of flex ducts thrown into a huge wasted attic space (and we can talk about the design and value-engineering sense of having another entire story’s worth of volume that is totally unusable—usually even for storage). Flex duct is, of course, marginally insulated, but worse, it’s almost never sealed at the terminations, which means that a ton (probably literally) of cooling is escaping into a 120° high-humidity attic. We’ve seen condensation damage and mold happening in homes that are barely complete and waiting for their first occupants.

The other hideous trend is using one giant return air grille in the center of the house to save money. Aside from sounding like a tornado when the air handler turns on (often in million-dollar-plus homes), it creates horrible drafts and makes the system impossible to balance. —*Joe Stoddard*

Cost of Helical Pile Foundations

Contractors weigh in on the advantages of helical piles over concrete tubes, in this thread from 2012

I'm intrigued by helical coil technology, but everyone I've spoken to says they're more money than conventional concrete. Wondering if someone with experience could speak to their cost for new construction vs. Sonotubes. *—cdservices, Boston*

Helical pile, not "coil." On face value, the cost of the concrete and tube are minimal and are way cheaper than any helical pile. But when you factor in the time to excavate, cost to relocate spoils and/or backfill, time to wait for an inspection, time to place the concrete, time waiting for concrete to cure, and the fact that you have no idea if the soil you just placed those Sonotubes in is actually capable of bearing the load, helical piles win every time. Prices for installed helical piles start at around $150 per pile and get more expensive commensurate with the loading requirements. *—Greg Di, Bergen County, N.J.*

Make sure you look at the right product. The old helical piers (basically an auger that you leave in the ground) are definitely way expensive and almost never worth it. The newer Techno Metal Posts [TMP] are definitely worth looking into. *—Alaskan Son, Wasilla, Alaska*

1. Adding a vertical extension to the drilling rig makes it possible to drive piers into steeply sloped sites. **2.** In frozen ground, a pile can be driven normally after the ground is warmed using a proprietary heating rod. **3.** Several types of caps are available to attach piers to framing; some are adjustable in order to fine-tune the elevation.

Photos: 1, courtesy Techno Metal Post; 2, Dave Northup; 3, Andy Engel

Can you guesstimate how much a Techno Metal Post would cost with bearing capacity equivalent to a 14-inch-diameter concrete pier in 2,500 [psf] soil? *—cdservices*

Contact the guy who serves your area. They're helpful. technometalpost.com *—VTNorm, southwestern Vermont*

The smallest Techno Metal Post, P1, can handle up to a 6,800-pound load, which is more than double what that 14-inch Sonotube is estimated to take. Each dealer sets their own pricing, but it's probably around $150, give or take ... [The] P2 is the most commonly used residential pile and it can handle 9,600 pounds. You would need a 24-inch Sonotube in at least 3,000 [psf] soil to get that loading conventionally. *—Greg Di*

So, it sounds like the new metal pile technology blows away the justification for concrete piers in almost every case. *—cdservices*

I still use concrete Sonotubes with a Bigfoot base if I don't have much work, as I do most of the labor and therefore they are more profitable. If you are subcontracting it all out, the Techno Metal Posts are the way to go almost every time. Only other weakness to them is that they aren't as good as a conventional pile at going through solid rock. *—Alaskan Son*

For more information on concrete piers and helical piles, see the following articles: "Designing Pier Footings," *Professional Deck Builder*, Jan/Feb 2007 and "Working With Helical Piers," *JLC*, Oct 2012

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Q I'm planning on framing a landing to break up a long stairway that runs from grade to an upper-level deck. How should the landing be designed—as a separate deck or as part of the stairway?

A Mike Guertin, a builder and remodeler in East Greenwich, R.I., and the "Deck Workshop" presenter at JLC Live, responds: I treat a landing like a small deck. I design it to handle regular live and dead loads (40 pounds and 10 pounds, respectively) as well as the concentrated loads imposed by the stairs that attach to it. Just like a deck, a landing needs to have footings, posts, beams, and joists.

The minimum size for a landing is 3 feet by 3 feet or the width of the stair sections meeting at the landing—whichever is greater. As shown in the illustration below, the minimum depth is measured from the nosing of the stair, not the riser. Also, because the bottom of the upper set of stairs will rest on it, the landing must be large enough to fully support the heel of the stringers.

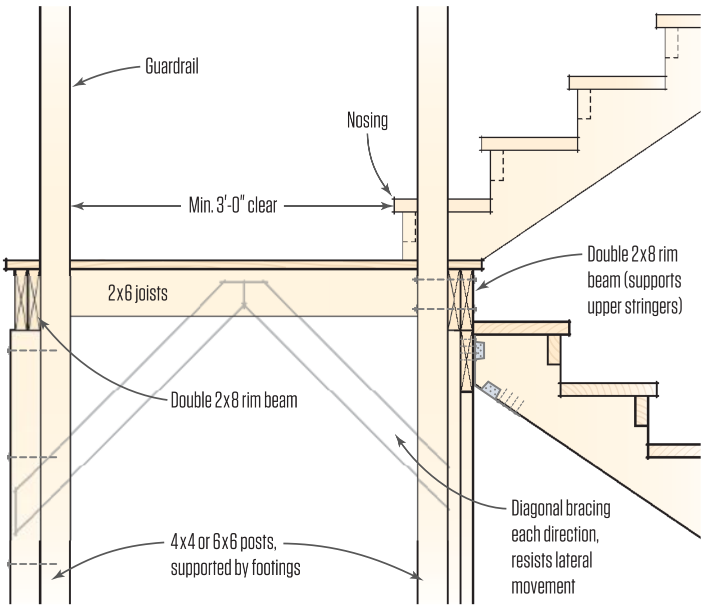
I double up the rim joists to serve as beams because placing separate beams beneath the landing would look too bulky. Then I install 4x4 or 6x6 posts beneath the ends of the rim beam and down to footings, which must reach frost depth if either the landing or the main deck are attached to the house. Diagonal bracing between the posts and the landing frame is needed to resist lateral movement.

I use 2x8s rather than 2x6s for the rim beams and joists. The 2x8 rim beams can usually handle the extra load of stair sections up to 4 feet wide. The only time that this changes is on a landing for a U-shaped stairway, when both sets of stairs bear on one side of the landing. In that case, I install an extra post and footing at the middle of the rim beam to reduce the span.

Posts for the guardrail are attached to the landing frame just as they would be on a deck.

Finally, when designing the landing height and position, keep in mind that the riser and tread cuts don't need to be equal between the two stair sections. The landing breaks a user's stride, so the difference doesn't cause a trip hazard.

Freestanding Landing



Q I know that blue board is not the same as standard drywall. But if drywall has already been hung, would a Level 5 finish be comparable to plaster skim coat?

A Myron Ferguson, a JLC Live presenter and drywall contractor in Galway, N.Y., responds: Level 5 is the highest-quality finish possible on regular drywall (see "Application and Finishing of Gypsum Panel Products," gypsum.org), and it is significantly different from veneer plaster on blue board. A Level 5 finish is most often achieved by skim-coating with joint compound, but several companies also make primer-surfacer products that provide a Level 5 finish, such as Tuff-Hide by USG (usg.com).

The most common level of drywall finish is Level 4, in which seams and corners have been taped, then coated (along with fasteners) with two coats of joint compound, and sanded with a fine-grit paper to remove imperfections. To achieve a Level 5 finish, a skim coat of joint compound is applied over the entire surface. This is fairly easy: Joint compound thinned with water is applied to the drywall (I like to use a medium-nap paint roller), then removed with a wide taping knife.

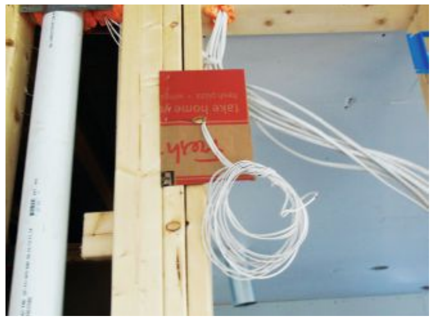
The Level 5 skim coat is intended to conceal slight differences in texture on the drywall surface. Areas that are very smooth from coats with joint compound (seams, for example), uncoated areas where sanding has raised the grain of the paper, and untouched drywall paper surfaces all have slightly different surface textures and vary in porosity. These differences can show even when the surface is painted. Applying a skim coat of joint compound creates a more uniform surface and minimizes the differences in porosity, making the surface look uniform when painted—even in the worst lighting conditions.

A veneer-plaster finish is very different. First, the plaster itself is not the same as joint compound, and when it is applied, it creates a layer of measurable thickness. In addition, plaster actually bonds chemically with the paper in blue board, creating a surface that is much harder than regular drywall with a Level 5 finish. Plaster does not bond well to regular drywall, so using it for a skim coat is not recommended.

If you've already hung regular drywall, you can apply one of the primer-surfacer products mentioned earlier. While these alternatives are not the same as a veneer-plaster finish, they have a measurable thickness and provide a harder Level 5 finish than skim coating with joint compound.

Q As a contractor, one of my pet peeves is when hasty drywallers run their sheets right over wires that are supposed to be left exposed, such as speaker wire or thermostat wire. Or they bring the wire through in the wrong spot. Do you have any ideas for making sure that the wire ends up where it's supposed to be when the drywallers are done?

A Andy Hannan, production manager for Mark IV Builders, in Bethesda, Md., responds: Whenever I have wires that need to come through the drywall in a certain spot, I run them out through a good-size square of corrugated cardboard stapled to the framing in the exact position of the speaker, security sensor, or other fixture that the wire is supposed to feed. The corrugated cardboard is compressible, so it can be left under the drywall, and the arrangement makes it difficult for the drywall hangers to move the wire or bury it.



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BY TIM UHLER

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Framing an Octagonal Vaulted Ceiling

On the houses we frame, we often add a "hip tray vaulted ceiling" in the master bedroom, hallways, or other rooms where we want to add inexpensive architectural drama. Over the years, we've refined an efficient and easy method for framing them (see "Framing a Hipped Tray Ceiling," *JLC,* May/06).

We recently had a master bathroom where we decided to frame the tray ceiling octagonally rather than as a rectangle **(1)**. We chose this layout because the room had one 45° wall, and with a simple hip tray, the ceiling corner would have awkwardly died into the angled wall. But with the octagonal layout, the soffit mirrored the 45° angle instead. We use this same layout method for turret roofs as well.

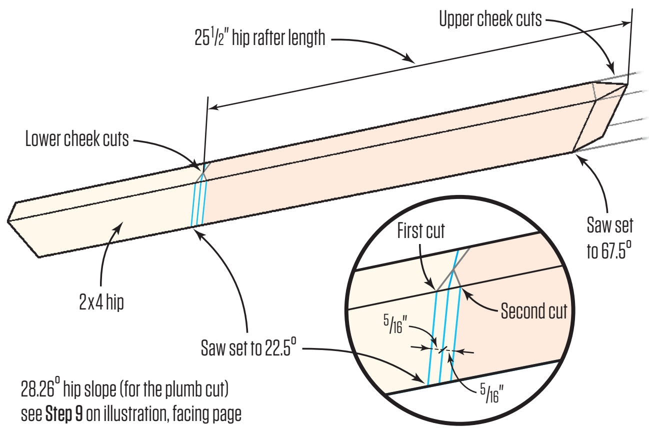
Soffit framing. The first step is to frame out the perimeter soffit. We often have 2x12 scraps left over from cutting and stacking a roof, and we save any pieces that are long enough to frame out these ceiling soffits. We typically frame them to be either 18 or 24 inches wide. This room was on the smaller side—about 10x12 feet—and 18 inches worked well. For a normal master bedroom—12x16 feet or larger—we would frame 24-inch soffits.

To keep the soffit straight, we run a string and fill in with cripple blocks to the ceiling rafters as needed to push the soffit in line. After the soffit is boxed in, we "45" the corners, making a 24-inch diagonal at each inside corner. Once this is done, we snap a line 5 inches up from the bottom of the soffit all the way around. The bottom edge of the rafters will fall on this line, leaving a fascia for crown and for lighting, if the customer chooses.

Full-scale drawing. I like to grab a piece of sheathing and lay out one corner of the ceiling at full scale **(2)**, so I can write down the numbers I need for all my calculations (see illustration, page 25).

Photos: Tim Uhler

Hip Rafter Cheek Cuts



I do all the layout on this piece of sheathing, using its edges as the inside face of the 2x12 soffit, and drawing a diagonal across the corner to define the 67.5° corners where the hips will be nailed. A regular hip splits a 90° corner (making 45° angles); an octagonal hip then splits the 45° angle, making 22.5° angles between the hip and the commons on either side of it.

I start the layout by finding dead center of the diagonal corners of the soffit (12 inches on this particular ceiling). Drawing "A" on the facing page shows the calculations that I make using my Construction Master calculator to lay out a full-scale section of one corner.

Upper ceiling plane. Once this section is drawn, I draw where my upper ceiling line will be. I like to work in round numbers, so for this size room I chose a 24-inch-long rafter at the same 7:12 pitch as the roof above. (To draw attention to the ceiling in a larger room, I might use a 36-inch-long rafter and steepen the pitch, but in this small room, that wasn't necessary.) Drawing "B" (facing page) shows the layout and calculations needed to draw the upper ceiling line on the full-scale drawing.

Hip-rafter layout. Next, I lay out the hip rafter, as shown in drawing "C" (facing page). This allows me to draw the actual thickness of the hip (2-by) and the common, so I can just measure off my adjustments to get my cheek cuts laid out, as shown in the illustration above.

Cutting rafters. I can now cut eight hips (two per corner) and all the commons. To cut the hips, I use the Big Foot 10-inch saw with a swing table. This base plate will bevel to 75°, so it can handle the 67.5° bevels needed for the upper hip cheek cuts.

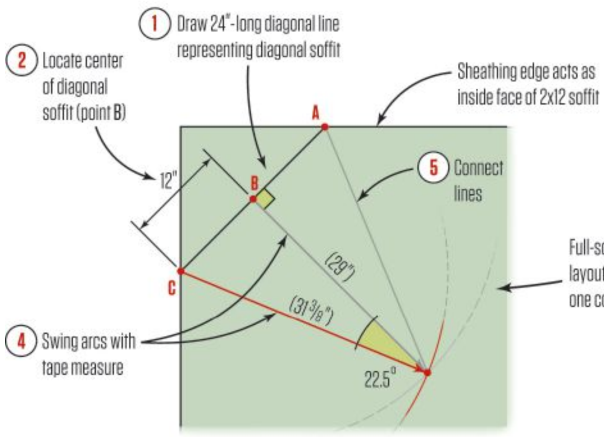
I like to cut the steep cheek cuts first **(3, 4)**, then pull the length and layout, and cut the lower cheek cuts. For the lower cuts, I square the length to the side of the rafter and draw a plumb line. Then I measure the setbacks (5/16 inch) on both sides of this first plumb line, giving me three parallel plumb lines. I cut on the "long" line first, with the blade angled back toward the rafter; then I cut the "short" line from the other direction, giving me the double cheek cut.

I like to frame all my corners (two commons and one hip) **(5)**, then fill in the common rafter framing **(6)**. Once that is finished, I measure in the upper ceiling framing and nail it off, making sure it's strong enough to hang from and that there will be no ceiling joists in the way of the light placement.

Tim Uhler is lead framer for Pioneer Builders, in Port Orchard, Wash.

Layout of an Octagonal Hip

A. Find Intersection of King and Hip

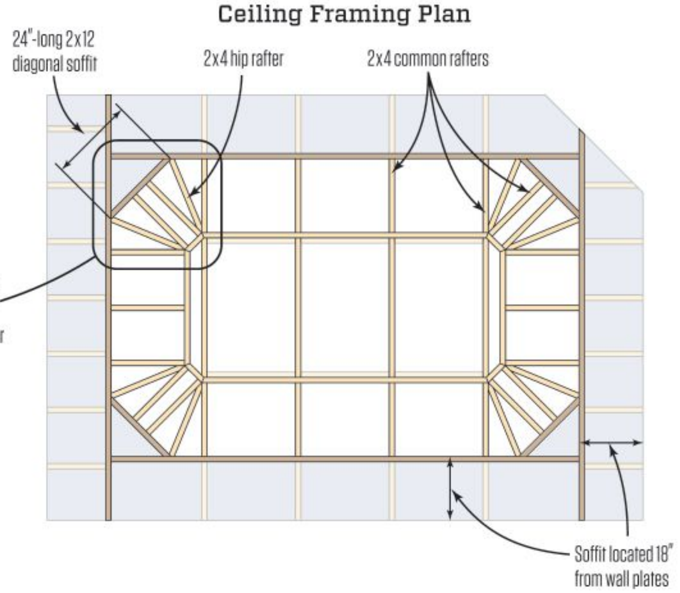


3 Find king and hip rafter runs using Construction Master:

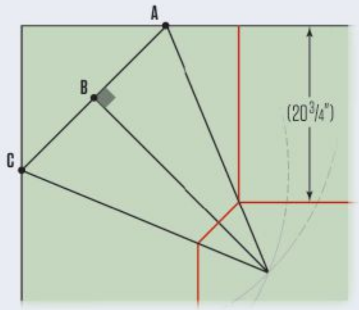
12 **Inch** **Rise** 22.5° **Pitch** **Run** = 29" common run

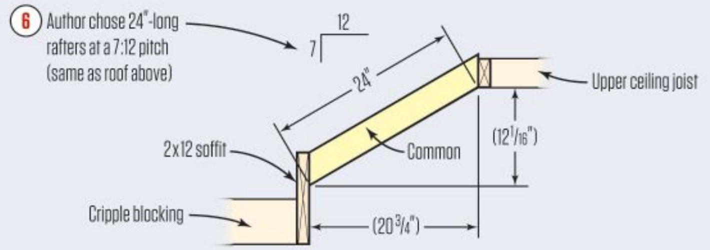
Hit **Diag** = 31 3/8" hip rafter run

Ceiling Framing Plan



B. Locate Upper Rim Board



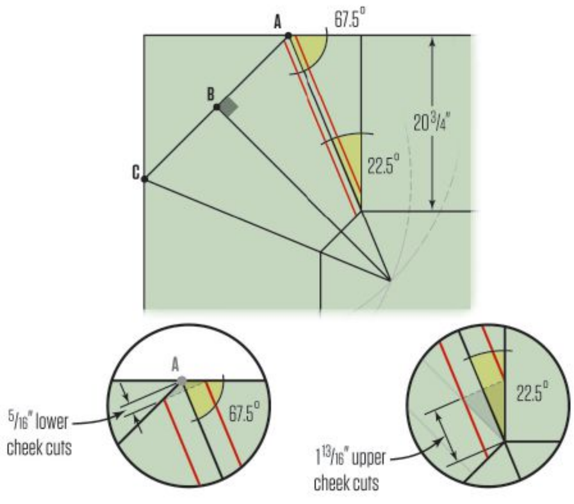


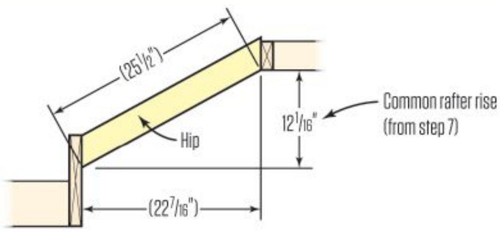
7 Find common rafter run and rise:

24 **Inch** **Diag** 7 **Inch** **Pitch** **Run** = 20 3/4" common rafter run

Hit **Rise** = 12 1/16" common rafter rise

C. Hip Rafter Layout





8 Find hip rafter run:

20 3/4 **Inch** **Run** 22.5° **Pitch** **Diag** = 22 7/16" hip rafter run

9 Find hip rafter length and plumb cut (using the common-rafter rise from step 7):

12 1/16 **Inch** **Rise** 22 7/16 **Inch** **Run** **Diag** = 25 1/2" hip rafter length

Hit **Diag** again = 28.26° hip slope (for the plumb cut)

10 Find plumb line offset for cheek cuts:

3/4 **Inch** **Rise** 22.5° **Pitch** **Run** = 1 13/16" upper cheek cut

3/4 **Inch** **Rise** 67.5° **Pitch** **Run** = 5/16" lower cheek cut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BY JOE STODDARD

Bring Your Own Device

Bring Your Own Device (BYOD) is a trend among employees and subcontractors who resist using employer-supplied mobile hardware in favor of using their own personal smartphone, tablet, or laptop for work. BYOD is nothing new, but the potential effects on businesses are changing fast. Ten years ago, the occasional BYOD request came from an "early adopter" asking to use a personal laptop for work, possibly before the company itself had been computerized. Today, practically every company is using technology, but then so is practically every employee, tradesman, and homeowner. And this year's smartphones are next year's "wearable computers" with the Internet built in. BYOD is here to stay, so you might as well start thinking about how to integrate employee-owned technology with company systems.

When it comes to office technology, adoption is everything. If people are unwilling or unable to use the systems you set up, the whole initiative will never get off the ground. BYOD is not a cure-all, but people are much more likely to use a device that they're already familiar with—and that is already set up just the way they like it—than they are to use a company-issued device.

The problem is that a device which is set up "just the way they like it" is often at odds with what is best for your business. In general, people are terrible at securing and maintaining their digital devices. Consequently, one of the first things I do for my builder and remodeler clients is to survey every device that could potentially access their network, cloud-based applications, or data, whether online or off. Then we create a policy that will allow employees and subcontractors to bring their own devices to work while reducing the potential risk to the business.

Here is a list of some of the potential BYOD issues you'll face, with suggestions for how to deal with each of them.

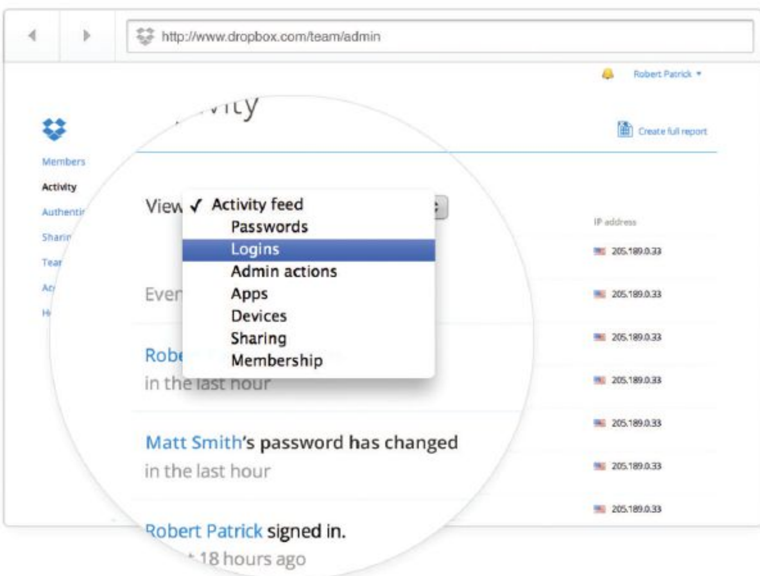

Image: courtesy Dropbox.com

Dropbox for Business provides a central administrative console where you can manage members. Members can add and edit, but they can't permanently delete files in the company's Dropbox. The administrator always has tools to recover damaged or deleted files.

Mismatched devices. If the mobile apps your company is using are designed to work best on Android smartphones, but your employee shows up with an iPhone, the mismatch—even if there is a way to make it work—could create endless technical support issues, as well as generate lots of excuses like, "I couldn't get on the project website."

Solution: Require employees (and trade contractors) to sign off on a list of approved devices that will work correctly with the apps and services your company uses. This should also include specifications for the operating system, minimum processor speed, amount of memory and storage necessary, and so forth. Update the standard annually and make it part of your employee handbook and your trade contractor agreements.

Password problems. Using weak—or no—passwords is the digital equivalent of leaving all of your doors and windows wide open, then complaining when someone breaks into your office. In my experience, most people avoid anything that slows them down when they use their technology, and having to enter passwords of any kind tops the list of obstacles. And strong passwords that are difficult to remember or enter? Fuggetaboudit.

Password managers such as LastPass and RoboForm (shown here on an iPhone) can keep hundreds of passwords, account numbers, credit cards, and other sensitive information secure and synchronized across multiple devices. Using these password helpers makes it less of a hassle to always use unique, strong passwords to access cloud service accounts.

Solution: You can't do much about a user's lack of common sense, but you can ensure that the cloud-based services your company uses require strong passwords—that is, eight characters or more; no "dictionary" or other easily guessed words; a mix of numbers and letters, lowercase and caps; and at least one special character. Password-management software, such as LastPass (lastpass.com) or RoboForm (roboform.com) can be a big help.

Malware. Roughly 75% of all personal devices I've surveyed have had a virus or some form of malicious software installed on them. That includes iPhones, iPads, and Android devices, which, contrary to popular belief, are not immune to malware. Sources of this junk include celebrity websites, ad pop-ups, social media, and other free software installations. It's easier to evict a deadbeat tenant from a rental property than it is to completely get rid of malware from a mobile device.

Solution: If employees are using their own devices for work, you can't control which sites they surf or what software they download, but you can insist that they install and use good anti-malware software and that they allow you to spot-check their devices to make sure they're keeping them up to date. This is easier than it sounds because most people don't want the malware hassle either. Sometimes all it takes is a bit of education about which websites and games to avoid.

No security updates. As is the case with malware protection, it's rare to find someone who regularly updates his or her operating system and software. Even when the device is set up to automatically do the updates, often the process is interrupted and never restarted and completed.

Solution: One builder I worked with allowed BYOD, but only after checking out the devices to make sure they were malware-free and fully updated. This builder scheduled the checks for times when a group of employees was together—at a weekly sales or production meeting, for example. Even though this required some hands-on attention from him, it was no more effort than it would have been had the company supplied the devices.

Personal versions of business services. Employers used to worry about employees storing sensitive company documents or other data on thumb drives or SD cards, then losing those devices or being careless about who could access them. Lost thumb drives still represent a threat, but an even more serious threat today is employees or subs using their personal cloud-based file-storage accounts for work. I'm talking about personal consumer versions of such services as

Evernote (evernote.com) and Dropbox (dropbox.com). Once your data disappears into one of these personal accounts, you've lost control of it.

Solution: Spend a little more money to purchase cloud-based services that have "business" or "professional" versions. These typically give you better control over the data created and stored, including access to it. Employees and subcontractors should be able to add and view information—and possibly edit some information—but they should never be able to delete it. If storage space is an issue, employees can make room for new files by archiving rather than deleting existing information.

The business versions of these services add an administrative interface that allows you to stay in control of who can access the service and what they can do once there (see screen image, page 27). Some services even have an option to store every version of every file forever—cheap insurance against someone accidentally deleting something important.

Unfortunately, none of these controls will stop people from making personal copies of things they shouldn't, but at least they won't be able to accidentally delete or corrupt mission-critical business data.

Other inappropriate uses. Last of the BYOD issues are those related to employees spending hours on the phone for personal calls, wasting work time surfing the Internet for fun, and publishing compromising photos—which can be something as simple as a picture of a client's address that winds up on Facebook. In my experience, these things will happen whether it's your device or the employee's, but it's arguably much easier for you to discover and control these behaviors if you supplied the hardware.

Solution: Good hiring practices along with a solid, written company policy and procedures manual go a long way here. Even if you don't allow BYOD and you supply everything yourself, you still need a good mobile-device management policy on which everybody signs off. Of course, policy alone probably isn't going to stop every employee or subcontractor from doing something they shouldn't do with the technology in their pocket, but it's part of the education process, and at least it gives you some recourse to handle a repeat offender.

Joe Stoddard consults with contractors about technology. jstoddard@mountainconsulting.com; twitter.com/moucon

BY GLENN MATHEWSON

The Case of the Sobbing Siding

Working as a municipal building inspector and having a passion for construction can often be a tease. Every day I see a variety of construction projects built by a wide assortment of tradesmen—both professional and amateur—and even by homeowners. I'll admit that I get satisfaction from the feeling that I'm part of the team, but building inspectors don't typically get thanked for their contribution—quite the opposite, in fact. So while "call backs" are not generally viewed as positive experiences, one in particular was quite memorable and educational both for the contractor and for me.

Let me provide some background, as a confession and as an inadequate excuse for my missing the problem during the initial inspection. In 2008 when the call came in, my jurisdiction had just suffered through a major Colorado Front Range windstorm, followed by a severe hailstorm, which precipitated an uptick in roof repairs and permits for new roofs. With the Great Recession getting a tight grip on the economy, I couldn't count on any new hires to help with the thousands of permits being issued. Delays for roof inspections quickly grew from weeks to months, and I was getting in great shape climbing ladders all day. Perhaps this was part of the reason why I failed to notice the problem that prompted this particular call.

The citizen was upset and went straight to the inspector who had passed the new roof installation: me. She wanted to know why—after getting a brand new roof—the lap siding on her garage had suddenly begun "crying" after every rain. I was, of course, intrigued by her comment, but based on my experience handling obscure calls from homeowners, which often have little validity, I was also skeptical. Nonetheless, I scheduled a courtesy


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inspection the next day to do a call back on my previously passed inspection.

After I greeted the homeowner, she took me to the side of her garage at the front of her house and showed me the staining—evidence that water had indeed been dripping from her siding **(1)**. This was going to be interesting.

Not seeing anything unusual in the siding or in the roof, fascia, gutter, or soffit above the leaking wall, I went to take a look from inside the garage. Fortunately, there was no wall or ceiling covering, and the roof had been framed using raised-heel trusses. The exterior wall sheathing ran up the heel but stopped below the 2x4 truss tail. This space allowed me to see inside the soffit **(2)**.

Peering inside the soffit with a flashlight revealed more water staining and more clues **(3)**. Granules that had sloughed off the new shingles lay on the inside surface of the soffit, a clear sign that wherever this water was coming from, it had first run down the shingles.

Right about then I realized that the problem was indeed an issue caused by the new roof; the very roof that I had inspected and passed. I could already smell the humble pie cooking for me!

Looking both ways down the length of the soffit, I could see which direction the water was coming from. Working my way toward the source, it seemed that the water originated where the garage soffit intersected with the roof plane of the house, about 10 feet from the site of the staining **(4)**. Now it was time to get out of the garage and back onto the roof.

Once I got on the roof and down on my knees to take a good look at where the soffit intersected the adjacent roof, it was clear what was happening. The fascia had been cut at a long angle to match the roof plane and was held up the proper distance from the shingles. The gutter had also been cut to the same angle, with the idea that water would drain from the gutter onto the roof shingles and then down to the house gutter—unorthodox, but it still should have worked, except that there was no flashing under the gutter.

Still, these factors alone didn't create the problem. The soffit material had been run tight to the shingles **(5)** and past the angled edge of the fascia. This combination created a scoop that allowed water to flow under the fascia and on top of the soffit **(6)**. From there the water made its way down the soffit and finally behind the siding. I thought, "Look on the bright side: At least the water-resistive barrier behind the siding did its job well!"

At this point, my work was complete, except for the apologies. I called the project contractor and told him what I'd found. In light of missing the problem the first time, and knowing that it could be fixed with a single piece of step flashing **(7 & 8)**, I agreed to meet the contractor on site the next day. I showed him the issue and he fixed it in a matter of minutes. The siding would weep no more.

The experience was a great lesson in humility for the contractor and for me, and the homeowner was wonderfully patient. In the end, the three of us worked as a team to handle and resolve the problem—a little whipped cream to sweeten that humble pie.

In addition to having a Master Code Professional Certification from the ICC, Glenn Mathewson is a plans analyst and former building inspector for the city of Westminster, Colo.

BY RYAN SHANAHAN

When it comes to improving the energy efficiency of a building, lots of attention is paid to insulation R-values, thermal bridges, and air sealing. But don't forget the windows, which account for the biggest energy loss in a high-R wall.

Holes in the Wall: To Improve the Energy Performance of Walls, Look at Total R-Value

If you look at a building's thermal envelope as a six-sided cube, the walls represent the largest surface area and have the weakest R-value. So if the goal is to improve the thermal efficiency of that envelope, the walls have the most room for improvement. We can increase their R-value by making them thicker or by using insulation with a higher R-value per inch, but unfortunately, framing a thicker, better-insulated wall is only one piece of the puzzle. We also have to deal with the thermal bridging associated with traditional framing methods and we have to improve the windows. In fact, it's the windows that have become the weakest link in a high-performance wall.

Today's builders are learning to mitigate thermal bridging by using alternative framing techniques, continuous exterior rigid foam products, or both. The reason is obvious: Wood framing materials have a resistance to heat flow (R-value) that is roughly one quarter that of common insulation products such as fiberglass and cellulose. Because heat energy will choose the path of least resistance, the framing members become the heat energy's "bridge" to the outdoors. Without addressing these thermal bridges, the overall R-value of any wall system is weakened immensely, regardless of the insulation type installed in the cavities between framing members.

Advanced framing (24-inch on-center studs with single top plates) by itself can increase overall wall R-value by only 4% to 6%. To really address thermal bridging, many builders are also incorporating


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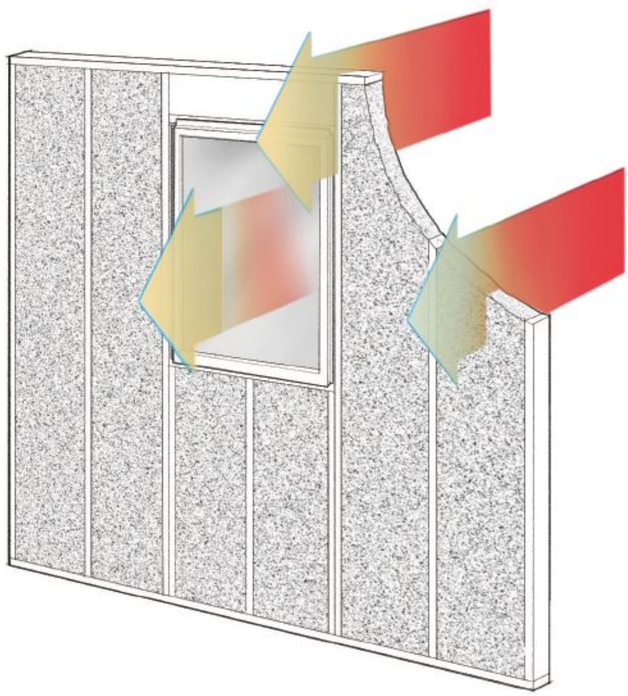
U_o of Standard 2x6 Wall Assembly

R-23 in cavities; framing = 23% of wall area

Without windows:
R-18 Overall

With windows at 15% of wall area:
Window U = 0.30,
R = 11 Overall



continuous exterior rigid insulation or using alternative construction methods, such as staggered stud walls, double walls, or I-joist walls to tackle the thermal bridging problem (see "Building Above-Code Walls," *JLC,* Dec/13).

Thermal bridging is the low-hanging fruit. Pick off the energy losses due to thermal bridges, and the next weakest link in any wall assembly is the window.

So here's the question: Does it make more sense to frame an 18-inch-thick wall with double-pane windows; a 12-inch-thick wall with triple-pane U.S.-made windows; or a 6-inch-thick wall with triple-pane European windows? For most projects with a substantial heating or cooling load, the answer may not be any of these. It probably lies somewhere in the middle, and to find it, you'll need to evaluate a wall's total R-value, not just insulation R-value.

The illustration above shows the effect of a typical U-0.3 window on the R-value of a typical 2x6 framed wall. Through a simple U_o (area-weighted U-value) calculation, we see the impact of thermal bridging and heat flow through the window: R-11, which is not a great R-value in any climate.

Now look at the illustration on page 37 to see what happens when you put a lot of effort into framing a super-insulated wall. If you focus all the attention on wall insulation and framing but do nothing to improve window performance, you're not doing as much as you might think to improve the energy performance of the

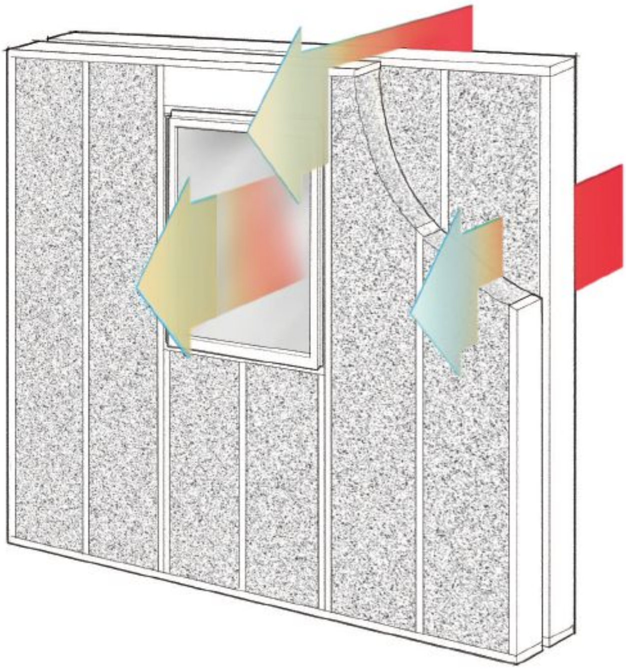
Illustrations: Charles Lockhart

U_o of 18-Inch Wall Assembly

R-61 in cavities; framing = 18% of wall area

Without windows:
R-60 Overall

With windows at 15% of wall area: Window U = 0.30,
R-17 Overall



building. We must ask ourselves, how good is good enough? At what point does it make more sense to purchase better windows than to increase the overall R-value in the wall?

It may be that the best option is a balance of insulation and window performance. Address the thermal bridging and improve the cavity insulation with, say, a 12-inch double wall, as shown on page 39, but improve the window U-value, too. It quickly becomes apparent that improving window performance is a more effective path for improving wall performance than simply adding more insulation.

A U_o calculation can help convey some effects of design choices, but a comprehensive energy modeling tool can help a project team extract other useful information, such as the effects on overall energy loads, energy losses through various building components, and mechanical-system sizing. Using local utility cost data, energy modeling software can help project teams understand payback periods and plug numbers into a cost-benefit analysis for their clients. Of course, the availability of materials and skilled labor can be significant factors as well.

When contractors are attempting to reach a performance goal such as Passive House or Net Zero Energy, the thermal performance of the windows cannot be overlooked. If the cost of the windows is an obstacle, has the project team considered using fewer windows? Or moving windows to a more favorable position with respect to the sun? Has the project

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U_o of 12-Inch Wall Assembly

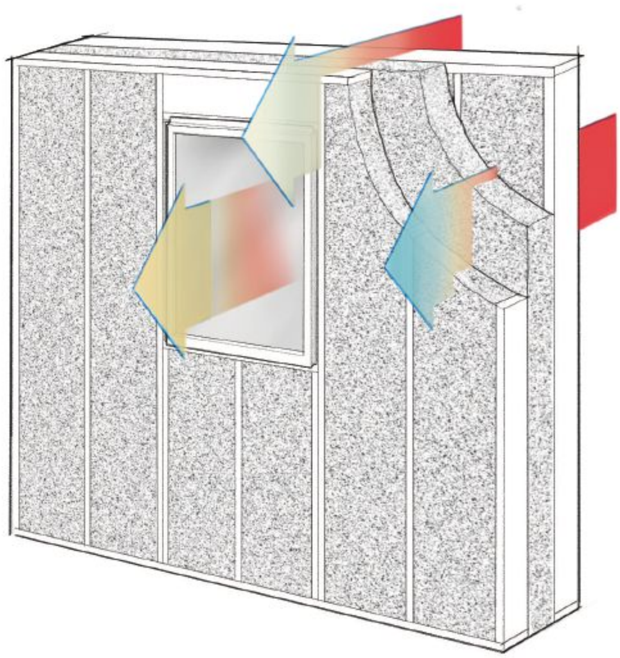
R-41 in cavities; framing = 18% of wall area

Without windows:
R-39 Overall

With windows at 15% of wall area:
Window U = 0.30,
R-15 Overall

Window U = 0.15,
R-22 Overall

Window U = 0.10 (best available),
R-27 Overall



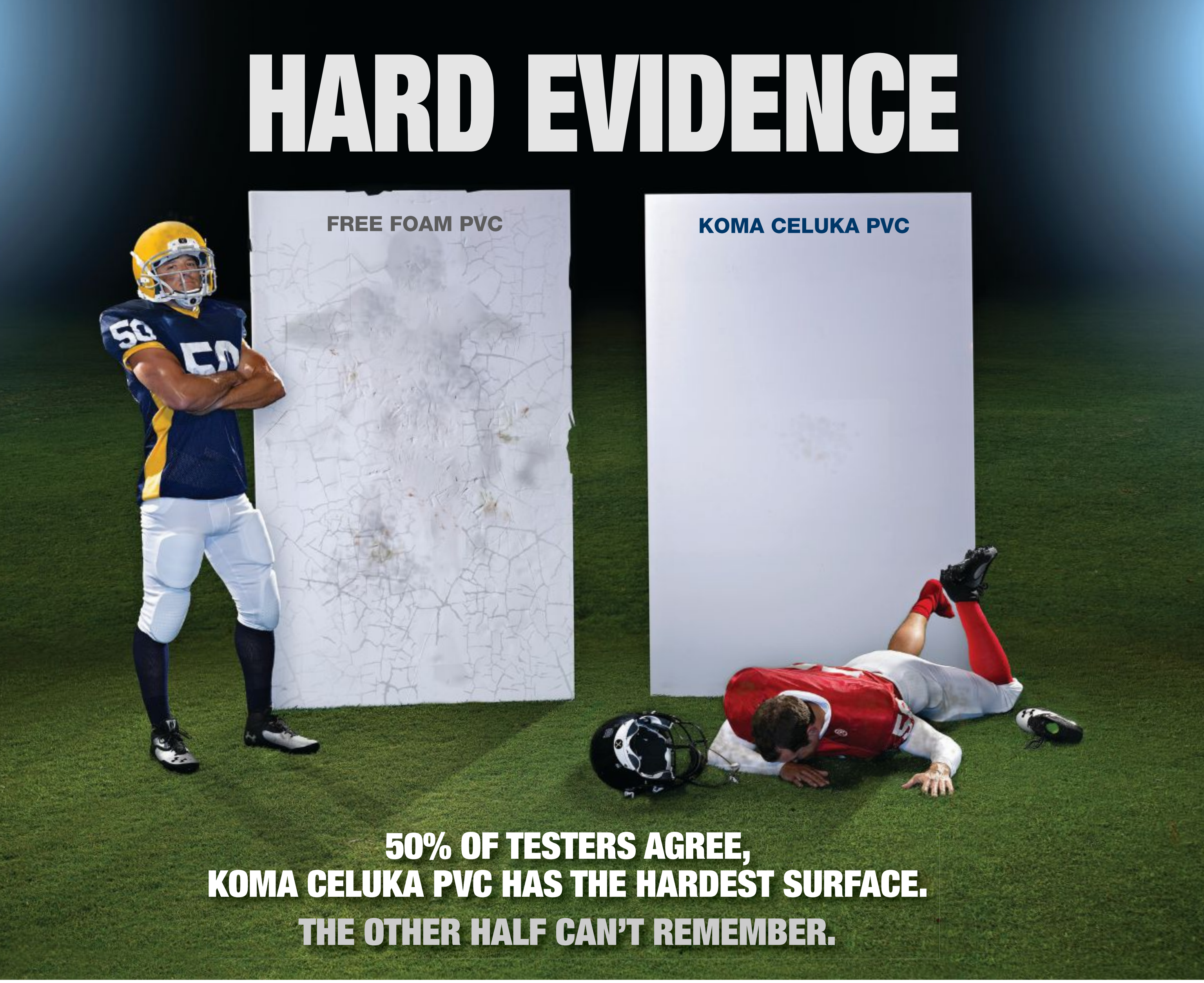
team considered re-orienting the room layout to work better with a re-orientation of the windows?

When considering window orientation, keep in mind that it's possible to have windows that are sometimes referred to within the Passive House community as "net gainers." With the right climate, envelope, orientation, and design, the right windows can actually gain more solar heat energy in the daytime than they lose overnight. Without a good energy modeling tool to confirm this assumption, however, it's a safer bet to assume the opposite.

Passive solar homes of the 1970s used this same technique but incorporated large quantities of thermal mass to absorb the heat energy coming in through windows. Most high-performance building envelopes today can accomplish a similar goal without a large thermal mass and are less prone to overheating, as long as a good shading strategy is incorporated into the design.

As our industry moves forward, I celebrate the American window manufacturers who are adopting European quality for their U.S.-made products. This trend is allowing more builders to improve building performance and occupant comfort at lower cost premiums and with quicker lead times to order.

Ryan Shanahan is a Passive House rater and green-building consultant at Earth Advantage, an organization that provides green-building certification and education to building professionals in and around Portland, Ore.



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Insulating Cathedral Ceilings

Practical solutions to prevent call backs and boost energy performance

BY CLAYTON DEKORNE

Questions about building cathedral ceilings have troubled energy-conscious builders for decades. Common questions include: With only the depth of the rafter to work with, how do we get enough insulation R-value to meet the energy code, much less meet high-performance building standards? How do we even come close to having room for ventilation? If we leave out the roof ventilation to maximize insulation depth, how can we avoid ice dams? How do we prevent condensation from "raining" down from skylights and recessed lights?

There are answers to all these questions, which is fortunate because the risks of water damage and a likely drop in thermal performance don't seem to make cathedral ceilings any less popular with clients. This article will sort through the options and summarize the answers provided by the energy code and the building-science community.

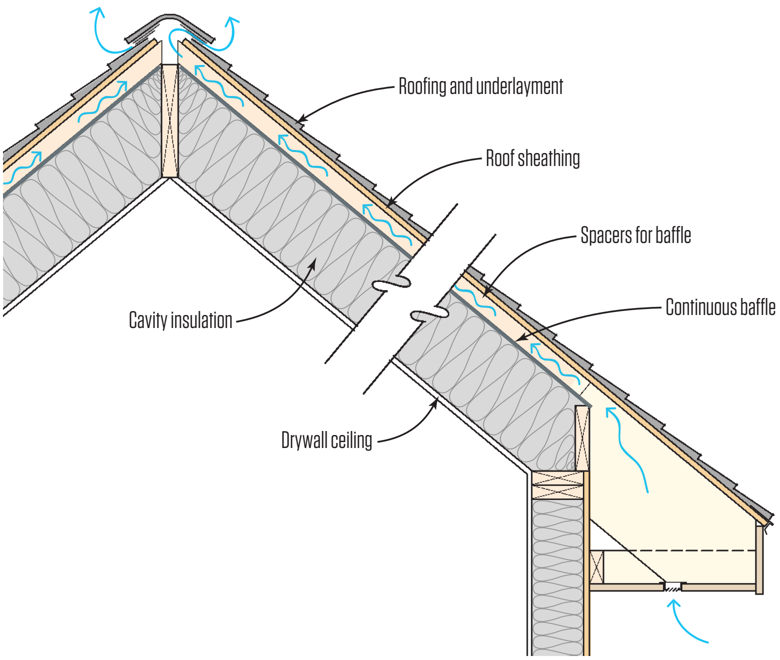
MEETING CODE

Chapter 11 of the International Residential Code (IRC) allows for two cathedral ceiling options—one with roof ventilation and one without. For the vented assembly, insulation requirements are straightforward. Under the 2009 IRC, minimum ceiling R-values

Vented roofs work in all climate zones, but depend on a few critical details: 1) Both soffit and ridge vents in each rafter bay. Balanced openings work, but it's better if the soffit inlets are larger than the outlet at the ridge to positively pressurize the vent space. 2) A perfect air barrier, either at the ceiling or at the baffle. Avoid can lights, but if you must use them, make the baffle the air barrier. 3) A continuous baffle to prevent ventilation air from washing over and passing through fibrous cavity insulation.

The challenge with a vented cathedral ceiling assembly is getting enough insulation into the limited space of a rafter cavity to meet energy code minimums. Consider either using deeper rafters (using I-joists or parallel-chord trusses) or adding a layer of rigid foam to the underside of the rafters and strapping the ceiling for drywall. The rigid-foam option has the advantage of providing a thermal break.

Vented Roof
Air space under sheathing



range from R-30 (climate zones 1-3) to R-49 (climate zone 6-8), with at least R-38 required in climate zones 4 and 5. Under the 2012 IRC, these values have increased to R-38 in climate zones 2 and 3, and R-49 in zones 4 and 5 (with the requirements remaining the same for climate zone 1, at R-30, and climate zones 6-8, at R-49).

For small areas ("limited to 500 square feet or 20% of the total insulated ceiling area, whichever is less"), both versions allow for a minimum R-30 in all climate zones if you don't have enough joist depth to accommodate more insulation. This exception might get you past the insulation inspection on a small project, but it's not going to do a lot for the building's energy performance.

The code's ceiling R-values assume a vented assembly. If you opt for an unvented "hot roof," insulation requirements are a bit more involved: You still have to meet the overall insulation values described above, and you also have to pay attention to how much "air-impermeable" insulation you place either directly above or directly below the roof sheathing. The aim here is to keep the temperature of the sheathing from falling below the dew point, which would allow condensation to form and rot out the sheathing. Table R806.5 ("Insulation for Condensation Control," on page 47) provides the minimum insulation values required for condensation control.

"Air-impermeable" insulation can be either rigid foam board or closed-cell spray foam, and it must be placed without an air space between it and the roof sheathing. Of course, you can add air-permeable insulation, such as blown cellulose or fiberglass batts to boost the R-value of the whole assembly. But the impermeable stuff has to be next to the roof sheathing.

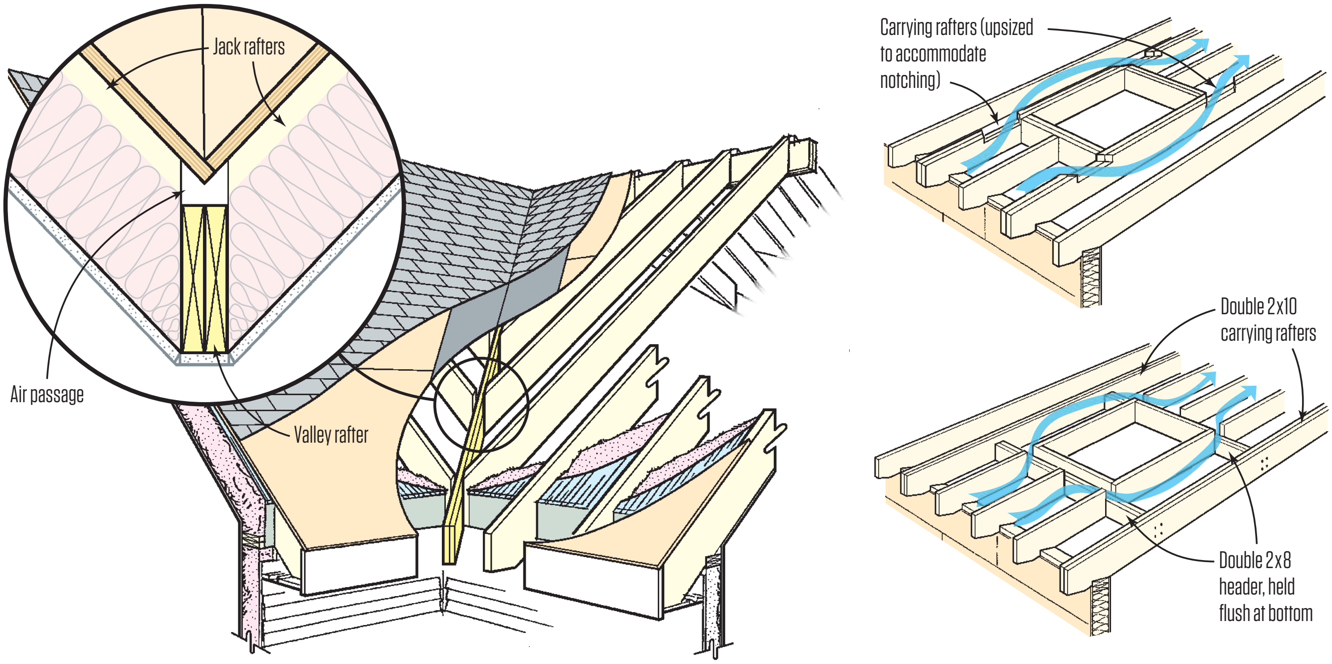
These code requirements boil down to three basic options:

- A vented assembly with any type of insulation that meets the R-value requirements for the whole assembly.
- An unvented roof with enough air-impermeable insulation below the sheathing (closed-cell spray foam), *plus* enough insulation to meet the R-value for the whole assembly.
- An unvented roof with enough air-impermeable insulation above the sheathing (rigid foam), *plus* enough insulation (of same or another type) to meet the R-value for the whole assembly.

VENTED ROOF

In a vented cathedral ceiling, a vent channel runs from soffit to ridge under the roof sheathing and above the insulation. This

Venting Around Framing



venting is supposed to deal with the problems resulting from heat or moisture. In cold climates, heat escaping through an under-insulated assembly can melt snow on the roof, causing ice dams. Venting above the insulation helps keep the roof deck cool. If humid indoor air leaks though the ceiling, the vents are supposed to whisk it away before it has a chance to condense on a cold surface.

However, ventilating above fibrous insulation comes with an energy penalty. Fibrous insulation is designed to be enclosed in an airtight cavity. When air flows over and through it, the insulation suffers a substantial loss of thermal performance. Best practice calls for installing a continuous insulation baffle from soffit to ridge to isolate fibrous insulation from the vent channel.

Warm climates are a bit more forgiving to cathedral ceilings. The venting can introduce humid air into the assembly, which could be drawn toward cool interior surfaces and then condense. Throughout the southeast, there are plenty of examples of "sweating ceilings" and the resulting mold growth to show the inadequacies of a vented assembly. But these sorts of problems are more common to attic assemblies where the humid outdoor air often encounters cooling ducts and air handlers located in the attic.

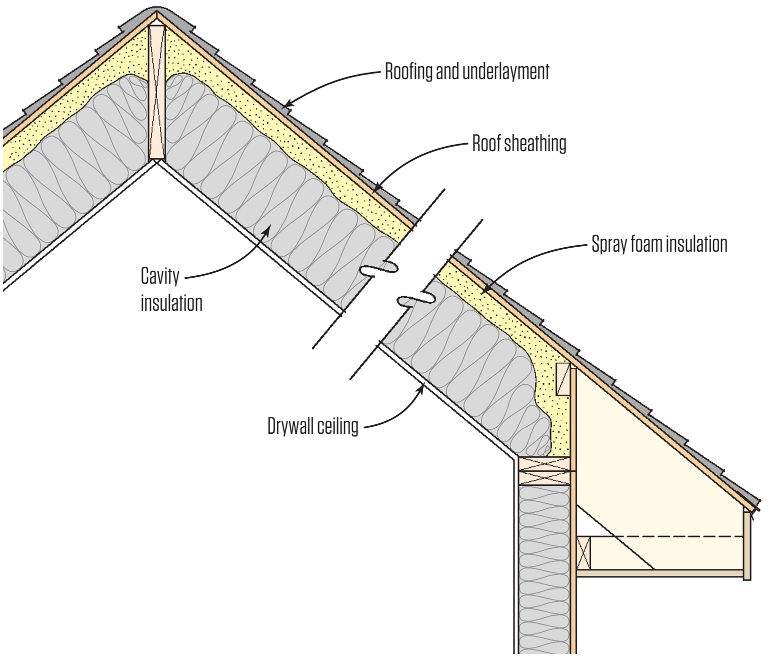
A vented assembly *can* work in any climate, but it has real limitations for a cathedral ceiling. For starters, high-density 10 ¼-inch batts will give you R-38 in a 2x12 assembly, so they'll work up to climate zone 5 under the 2009 IRC, and up to climate zone 3 under the 2012 IRC. In colder climate zones, however, you'll have to bump up to deeper rafters, using blown-in insulation with I-joist rafters (see "Framing a Roof With I-Joists," Jun/13) or parallel chord trusses. Or you can add a layer of rigid foam to the underside of the ceiling joists and strap the ceiling drywall. This latter option works well to reduce thermal bridging through the rafters, which takes care of a variety of misfortunes, including condensation on rafters due to thermal bridging, particularly for an imperfect batt insulation job.

Perfect air barrier. Assuming that you have enough insulation in the ceiling, the next hurdle to overcome with a vented assembly is installing a near-perfect air barrier. This can be at the ceiling plane or at the insulation baffle. If air sealing at the baffle, use rigid insulation as the baffle. Mount the panels between the rafters on strips of rigid foam glued with adhesive to the sheathing, tape between panel sections, and foam seal at the edges, paying

The IRC allows for an unvented assembly, provided the assembly meets the Chapter 11 insulation requirements (Section N1103.2.1), and that there is enough "air-impermeable insulation" in contact with the roof sheathing to keep it above the dew point and to protect it from condensation. What constitutes "enough" varies by climate zone and is specified in Table R806.5 (see "Insulation for Condensation Control," page 47).

Doing all this below the roof deck requires a closed-cell spray polyurethane foam. (Open-cell spray foam is air permeable and would require extra labor to install a secondary vapor retarder.) Closed-cell foam is expensive stuff, though, so to keep material costs in check, builders favor installing just enough to meet the Table R806.5 requirements and filling the rest of the cavity with a less-expensive fibrous insulation such as blown cellulose or fiberglass batts.

Spray Foam Under Sheathing
Unvented assembly



particular attention to the seal at the eaves blocking and at the ridge. Without an effective air barrier, the air flow in the vent channel from soffit to ridge will create negative pressure, drawing moist indoor air through any leak in the ceiling and pulling that air through the fibrous insulation where it can condense on the underside of the sheathing

Forget can lights. If you make the ceiling the air barrier, you can't have recessed lights in the ceiling. Recessed lights are not recommended in any cathedral ceiling because they will create an insulation weak spot at best, and an egregious air leak most of the time. Even so-called "air-tight" cans will leak air with pressure pulling on them. However, builders don't always have the option to say no. So if you can't avoid recessed fixtures, opt for using the baffle as the air barrier or build an unvented roof assembly.

Framing obstructions. Perhaps the biggest limitation of a vented assembly is that it works well only on a simple roof configuration. Any interruption in the framing, such as a hip or a valley, or a skylight opening penetrating the roof, will add significant complexity that is of questionable value. A roof that intersects a wall is perhaps the most difficult of all to ventilate. Clever builders have come up with some workarounds over the years, as shown in the illustrations on page 43. But while these look possible on paper, they're difficult to install well and are hard to justify as a "best practice."

SPRAY FOAM UNDER SHEATHING

For the two types of unvented assemblies allowed by code, spray foam is typically used to insulate *below* the roof sheathing, and rigid foam board is used to insulate *above* the sheathing.

Types of spray foam. There are two basic kinds of spray foam: open-cell foam and closed-cell foam.

Open-cell spray foam is a good air barrier, but it's not a vapor retarder, so it doesn't qualify as "air impermeable" and won't meet code for protecting the roof sheathing from condensation. Problems with the use of open-cell foam when high indoor humidity exists have been well documented (see "Repairing a Rotting Roof," Jun/10). Open-cell foam can be used for an unvented roof assembly, but you'll need to install a secondary vapor retarder to meet code. In addition, every effort should be made to lower indoor humidity using mechanical ventilation. Some builders also suggest installing the roofing on battens to help dry the sheathing if it does get wet. But the

Photos: James Morshead

least risky and least labor-intensive option is to stick with closed-cell spray foam.

Closed-cell foam is denser than open-cell material and dries stiff, making it more difficult than open-cell foam to clean off the face of the joists when it has to be sprayed in a shallow bay **(1)**. It can be done, however, and a horse curry comb seems to be the tool of choice for this task **(2)**. Closed-cell foam also has more insulating value per inch. The typical closed-cell spray polyurethane foam has an R-value ranging from R-5.8 to about R-6.8 per inch. (Note: The California Energy Commission, via Title 24, only allows R-5.8 per inch when calculating R-value for sprayed polyurethane foam (SPF). The discrepancy between this and manufacturer claims is credited to variances in site-mixed formulations. For more information about SPF variations, see: "Troubleshooting Spray Foam Insulation," Sep/10.)

When sprayed in a cavity, closed-cell foam expands from 30 to 50 times its liquid volume, making it easy to apply in very narrow cavities—for example, in a complex vaulted ceiling **(3)** that couldn't be insulated with anything but spray foam. The low expansion also makes it easy to install without completely filling the framing bay. With an installed cost upward of $5 per square foot, this is increasingly how it's done: Fill the cavity enough to satisfy the minimum requirements of Table R806.5 (page 47), then blow the remainder of the cavity with cellulose or fiberglass, or install batt insulation to reach the overall insulation requirement. In an unvented assembly, the insulation must be placed against the bottom of the sheathing (no air space).

Do not partially fill the cavity with spray foam and leave an air space between the foam and the back of the finish ceiling. Thermal bridging through the joists can create a cold surface at the edges of the joist bay, and a thermal cycle between these cold surfaces and the warmer space between the joists will move the air and siphon away heat. If you can satisfy the whole assembly insulation requirements with just a partially filled cavity and don't have the budget to fill the rest of the void with insulation, be sure to hit the entire side of the joists with spray foam so that the cold rafter is isolated from the air space behind the ceiling.

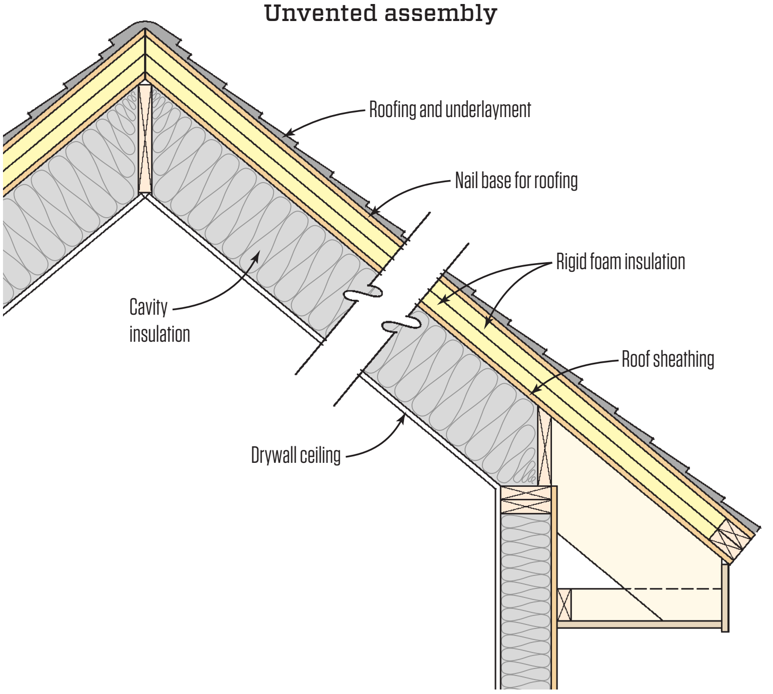
Dealing with can lights. If you have the option, avoid recessed lighting in a cathedral ceiling insulated with spray foam. Even without the ventilation air flow to exacerbate air leaks, you'll end up with an insulation dead space. The other issue is clearance. Even

Air-impermeable insulation can also be added above the roof deck using rigid foam board. As with spray foam, you need to add enough R-value to protect against condensation (see table, page 47), and it needs to be located directly above the roof sheathing with no air space (though it is common to install an underlayment such as roofing felt or a synthetic membrane to protect the building until the roof is dried in). You can, of course, add much more rigid foam than the minimum needed to satisfy the code requirements.

While you can add roof venting to an assembly insulated with spray foam for an extra margin of safety (as shown in the illustration at far right on the facing page), you can't add ventilation below the roof deck with rigid insulation installed above it. If you want to vent the roofing, though, you can add an air space above the rigid insulation. At the eaves, a nailer applied to the roof deck will simplify the drip-edge installation.

Rigid Foam Above Sheathing

Unvented assembly



if the fixture is IC-rated (for insulation contact), you can't embed it in foam. You need to provide enough clearance from the insulation so that the fixture doesn't overheat and pop the thermocouple.

When recessed lighting is unavoidable, best practice calls for installing a piece of foil-faced rigid foam above the fixture, **(4)** on previous page, or isolating the fixture from the insulation by installing it in a metal box, **(5)** on previous page. Before spraying foam, mask the fixture to keep it clean and lap the spray foam onto the rigid board to create an airtight seal. If the rigid foam butts framing, caulk that joint using a polyurethane sealant. (It will also help to advise the homeowner to use only CFL or LED lights, to avoid heat build-up.)

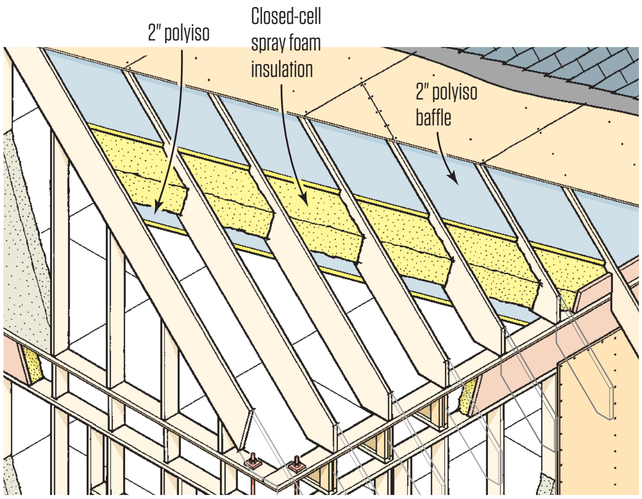
Filling the void. Below the foam, the cavity can be filled with blown fiberglass or cellulose, or with any batt insulation. The shortcoming with batts is the frequency of installation error. Voids and compressions are more common than most of us want to admit. In new construction, blowing the cavity is more commonly done through netting or reinforced poly, mostly because the insulation will need to be inspected before drywall. Installing the netting or poly usually takes twice as long as actually blowing the cavities.

RIGID FOAM ABOVE SHEATHING

If you don't insulate from below, you can insulate from above using rigid foam board. The advantage of this method is that you eliminate thermal bridging by isolating the roof structure from the exterior. As when insulating below the deck, the insulation must be next to the sheathing. This means no air space; a layer of roofing underlayment can still be installed over the sheathing before the insulation to protect the building from rain until the roof gets dried in.

As described in "Best Practices: Continuous Exterior Insulation" (Nov/13) rigid foam options include faced polyisocyanurate at about R-6.5 per inch or extruded polystyrene (XPS) at about R-5 per inch. Expanded polystyrene (bead board), which has a high water absorption rate, is not recommended on roofs.

The foam boards must be installed at a thickness to meet the minimum R-value of Table R805.6. (For example, to meet the R-25 requirement for climate zone 6, install 4 inches of foil-faced polyiso.) This, of course, is a minimum and much more insulation can be installed. Building Science Corp. (BSC), for example, regularly describes an R-40 roof assembly using 6 inches of polyiso board—



Insulation for Condensation Control

Climate zone	Minimum rigid board or air-impermeable insulation value
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

A = moist; B = dry; C = marine. For clarification, search IECC Climate Zone map at the Building America Solutions Center (basc.pnnl.gov).

Minimum insulation required directly above or below roof sheathing. Values contribute to, but do not supercede, Chapter 11 IRC requirements.

Photo: Dan Perkins

installed in two 3-inch layers or three 2-inch layers—with the vertical and horizontal joints between panels staggered. David Joyce, of Synergy Companies Construction, in Lancaster, Mass., has installed this assembly a number of times for BSC (see one example in "Retrofitting Exterior Insulation," Nov/09). His crew tapes the seams between insulation panels, then secures the panels through a layer of ⅝-inch plywood sheathing with 10-inch FastenMaster HeadLok screws driven into the rafters.

Roofing and ventilation. Ventilating above the foam is optional **(6)**, but many people like the idea because it helps reduce the chance of ice dams and promotes drying of the roofing. But ventilation isn't necessary for all roofing types. Testing begun by Bill Rose at the University of Illinois, and corroborated by the Florida Solar Energy Center, has shown that roof ventilation has little effect on roof surface temperatures, and most shingle manufacturers seem to have dropped this requirement from the instructions printed on shingle wrappers. However, code still requires that wood shingle or shake roofs be installed over battens to provide back venting. This is not to reduce temperatures, but to promote drying and stave off rot. Battens may also be required for some metal roofing (often metal tiles and "shakes"), and may be used for standing seam and other metal roofing panels to help reduce heat that can increase thermal expansion. You need to pay attention to the manufacturer requirements. In most cases, if it's required by the manufacturer, it's required by code.

BEST OF ALL WORLDS

The roof built by David Joyce and designed by BSC's Betsy Pettit (see "Air-Sealing and Insulating a High-Performance Shell," Jun/10) is a sort of über-assembly designed to cover all possible roofing contingencies (see illustration, above). It's a vented assembly, which uses a layer of 2-inch (R-13) faced polyiso foam board as the baffle. Below this, the cavity is completely filled with closed-cell spray foam, then an additional layer of 2-inch faced polyiso. It's an expensive assembly, but at a total of about R-70, and as near to call-back proof as possible, there's no questioning its value.

Clayton DeKorne is executive editor of JLC. *For more information, see "Cathedral Ceiling Insulation Resources," at jlconline.com.*

New Joists for an Old Floor

Rebuilding a sagging floor with LVL joists makes a solid base for a new kitchen

BY EMANUEL SILVA

Photos: Carter Silva

Putting a new kitchen in an older home can be a real challenge. The cabinets need to go in level and even, and most old floors are neither. One option is to shim and scribe all the cabinets to find a compromise between the high and low points of the floor, but that works best when the adjustments are small and are confined to one area. On a recent project, I opted instead to tear up the old floor and create a new, perfectly flat and level surface. This gave me a solid floor to work from and saved me tons of time and aggravation in the long run.

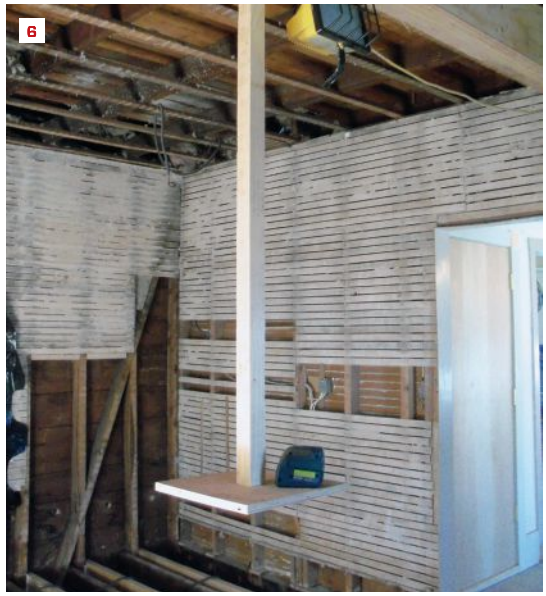
The second-floor kitchen was part of an ongoing project that we had started a couple of years earlier. I had taken most of the bounce out of the sagging floors by re-supporting the center beam in the basement (see "Shoring a Sagging Floor," *JLC*, Mar/12). That beam supported stacked bearing walls, and the one on the second floor needed to come out to create a bigger space for the new kitchen. (To pick up the ceiling joists, I replaced the wall with three 11 ⅞-inch LVLs glued and screwed together.) After stripping all of the old plaster and floor coverings from the room, I was ready to tackle the floor.

TEAR OUT

The existing subfloor in the room consisted of 1-by boards nailed to the old joists. I gave the floor a quick check with my laser level, which confirmed that the floor was high in one corner and sagged almost 1½ inches in the middle—in spite of there being a supporting wall below. (I hadn't tried to take the sag out when I beefed up the center beam for fear of causing cracked plaster and misaligned doors in the rooms above).

The quickest way to remove the old subfloor was to first saw along one of the joists near the middle of the floor. I set the blade of my circular saw at a shallow depth **(1)**, so that I didn't inadvertently slice through anything under the floor. (Supply pipes for the old heating system had been turned off and drained.) The nails holding the old subfloor didn't offer much resistance to my long pry bars, and once I got an end separated from the joist, the rest of the board popped out quite easily **(2)**.

Where the boards ended at a wall, removal was fast and simple. But where the boards continued under an interior wall, I made an initial cut about 6 inches from the wall, which let me quickly remove most of each board. Then using a reciprocating saw, I cut back the remaining stubs flush with the wall framing **(3)**. As you can imagine, dirt and debris from several decades had accumulated in the spaces between the joists, along with loose cellulose insulation that had been added at one point. To give me a clean starting point, I vacuumed the bays thoroughly as I tore out the old subfloor **(4)**.



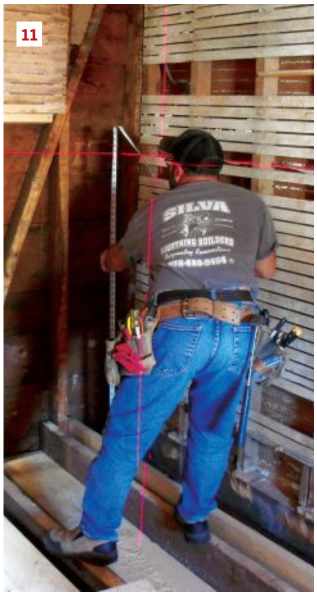
PREPPING FOR THE NEW JOISTS

With all of the floor boards removed and the joist bays cleaned, I brought in an electrician to move the wires that would be in the way of the new joists. The original joist spacing was 19 ⅕ inches on-center, a frugal layout that required less material. But fewer joists resulted in a weaker floor that had sagged severely over time. Notches in the joists for plumbing didn't help matters. My plan was to lay out the new joists 16 inches on-center and to ensure that they were long enough to sit solidly on the plates at both ends, just inside the exterior sheathing.

Keeping your balance as you walk on the edges of joists can be tricky and dangerous, so I tacked down a few of the old boards for safe footing. Because storage space in the house was at a premium, I built temporary supports out of scrap 2x4s and loaded all the LVL joist stock into the room **(5)**.

It became obvious that I would need a place out of the way to position my laser at a consistent height while I installed the joists. I ended up building a small platform that I suspended from the ceiling near the middle of the room **(6)**. Then I set up my laser level and confirmed my high point to start the framing **(7)**. With the joists cut to fit just inside the exterior sheathing, it would be tough to slide them by the stools on the two windows, which faced each other from the center of opposing walls. My solution was to cut notches in the framing for the joists to slip through **(8)**. That allowed me to distribute the rest of the joists along the floor **(9)**.


10



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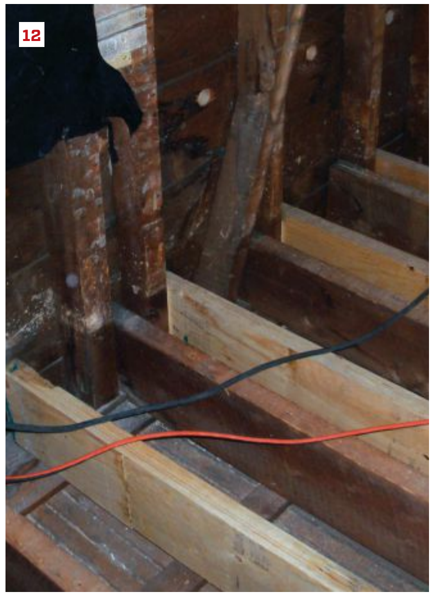
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14

INSTALLING THE JOISTS

I began the installation in the highest corner. Pulling the layout from the opposite wall, I locked the first new joist in position with a scrap screwed to the nearest old joist **(10)**. With the high point set, I measured the height from the joist to the laser, then shimmed up the other end of the joist until the measurement matched **(11)**. At the midpoint of the joist, I measured the gap between the joist and the top plate of the supporting wall below and cut a block to fit. The first joist set the height for the rest of the floor, so it was just a matter of working my way across the floor, bringing each joist up to that level.

The exterior wall was framed at 16 inches on-center except under the windows, so I was able to use the studs to set the rough layout for most of the joists. The studs also gave me a place to attach the joist ends **(12)**. For each joist, I checked the layout at both ends, and if they didn't land next to a stud, I added shims or blocking to the nearest one. As with the first joist, I measured and cut a block to fill the gap between the bottom of each joist and the wall below. After slipping the block under the joist and screwing it to the plate **(13)**, I pulled the layout for the joist and toe-screwed the joist to the block to lock it in place **(14)**.


15


16


17


18

FINAL FRAMING DETAILS

To stiffen the floor, I glued and screwed solid blocking between the joists in three separate spans across the floor **(15)**, and I blocked every space between the new joists and the old joists. At the ends of the joists, I added horizontal 2x4 blocks between the wall studs to close off the bottoms of the stud bays and to provide nailing for the wallboard **(16)**.

I needed to provide attachment for the subfloor along the walls running parallel to the joists, but it would have been wasteful to run a full LVL joist where I just needed a "nailer" below the studs. Instead, I screwed vertical blocks to the beam that forms the plate every 16 inches to catch the edge of the OSB subfloor **(17)**. Finally, I insulated the ends of each joist bay against the outside wall with fiberglass batts. To complete the floor system, I glued and screwed ¾-inch OSB subfloor to the joists, staggering the end seams as I went along **(18)**. In the end, the extra time I spent paid off. The floor was completely flat, level, and solid as a rock—a perfect foundation for the new kitchen cabinets.

Emanuel Silva is a frequent contributor to JLC *and owns Silva Lightning Builders, in North Andover, Mass.*

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GUTTERS

Replacing a Wooden Gutter

A bowed, sagging wall complicated this custom repair

BY KYLE DIAMOND

Photos: Kyle Diamond

Late last fall, my company was asked to repair the roof on an older home—portions dated back to the mid- to late-18th century—that was an interesting mix of Federal style with Italianate influences. The clients had known when they purchased the house a couple of years earlier that the roof was in need of repair and that the built-in gutter on the main house was sagging and starting to pull away from the wall. During a pre-construction walk-through, they informed me that there had been large ice dams the previous winter and the gutter had pretty much ceased to drain properly over the spring and summer. Water stains were starting to appear on the inside walls on the main floor. It was time to act.

TEAR-OFF

With winter fast approaching, we decided to fix only the problematic gutter and adjoining roof on the front side of the main house and to postpone repairing the remaining roofs and gutters until the following spring. The existing roof had three layers of asphalt shingles over a bottom layer of cedar shakes, so a complete tear-off was in order, though we planned to salvage the existing brackets, frieze, trim, and siding as best we could. The roof deck consisted of 1x10 boards spaced an inch or so apart to act as skip sheathing for the shakes **(1)**. When we ripped off the layers of leaded tin, tar, and aluminum coil stock that lined the existing fir gutter, we found

that the original wood trough had deteriorated; where the gutter was sagging the most, it was cracked and severely rotted **(2)**. The gutter was big—8 inches deep, 12 inches wide, and 39 feet long—so we cut it into manageable pieces with a chain saw to safely get it to the ground **(3)**.

The clients mentioned that the second-floor bedrooms in the front of the house were drafty and difficult to heat, and I suspected that the splayed ceilings in these rooms had little or no insulation. So I proposed sealing the rafter bays with spray foam from the outside while the roof was open. The clients agreed, and we removed the bottom five sheathing boards and sprayed closed-cell foam using Touch 'n Seal's CPDS Series 2 portable two-part sprayer. We were able to spray, cure, and trim the foam to the top of the rafters in one day **(4)**.

BRACKET REPAIR

While removing the gutter, we managed to salvage most of the Italianate-style brackets, although the outer pendant profile snapped off a few of them. Also, we noticed that the brackets had pulled away from the frieze and that the subsequent gaps had been repeatedly caulked and painted over the years, which accounted for a fair amount of the gutter's outward bowing.

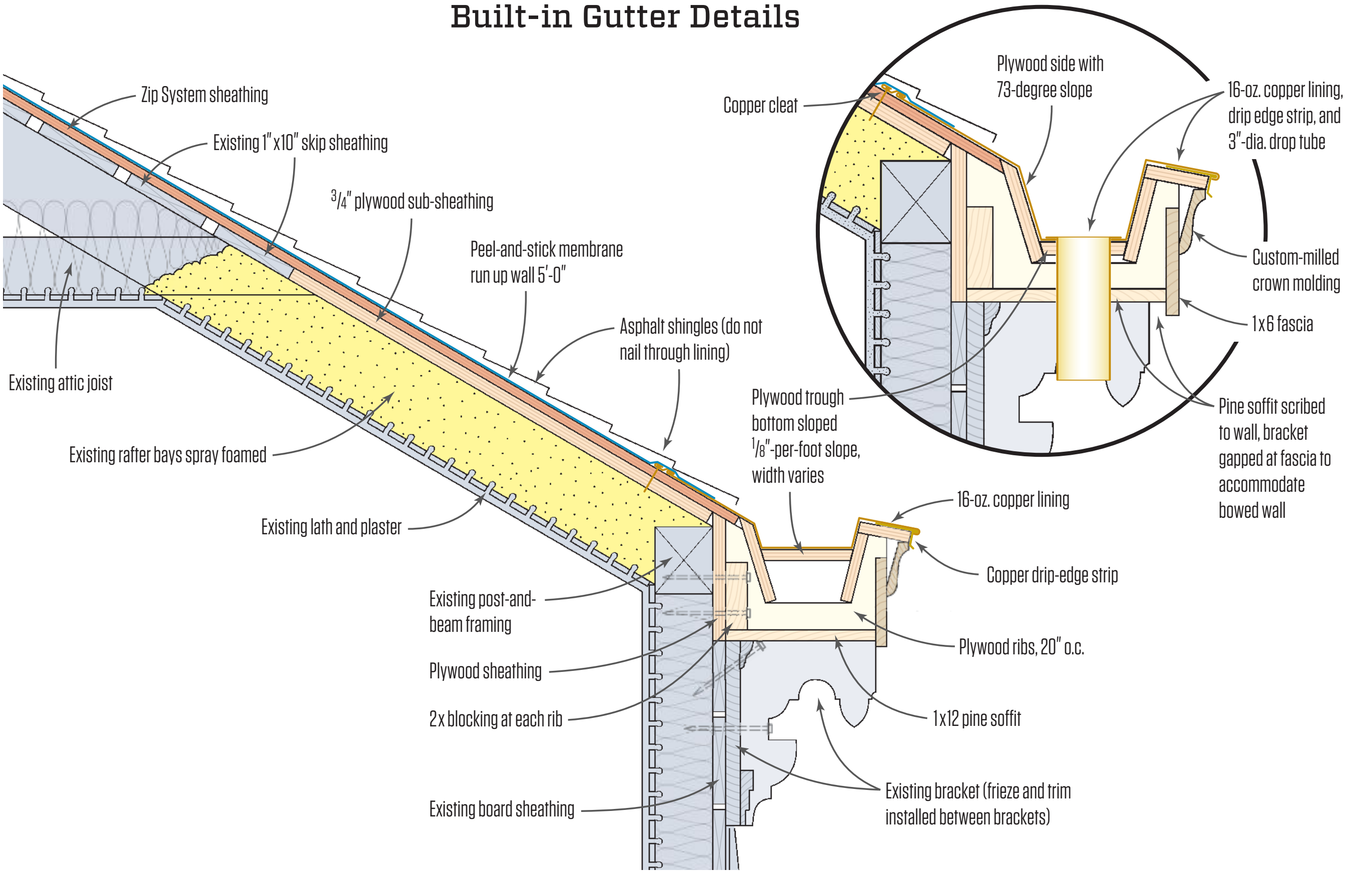
We decided to remove and properly reattach the brackets, with an eye toward leveling them as well. They had been fastened to the existing board sheathing, which was in fairly good shape, and the frieze and associated trim had been installed between them **(5)**. In a few locations, we added 2-by blocking behind the board sheathing where its ability to hold a screw was questionable **(6)**. We reattached the brackets top and bottom with GRK R4 multipurpose screws **(7)**.

Prior to reinstalling the brackets, I traced one that was undamaged on a scrap piece of plywood and cut it out to use as a template **(8)**. Back in our shop, I repaired the damaged brackets, cutting replacement pendant profiles from scraps of salvaged heart pine, joining new to old with wood glue and multipurpose screws.

With the brackets reinstalled, we sheathed over the foamed area with ¾-inch CDX to match the thickness of the board sheathing, then sheathed over the entire roof deck with ⅝-inch Zip System sheathing **(9)**. Along the top of the front wall, we installed a strip of plywood sheathing to close in the exposed wall framing, trimming the upper edge to match the roof pitch **(10)**.

For the sheathing layout, it worked out that the last course extended over the gutter, so we decided to use the sheathing to protect the gutter work area from the weather. Each night we tacked the last course of sheathing in place and taped the seams; then each morning, we peeled off the tape, removed the plywood, and continued working on the gutter. When the gutter work was done and we were ready for roofing, we ripped the last course of sheathing to width and fastened it permanently.

Built-in Gutter Details

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NEW GUTTER ROUGH-IN

With older homes like the one here, substandard framing and years of snow and ice loads cause the exterior walls to bow in the middle (the ends are more resistant to lateral forces due to their proximity to corner framing), which also brings the top of the wall out of level—with the middle being lower than the ends. For the new gutter, though, we wanted the middle to be the high point, with a downward slope toward the ends. That meant the new one would have to be taller than the original.

The wall had bowed approximately 2 inches out of line—not too bad for a house this old, though still significant. We decided to split the 2-inch difference. When we installed the new 1x12 pine soffit on the existing brackets, we scribed it to the wall, taking about an inch from the soffit's width in the middle of the wall where the bow was at its worst. We also "cheated" the bracket-to-fascia relationship somewhat: Whereas the brackets and new fascia touched at the ends, we left a 1-inch gap between them in the middle (see illustration, page 57).

To make it possible to keep the new gutter straight and fine-tune its slope, we installed a series of ¾-inch plywood "ribs" 20 inches on-center, scribing them to the bowed wall as needed to keep them in line, and adjusting them up or down in a few spots to help keep the bottom flat **(11)**. We cut them out using a router, providing a 73° slope for the sides and a notched front to receive the fascia board **(12)**. On one side of each rib, we fastened 2-by support blocking to the wall with a couple of 6-inch-long TimberLok screws. After the ribs were secured, we installed the rest of the Zip roof sheathing along the eaves, then inserted the sloped ¾-inch plywood sides of our rough trough, cutting the top of the inner panel to the roof's pitch.

Then came the fun part: fitting the sloped plywood bottom. First, we snapped lines on the plywood sides representing the ⅛-inch-per-foot slope we wanted, which worked out to about a 2½-inch drop from the middle out to the ends. Next, we custom-fit the plywood bottom, which, because of the angled sides of the trough, became narrower as it dropped in height **(13)**. This process took some time, but was made easier by having straight, parallel sides to work with. From inside the trough, the slope looked more pronounced than the 2½-inch drop we needed **(14)**, but this was an optical illusion created in large part by our compensating for the out-of-level wall. We fastened the trough bottom with screws countersunk into the angled sidewalls.

With the trough bottom in place, we installed a 3½-inch plywood cap that would help to align and support the crown molding **(15)**. The cap and molding wrapped around both ends of the trough, which


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were sloped inward at the same angle (73°) as the sides **(16)**.

The last step in prepping the trough was to back-prime and install the fascia and crown **(17)**. We used Lifespan trim (lifespan outdoor.com), a pressure-treated, solid select pine from New Zealand. I ended up milling the new crown, using knives from a previous remodel, to match the existing rake molding at the return **(18)**.

We ran peel-and-stick membrane up the roof 5 feet, leaving the backing on the bottom 12 inches until after the copper was in place. Before starting the copper work on the gutter, we installed architectural-grade shingles, leaving the bottom three courses off until the copper work was complete.

COPPER LINING

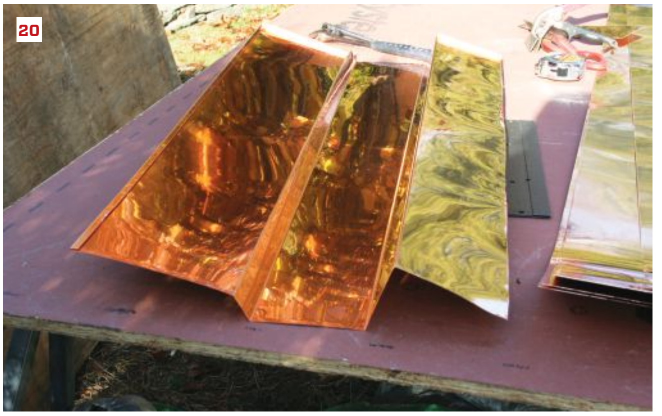
We've worked on five or six similar built-in gutters over the years. On the earlier ones, prior to installing the copper lining, we would fit building paper into the trough as best we could, fastening it with galvanized staples. But half the time the wind blew away the paper. Using a peel-and-stick membrane under the copper is out of the question because of the heat generated from soldering. These days we just place the copper directly into the plywood trough, which we are careful to keep free of debris, splinters, and raised fasteners.

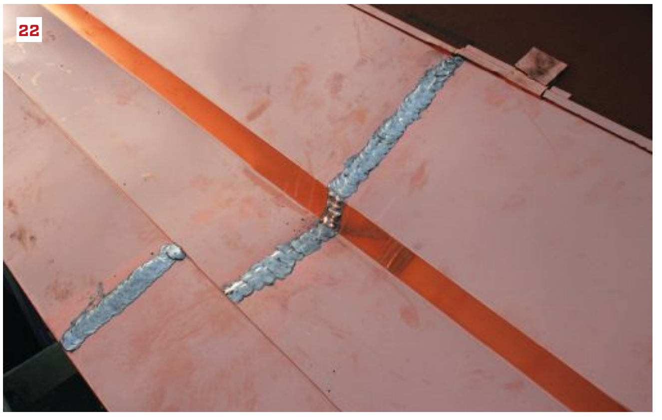
Typically, we install 16-ounce copper on all our work. We use a lot of it throughout the year, so we buy it in bulk to get the volume discount, which helps in the long run. The copper comes in 3-by-8-foot sheets, which worked out perfectly for this job.

We planned to start at the ends of the trough and work toward the middle, running two full-length pieces on each side, with two 44-inch lengths in the middle of the 39-foot gutter, where we would also create an expansion joint. To make all of the necessary bends, hems, and cuts, we used a Tapco Port-o-Bender Pro 2 brake **(19)** and a cut-off wheel. We began by running a continuous copper drip-edge along the top of the crown molding to keep water from running down the face of the molding and fascia. This is a big improvement over older methods, in which the metal liner was simply bent over the crown and nailed off every inch or so.

Each panel was formed with a trough in the middle and an upper and lower leg **(20)**. On the 6-inch-long roof-side leg, we formed a ½-inch upturned hem that would receive the copper cleats that hold the panel in place. It's important to gap this hem a little less than ⅛ inch to allow for movement when the copper expands and contracts. On the 4-inch-long crown-side leg, we made a ½-inch downturned hem.

Starting at one end of the gutter, we slid the crown-side hem over





the drip edge and settled the panel into the trough **(21)**, then secured it on the roof side with 1 ½-inch-wide copper cleats 24 inches on-center, fastened to the sheathing with 1 ½-inch-long copper nails. We overlapped the next liner panel by 3 inches, then soldered the seam **(22)** (see Soldering Seams, facing page). With two panels in place at one end, we switched sides and installed two panels at the other end.

EXPANSION JOINT

As the sun heats up a copper liner, every 20-foot run has the potential to expand approximately ¼ inch, moving from the fixed end point toward the center. Without an expansion joint on a gutter this long, the solder joints would likely fail. Where expansion joints should be located depends on the gutter's width and the thickness and profile of the copper. As a general rule of thumb, there should be an expansion joint no less than every 30 feet. Following guidelines from an old edition of Revere Products' *Copper and Common Sense*, I determined that our new gutter—built with 16-ounce copper, a 5 ¼-inch bottom dimension, and sidewalls angled at 73°—should have expansion joints somewhere between 19 and 21 feet on-center, which works out to be dead-center in our 39-foot run, between the two 44-inch panels.

One end of each of these short panels overlapped the full-length panel next to it. At the other end, where the two short panels faced each other, we bent 1-inch upturned hems. We left a gap of a couple of inches between the two panels—this would become the expansion joint—then soldered vertical "dams" in the troughs **(23)**. Hems at 90° on the edges of these dams would interlock with the expansion-joint cap where it crossed the gutter trough.

We installed the cap in two pieces **(24)**, bending its hemmed edges over the hemmed edges in the panels, then soldering the horizontal seam between the piece running up the roof and the one covering the trough **(25)**. The unsoldered hemmed edges would act as slip joints as the gutter expanded and contracted.

With the expansion joint set, we finished off the returns at each end. We used the brake and a pair of tin snips to form filler pieces that capped the ends of the trough and also covered the remaining exposed roof and the crown-molding cap returns. Where the filler

SOLDERING SEAMS

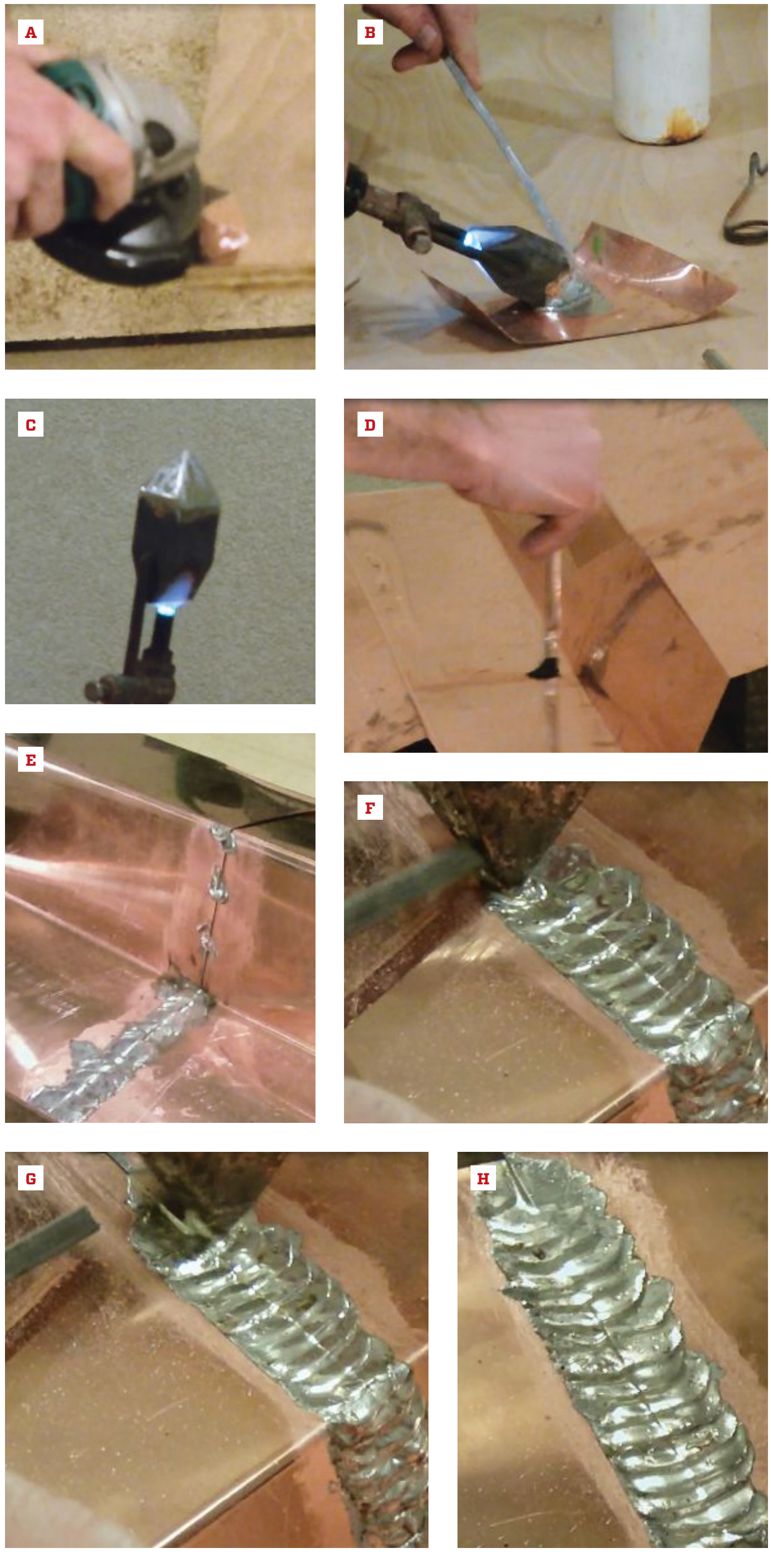
We use a pyramid-tipped, acetylene-fueled soldering iron for our roof and gutter work; propane models and other types of tips are available. Regardless of the iron or tip used, soldering requires some prep work. Make sure that the tip is clean and that the four facets are flat and meet at a sharp point; otherwise it will be difficult to control the flow and direction of the solder. We use a grinder with a metal wheel to flatten the facets **(A)**, then we sand them using an orbital sander with 80-to-120-grit paper.

Light the iron and keep it on a low setting so it heats up slowly. When it's hot enough, "tin" the tip on a scrap piece of copper **(B)**. Spread flux, then melt enough solder to spread evenly on all four facets of the tip **(C)**. Tinning makes for a smooth flow of solder when working a seam.

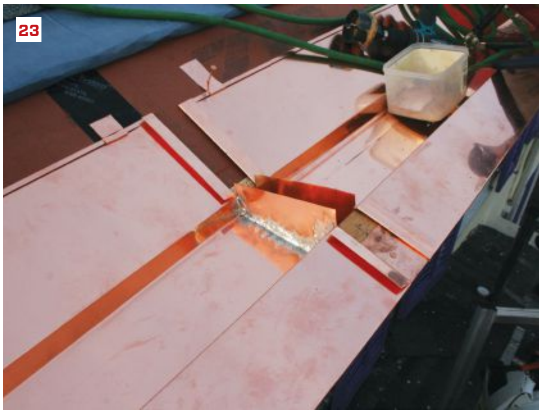
Most of the seams in a gutter are flat—no fold, just metal overlapping metal. To begin soldering, brush flux on the seam, making sure it flows between the sheets **(D)**, then "tack" the seam in several places with a spot of solder **(E)**. This keeps the two pieces of copper in close contact with each other so that they will heat up evenly.

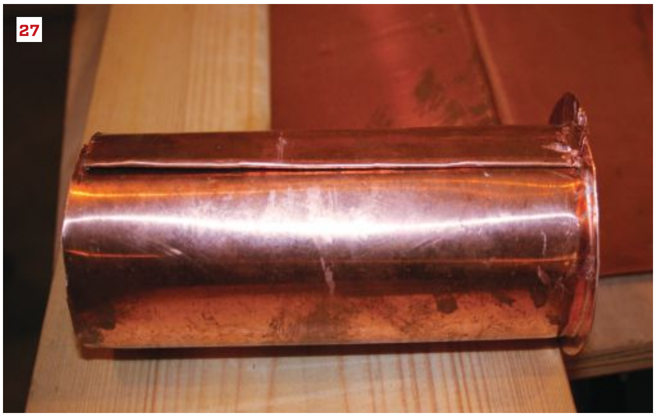
Soldering is two-handed work: One hand works the iron, the other controls the solder stick. While holding the iron at a shallow angle with the tip against the metal, press the solder stick against one facet of the tip until a drop of melted solder forms **(F)**, then use the iron to spread the drop across the seam **(G)**. Each drop adds another layer, and the heat of the iron on the copper draws the solder into the seam to make a water-tight seal. The thick "ribs" reinforce and strengthen the seam **(H)**.

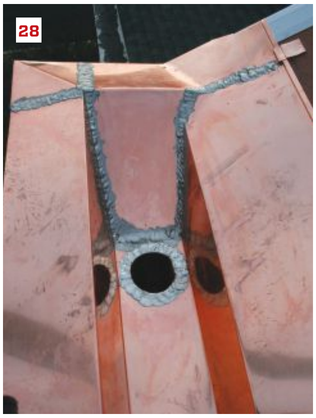
If the copper gets too hot, the solder will become runny and difficult to work, especially on a vertical seam. A slightly cooler tip will give you better control as you build layers of solder. If the copper gets too hot, lift the tip off the metal for a few seconds; adding flux will also cool the seam. —*K.D.*



Photos captured from author video







met the trough, we bent a ½-inch leg that would form the soldered connection. To install these pieces, we slipped the legs under the liner trough, molded the upper portion to the roof, the crown-molding cap, and the gutter return, and soldered the seams **(28)**.

DROP TUBES

We install drop tubes last. A typical flaw with older built-in gutters is undersized drop tubes—I've seen them with diameters as small as 1 inch. For this gutter, we planned for larger, 3-inch-diameter drops. We began by drilling a 3-inch-diameter hole through the copper liner, plywood trough, and pine soffit. We then shaped an 8-inch-wide piece of copper over a piece of pipe and closed the tube with a single-lock seam. Next, we inserted the drop pipe through a 3-inch hole drilled into a 2x8 clamped in a vise, then pounded down the top ⅜ inch with a hammer **(26)**, creating a flange that would seat itself against the trough bottom **(27)**. (Copper is only so malleable—any more than a ⅜-inch flange and it will tear.) After soldering the seam, we slid the drop tube into the gutter trough—it projected about 4 inches below the pine soffit—and soldered the flange to the trough liner **(28)**.

With the copper work finished, we peeled the paper from the last 12 inches of the peel-and-stick and sealed it to the copper, then nailed off the bottom three shingle courses, being careful not to drive any nails through the copper lining.

COST

Start to finish, the work described here was mostly done with a three-man crew and took about two weeks to complete. The total cost for the gutter, including the plywood trough, was about $6,400, with the copper fabrication and installation portion accounting for about $3,100 of that (roughly $165 per linear foot). Every project has complicating factors; this one was made more difficult by the work that had to be done to compensate for the bowed, sagging wall. I expect the other gutters on the house to be a bit easier and less costly to repair when we return in the spring.

Kyle Diamond is a partner with his father, Dale, in New Dimension Construction, in Millbrook, N.Y.

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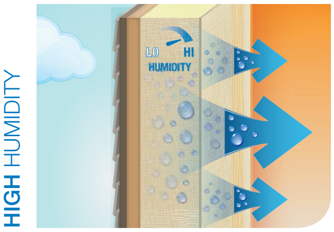

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Products

BY CHARLES WARDELL

Composite Tiles

Made from a limestone composite and recommended for floors and walls—but not showers or fireplace surrounds—Alterna Engineered Stone Tiles can be installed over minor subfloor irregularities without cracking, Armstrong says. Sizes range from 8x8 to 12x24 inches, in multiple shapes; square-foot price should be about $5.30 to $5.60. Armstrong, 877.276.7876, armstrong.com

Midrange Power Solution

Briggs & Stratton says that its new 25 kW Liquid Cooled Standby Generator will run two air conditioners as well as other essential circuits. The unit has an automotive-style engine in a galvanneal steel enclosure and is controllable via computer, smartphone, or tablet. Retail price: $8,600. Briggs & Stratton, 800.743.4115, briggsandstratton.com/us/en/generators

Tough Lightweight

InSpire Aledora 12-inch polymer-composite roofing tiles have the thick profiles and irregular edges of slate, can be installed with a nail gun and roofing nails, and have a 110-mph wind-uplift rating. Tiles weigh just 180 pounds per square with 8-inch reveals and come in an array of colors. Cost: $425 to $450 per square. The Tapco Group, 800.971.4148, inspireroofing.com

Code-Compliant Batts

With new energy codes requiring 2x6 walls to be insulated to R-20, Owens Corning has added an R-20 offering to its Propink EcoTouch insulation line. Soft to the touch, it comes unfaced or with kraft facing and is formaldehyde-free with 58% recycled content. Expect a cost of about $50 for a 78-square-foot roll. Owens Corning, 800.438.7465, owenscorning.com

Off the Tracks

Most two- and three-door pocket doors include a recessed floor track. Johnson's Sliding Multi-Pass and By-Pass Pocket Door Hardware replaces that with J-shaped guides that fasten to one door's side and fit in a channel in the adjacent door's bottom, locking them together. Overhead tracks support doors up to 200 pounds. Hardware for the doors shown should cost about $150. LE Johnson Products, 800.837.5664, johnsonhardware.com

Nearly Custom

Wolf's new semi-custom, American-made Designer Cabinet line offers dozens of styles and hundreds of finishes, and can match any paint color. Boxes can be ordered in stock sizes or in custom sizes in 1/2-inch increments in plywood or particle-board. Drawers are 5/8-inch solid wood with dovetailed corners and soft-close glides. Cost is about twice that of the Classic line. Wolf, 800.234.9653, wolfdesignercabinets.com

Tank-Tankless Hybrid

By blending on-demand heating with a 40-gallon storage tank, Rinnai's Hybrid Tank-Tankless Water Heater delivers more than twice the first hour water-heating capacity of a traditional 50-gallon tank. Aimed at replacement jobs where customers want more hot water but don't want to remodel their plumbing, it installs like a traditional unit, with the same gas line and water connections. Rinnai, 800.621.9419, rinnai.us

Bamboo Lumber

If you like the look of bamboo, check out Plyboo dimensional lumber, an interior-grade product made from Moso bamboo with a urea-formaldehyde-free binder. It comes in two colors, in edge-grain or flat-grain profiles. Dimensions range from 2x2 to 4x4, with lengths of 72, 96, and 120 inches. At $37 to $58 for an 8-foot 2x4, you won't be framing with this; its real use is as an interior finish. Smith & Fong, 866.835.9859, plyboo.com

HEPA Ventilators
Broan claims that the filtration on its new Energy Star–qualified heat recovery ventilators (HRVs) and energy recovery ventilators (ERVs) will remove 99.97% of airborne bacteria and viruses. HRVs transfer heat from warm to cold ventilation streams; ERVs also transfer moisture. A compact, 70 cfm model is available for small homes and a larger, 140 cfm unit for average homes. Prices range from $760 to $1,800. Broan, 800.558.1711, broan.com

Insulating Tyvek
An alternative to exterior rigid foam, ThermaWrap R5.0—Tyvek bonded to R-5 polyester insulation—can be installed as part of a rainscreen system under most sidings except cedar shakes and shingles. It comes in 25-pound, 4- by 40-foot rolls, with uninsulated flaps for taping pieces together. DuPont estimates a 15% to 20% higher installed cost than 1-inch XPS with standard house wrap. DuPont, 800.448.9835, weatherization.tyvek.com

Pressurized Water Saver
Gerber's new WaterSense-approved 1.28-gallon Ultra Flush toilet pressurizes the air in the tank as it fills, then uses the compressed air to force the tank water into the bowl. A MaP score of 1,000 grams puts it at the top of the high-efficiency category. Round and elongated bowls are available with 10-, 12-, and 14-inch rough-ins. List price: $407 with a 12-inch rough-in. Gerber, 866.538.5536, gerberonline.com

Quick Stain
Small staining jobs often fall to the carpentry crew, many of whom hate to paint. Enter Wood Finishing Cloths. There are no brushes to clean or cans to knock over: Just wipe with the pre-soaked cloth and remove the excess with a clean cloth. We tested one against a liquid Minwax stain and the results were comparable, though the colors weren't an exact match. Cost: $9 for a pack of eight. Minwax, 800.523.9299, minwax.com

Classifieds

February Advertising Index

EDITED BY BRUCE GREENLAW

Two New FatMax Tools

Stanley has introduced several innovative hand tools lately, including the FatMax 17-ounce Anti-Vibe Framing Hammer (model FMHT51244) and 25-foot Auto-Locking Tape Rule (model FMHT33338). Terry Goodrich, a hands-on Oregon framing contractor who employs 12 to 20 carpenters and frames up to 200 single- and multifamily houses per year, evaluated both of these tools for us.

ANTI-VIBE FRAMING HAMMER

Stanley's first Anti-Vibe hammers came out in 1998 and tamed shock waves with a perforated steel core in the handle and a vibration-damping tuning fork at the end. The new FatMax Anti-Vibe Framing Hammer still has a tuning fork, but it also has a shock-absorbing rubber collar between the head and the handle. In addition, it has two layers of shock-absorbing rubber in the grip on top of a high-impact polypropylene jacket that runs the length of the handle directly over the steel (which protrudes just below the head to protect the hammer body against damage from overstrikes). The head weighs just 17 ounces, continuing the trend toward lighter steel heads designed to compete with pricier titanium ones. A magnetic nail starter makes it easier to start nails with one hand.

"I didn't expect to like this hammer," Goodrich says. "I'd already gone from a 32-ounce framing hammer to a 28-ouncer to a 22-ouncer to reduce my wear and tear, and couldn't imagine framing with a 17-ouncer. But I love it. It has plenty of driving power, great balance, and a comfortable grip, and I appreciate the nail starter. I'm now using the Anti-Vibe full-time."

The FatMax Anti-Vibe Framing Hammer sells for about $40.

AUTO-LOCK TAPE MEASURE

Auto-locking tape measures normally have a spring-loaded bottom lever that you squeeze when extending the blade and release to lock the blade. Squeeze again and the blade retracts. Stanley's new 25-foot FatMax auto-locking tape measure simplifies that procedure. It locks automatically when the blade stops extending; to release or retract the blade, you simply press the top-forward release button. To override the auto-lock, slide the same button up until it clicks.

The new two-piece blade hook is also unique. According to Stanley, most framers like oversize hooks that can grab edges from the top, bottom, or sides, while finish carpenters like standard hooks because they don't get in the way. This tape has a standard hook along with a removable, oversize hook attachment that stores in the tape body and snaps onto the hook rivets when you need it.

"I like the new tape's auto-lock and override," Goodrich says. "But the bottom edge of the blade hook is flush with the base of the tape measure, which makes it hard to hook the edge of a material without extending the blade first. That extra step wastes time, and it drives me nuts. I'll stick with my other FatMax tapes for now."

The FatMax Auto-Lock 25-Foot Tape Rule costs about $25.

Bruce Greenlaw is a contributing editor to JLC.

HEAVY LIFTERS

Telehandlers resemble forklifts, but they have a telescoping boom for far more versatility.

Frequent *JLC* contributor Tim Uhler says that Pioneer Builders, the Port Orchard, Wash., company where he is a lead framer, bought its first machine—a '70s Badger Dynamics model—years ago for $7,500 and instantly saved some hard labor by using it to lift an I-joist package to a second floor. Pioneer now owns two Ingersoll Rand models: a VR-90 that it bought used in 2003 for $28,000 and a bigger VR-1056 that it purchased used in 2005 for about $80,000. The latter has a maximum capacity of 10,000 pounds and a maximum lift of 56 feet, with two outriggers up front for added stability when extending heavy loads.

"We use the VR-1056 on site every day for moving materials, lifting beams, raising walls, and other muscular chores," Uhler says. "Being able to grab 60 or 70 sheets of sheathing and move them in two minutes instead of lugging them manually is a godsend."

Tap into an engaging discussion about telehandlers on the "Please help me buy a Lull" thread in the *JLC* Rough Carpentry forum at jlconline.com. —*B.G.*

Werner Aluminum Pump-Jack System

BY SIM AYERS

Pump-jack scaffolding is ideal for sidewall work because you can erect the length you need with minimal hassle and adjust the infinitely variable plank height on the fly so you're always working at a comfortable height.

For years, we've used steel pump jacks with poles made of doubled 2x4s. This economical combination gets the job done, but the jacks inevitably dent the poles. While cranking the jacks down, we often have to hit them with a hammer to bypass the dents, which can trigger short but scary free-falls.

When we recently used Werner's aluminum pump-jack system (wernerco.com) to side and trim a house, though, we could relax. The aluminum jacks ride on structural aluminum poles instead of doubled 2x4s, gripping a rubber strip on the outer edge of the poles. No more scary rides down the poles. In fact, compared with using our old pump jacks, using these is like taking an elevator. We used 6-foot poles, which can travel in a pickup bed, but they also come in lengths of 12, 18, and 24 feet. The poles can stack to a maximum working height of 50 feet.

Werner's PJ-100 pump jacks cost $166 each, and the poles cost $85 to $408, depending on the length. Pole braces cost $65 to $72 each. Accessories include work-bench supports, end-rail kits, safety nets, and nesting stages. According to Werner, all of the components are interchangeable with Alum-A-Pole's pump-jack scaffolding components.

Sim Ayers owns SBE Builders, in Discovery Bay, Calif.

Photo: bottom left, Tim Uhler

Bosch Dimpler Drywall Driver

BY MYRON FERGUSON

Drywall screw guns are the standard tool for fastening drywall panels to wood or metal framing. Common corded models have a trigger lock-on button for continuous operation, a magnetic insert-bit holder that prevents screws from falling off the bit, and a nosepiece that fits over the bit holder to serve as an adjustable depth stop.

They also have a clutch consisting of two mating ratchet plates held apart by a spring. At rest, the clutch isolates the bit holder from the motor, allowing you to feed screws onto the bit with the trigger locked on. Once you load a screw, you push the tip against the drywall to engage the clutch, which drives the screw until the nosepiece hits the drywall and the clutch slips. Properly set, the unblemished countersunk screws leave a perfect dimple without tearing the drywall face paper or damaging the bit. The noses easily pop off so you can extract errant screws in reverse, swap bits, or work without the depth stop.

These tools cost about $80 to $180, which is reasonable for drywallers but hard to justify for remodelers who only occasionally hang drywall. One alternative is to chuck a heavy-duty Bosch Dimpler drywall driver into your existing corded or cordless drill. It will give you most of the benefits of a dedicated screw gun at a fraction of the cost.

The Dimpler has been around for years but was recently redesigned to provide better access into inside corners. Like drywall screw guns, it has a magnetic insert-bit holder, a depth stop, and a clutch. Its depth stop is fixed, though, so the tool consistently countersinks screwheads a millimeter deep and leaves a slight dimple. To change bits or to remove a screw, you simply push and twist the head, which exposes more of the bit and defeats the depth stop. Another push and twist resets the head for driving. You can't lock on your drill trigger and load screws while the motor runs, as you can with a screw gun, but that is a minor inconvenience.

The Dimpler is useful even for drywall contractors. I install panels using a drywall screw gun and then circle back later with a cordless drill and Dimpler to add screws where necessary or to set any high ones.

If you buy this tool online, make sure that you aren't buying the old version with the same D60498 part number (that version doesn't have a blue nose). The new Dimpler costs about $12.

Myron Ferguson is a drywall contractor in Middle Grove, N.Y., and presents the Drywall Trade Secrets clinic at JLC *Live.*

Photo: left, Linda Ferguson

QUICK CORNERS

Bullnose drywall corners are common in my area. To run baseboard around them, you can either butt the baseboard to pre-made radiused wood corner blocks—sold in standard base profiles by building suppliers—or you can cut three-piece corners that use a short wedge of the base material as the transition piece. I prefer three-piece corners because the thickness of the pre-made blocks is inconsistent, which can create a sloppy transition.

You need to lay out three-piece corners precisely, though, to prevent gaps. In the past, we've made short sample corners to use as a marking gauge, which is a tedious extra step. We now use Bench Dog's compact plastic Bullnose Trim Gauge instead (benchdog.com). We just hold it over the corner and quickly mark the two required layout lines. It's dead accurate every time, and costs about $10.

—Matt Arnold owns Mattco Construction and Carpentry, in Upland, Calif.

Backfill

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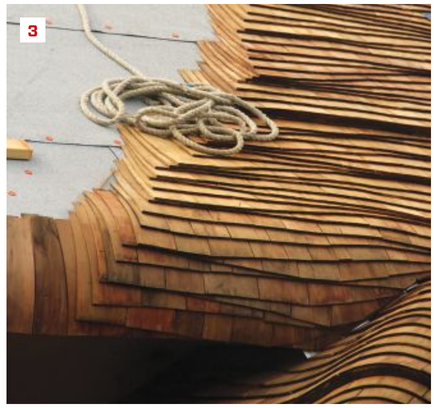
BY JON VARA



1. To conform to a curve, shingles are steamed in a basket above a drum of boiling water for 15 minutes, then clamped into one of a series of sheet-metal forms, each a different radius. Once cooled, the curve is permanent. **2.** The smoothly curved, irregular coursing characteristic of shingle thatch can only be established by eye. **3.** Convex curves are shaped by fastening 1x2 lath to framing members sawn to the desired profile, while valleys are rounded off with plywood infill. And yes, this kind of work does use a lot of shingles. **4.** Fire-retardant shingles—like those shown here—when laid over an approved fiberglass base sheet, qualify for an "A" fire rating.

Shapely Shingles

Shingle thatch roofing is a holdover from the early 20th century Tudor Revival movement. Cheap labor and a now-unimaginable abundance of clear red cedar made it a popular roof style around World War I. Most of those original roofs have since been stripped and covered with asphalt shingles, but Golden, Colo., roofer Walter Lacey is among a handful of modern practitioners keeping the art alive. Here, Lacey and his crew renew a roof they installed 30 years earlier, after it—along with many conventional roofs nearby—fell victim to a heavy hailstorm.

Jon Vara is a writer in Cabot, Vt.

Photos: Pat Kanan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