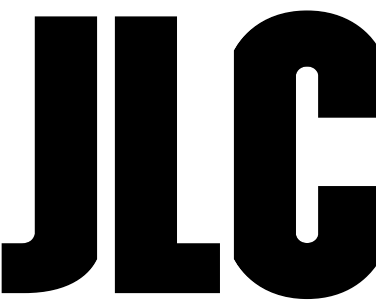

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Building an Eyebrow Dormer

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On the cover: Lead carpenter Ryan Labrenz of New Dimension Construction, in Millbrook, N.Y., applies the mortar setting bed for a stone tile floor over electric radiant heating as part of a home remodel in Dutchess County, N.Y. Photo by Kyle Diamond

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Group Editorial Director, Residential Construction John McManus, jmcmanus@hanleywood.com
Editor Clayton DeKorne, cdekorne@hanleywood.com
Art Director Sarah Bell, sbell@hanleywood.com
Managing Editors Ingrid Bush, ibush@hanleywood.com; Laurie Elden, lelden@hanleywood.com
Assistant Managing Editor Carey Hodges, chodges@hanleywood.com
Illustrator Tim Healey, thealey@hanleywood.com
Senior Editor Roe Osborn, rosborn@hanleywood.com
Graphic Designers Jen Aranyi, jaranyi@hanleywood.com; Kim Lofgren, klofgren@hanleywood.com
Contributing Editors Michael Byrne, Michael Chotiner, Ted Cushman, David Frane, Bruce Greenlaw, Dave Holbrook, Joe Stoddard, Jon Vara, Charles Wardell, Andy Wormer

Senior Web Developer Braddock Bull, bbull@hanleywood.com
Digital Content Strategist Austin Heller, aheller@hanleywood.com

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Editorial & Advertising Offices: **The Journal of Light Construction**, 186 Allen Brook Lane, Williston, VT 05495, 802.879.3335, Fax: 802.879.9384.

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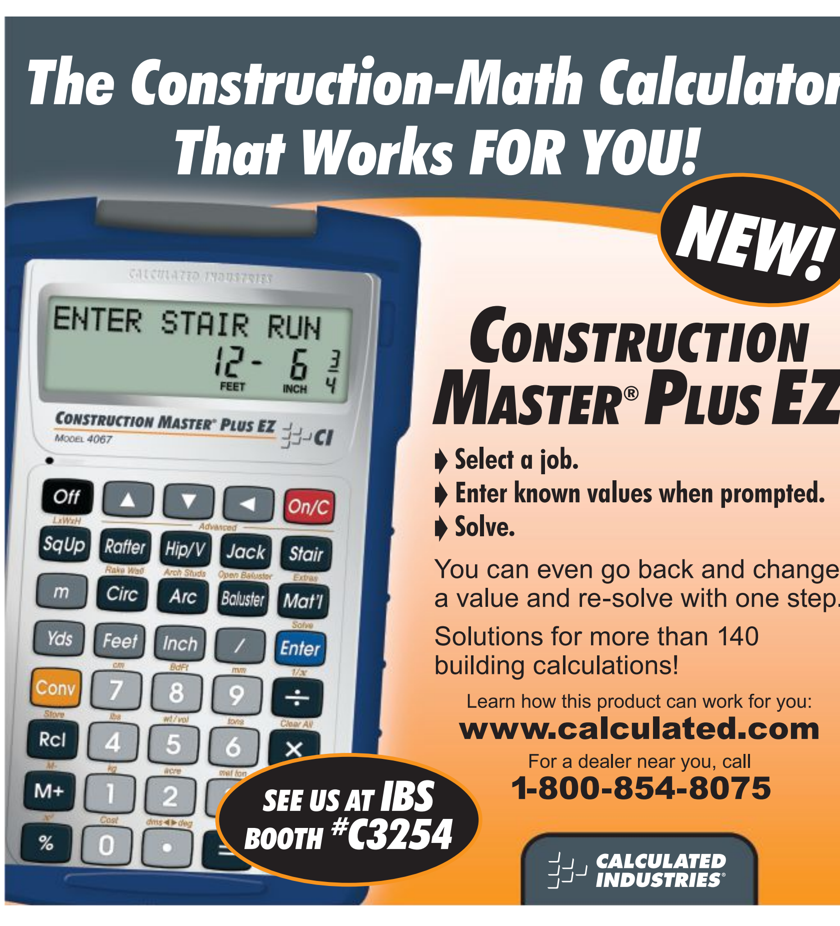

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Rick Strachan Group President, Residential Remodeling
202.736.3332 Fax: 202.785.1974
rstrachan@hanleywood.com

Fredderick Chandler Vice President, Sales
202.729.3544 Fax: 202.785.1974
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Letters

"THE $680K MISTAKE: BEACH HOUSE BUILT ON WRONG LOT," BY TED CUSHMAN (ONLINE, 10/28/14)

Dennis Celsor: Timely article. This shows the importance of getting a foundation form survey. Regrettably, your article makes it sound like it was all the builder's fault, that he neglected to obtain the proper surveys. The original article that you referenced makes it clear that the builder did all he could to verify he was building on the correct lot. The initial survey, the form survey, and the final survey by another company were all wrong. The builder says he took all the precautions that he normally takes to prevent this situation.

"IS OSHA THE NEXT ANGIE'S LIST?" BY CLAYTON DEKORNE (ONLINE 10/2/14)

Safetyfirst: I am there with you. I make residential construction safety inspections for builders. Unfortunately, I see the same safety issues [described in this article]. There is little or no planning for safety done by many residential subcontractors. Some subcontractors who work at heights appear to take pride in taking unnecessary risks with their personal safety. Part of what I do is explain how an OSHA inspector would view their particular safety situation in terms of issuing a citation and a fine. Some listen, most don't.

IS A HUMAN LIFE WORTH $2,363? (TOOLS OF THE TRADE, ONLINE, 10/30/14)

Stp479: This article illustrates perfectly why we have unions and reminds us that those who would suggest that this is adequate compensation are the same people who once sent company thugs to murder union organizers and strikers.

"FRAMING A ROOF WITH I-JOISTS," BY TIM UHLER (JUN/13)

Myrtron: I wonder how the I-joists hold up over time with wet weather before the building gets closed in? On the same note, has anyone had any experience dealing with rot repairs down the road in a roof framed with I-joists?

Tim Uhler, responds: As you know, we get a lot of rain here in Washington state. We've used I-joists many times in the wet time of year and have never noticed any problems with them swelling or coming apart. However, we have had plywood sheathing swell on the roof.

My thinking on using I-joists as rafters is that they aren't exposed for long before being dried-in. As joists, they get a lot wetter. I have not heard anything negative either from inspectors or lumberyards. About a year ago I went into the attic of a house we'd built in 2002 with I-joist rafters. We had built the house in the winter and it got very wet, but the I-joists looked great. Hopefully that helps a little.

"WHAT'S THE PAYBACK FOR BECOMING A HOME PERFORMANCE CONTRACTOR?" BY MYRON FERGUSON (AUG/12)

H20HeatingInfo: Thank you for sharing. I did not know about the yearly financial sale goal/requirements. I can see that being an issue for contractors in small markets. In my area (Northeast) within my segment (heating), the price point per job is reasonable. Energy prices in my state (Connecticut) are among the highest in the country. We still have many homes without natural gas that are either "all electric" or using "heating oil," or a combination of both for residential heating. Homes in my area without the benefit of low-cost natural gas are paying a lot for electricity and heating oil ($2,000 to $5,000 in heating expenses per season). High heating expenses usually result from a poor thermal envelope. I'm taking the BPI envelope course next month to better educate myself on the heat-loss process. With this improved understanding and BPI accreditation, I hope to get a leg up on my competition in the heating industry in the New Haven, Conn., market.

In general, the plumbing and heating industry in New England is different from the industry in other parts of the country. When looking at a $4,000 gas-fired domestic tankless water heater, for example, sure it looks like a lot of money if you're comparing it to a stand-alone atmospheric gas-fired water heater for $1,000 replacement "swap-out." But in my area, we run into a lot of indirect water heaters, aqua boosters, and oil-fired water heaters—items that have a replacement price of $2,000 to $5,000. In this case, upgrading to a $4,000 tankless unit might be marginally more, but you're getting a product one-fifth the size with a warranty that lasts twice as long. The upsell to a tankless water heater in my area is infinitely easier than it would be for a plumber trying to sell a tankless water heater to a homeowner in North Carolina. ROI calculations vary greatly from location to location. In New England, high-efficiency water heaters and boilers (usually) make a lot of sense because we have cold winters (long heating seasons) and the second-highest energy prices in the nation.

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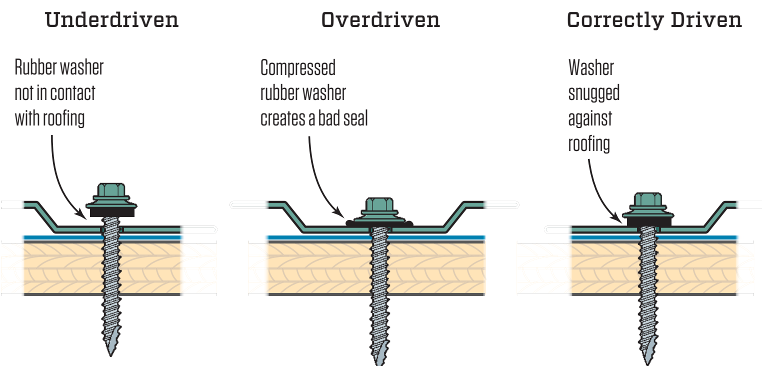
Q The new corrugated metal roofing on our client's garage leaks. The installer had driven the fasteners through the valleys and into the 2-by rafters. We've since been told that corrugated roofing should always be fastened through the ridges of the corrugation. Which method is correct?

A Rob Haddock, a metal-roof consultant and director of the Metal Roof Advisory Group, responds: The culture of fastening through the ridge (crest) or through the valley of the metal-roof profile seems to vary in the continental U.S. from one place to the next, from one contractor to the next, and even from one manufacturer to the next. Many years ago (before the advent of weather-sealing washers on fasteners), corrugated roofing was always fastened through the ridges using "lead head" nails. These were galvanized roofing nails with a lead washer under the head. As a nail was driven and its head came in contact with the roofing, the soft lead was supposed to conform to the surface of the roof to provide a seal. But these fasteners were notorious for leaking, which is why they were always driven through the high points of the roofing profile.

Today the fasteners of choice for corrugated roofing are gasketed hex-head screws with a metal and rubber washer below the head. As the screws are driven, the washer presses against the metal roofing to form a waterproof seal. If the screws are driven correctly, fastening through either the valleys or the ridges of the roofing is considered acceptable in this country. Valid arguments can be made for both preferences. If the fasteners on your roof were all properly driven, it is unlikely that they are the source of your leaks, regardless of whether they were driven through valleys or ridges.

No matter what fastener location your installer prefers, there are several factors to consider when fastening metal roofing to a building. Be sure to choose the right fastener—the right length as well as the right material—for your particular application. Roofing manufacturers often recommend certain fasteners and fastening schedules for their products according to the structural material of the roof. Each fastener must be driven straight into the metal roofing perpendicular to the plane of the roof to ensure that the washer seals evenly around the fastener hole. Also, fasteners should be driven using a properly adjusted torque-sensitive tool to avoid overdriving (see illustration, below). Applying too much torque when fastening through the ridges could crush or distort the profile of the roofing, and applying too much torque in the valleys could distort the washer to the point where it no would longer create an effective seal.

Fastening Metal Roofing



Q As a contractor, I often have to dig and pour concrete footings. But after long spells of dry weather, the soil at the bottom of the excavated holes can be super dry. How does the moisture content in the soil affect how bagged concrete cures?

A Bill Palmer Jr., an engineer and the editor-in-chief of Concrete Construction, a sister publication of *JLC*, responds: Concrete gains strength through a reaction called hydration, which means that water is consumed as it reacts with the mix and forms the crystalline structure that makes the concrete strong. If the concrete dries out before the hydration reaction is complete, it will not reach its full strength. This holds true for curing both at the top surface and at the bottom surface of the pour.

If concrete is poured into a hole with dry soil, the soil can pull the water out of the mix and for some distance

into the concrete (depending on how dry the soil is), the concrete will be weaker than intended. To prevent weakening the concrete, dampen any dry soil that will be in contact with the concrete. Dampening the soil can also help to reduce shrinkage cracks caused by water being drawn out of the mix.

Be aware that the type of soil can have a bearing on how much dampening you should do. For example, clay soil doesn't absorb much water, so it doesn't take much water to dampen it. Never pour concrete into a hole if there is standing water in it. Excess water increases the water-to-cement ratio in the concrete mix, which also reduces the strength of the concrete. Other important factors to consider with soil types are how much the soil will compact and settle with loads placed on top, and whether the soil will expand as it absorbs moisture, as with some clays. If you have doubts about the bearing capacity of your soils, be sure to check with an engineer.

Q Am I required to use a grounding screw when working with metal electrical boxes? And what about grounding when using plastic boxes?

A David Herres, a licensed electrician in Clarkesville, N.H., responds: Using a metal grounding screw is a convenient—and arguably the most reliable—method of grounding a metal wall box or light-fixture enclosure, but it isn't the only method. Certain metal raceways, such as the familiar electrical metallic tubing (EMT) that fastens to couplings and fittings by means of set screws (or compression fittings for outdoor work), also qualify as equipment-grounding conductors.

If a metal box is being used, best practice is to insert a green grounding screw into the threaded hole in the back of the box or enclosure. The equipment-grounding wires then connect to the screw, making the metal box part of the grounding system.

An alternative is to use a ground clip, which is an approved piece of hardware that slides onto the edge of a metal box and anchors the equipment-grounding conductor tightly against the metal. Conversely, the trunk slammers' old trick of folding back the bare ground wire so that it touches the inside of the Romex connector as the cable enters the box is not a reliable or an acceptable way to make a durable low-impedance grounding connection, and most electrical inspectors will flag it as a violation.

Plastic boxes cannot be grounded in the same way. But it's still necessary to bring the equipment-grounding conductor into the enclosure to ground devices such as switches and receptacles. Connect the bare or green wire directly to the green screw on the device. If another cable exits the box to feed downstream devices, connect a pigtail to the equipment-grounding conductors in both cables to attach to the grounding screw. The pigtail ensures that grounding continuity would be maintained even if the device were to be removed for some reason.

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BY GREG BURNET

Photos: Sue Burnet

Milling Rough-Sawn Lumber

My company makes a number of wooden doors every year (see "Building a Wooden Storm Door," Sep/14), using rough-sawn (unsurfaced) lumber that we purchase from a local supplier **(1)**. We order the stock with one ripped edge to facilitate the initial milling steps.

The advantages to milling our own lumber—instead of working with S4S (surfaced four sides) lumber (available in most lumberyards and home centers)—go beyond door making and extend to any number of fine-woodworking tasks where having control over the flatness and stability of the wood is paramount. Doing our own milling also lets us dictate the exact thickness of the boards after they are surfaced.

There is a drawback to buying rough-sawn stock, though: You are unable to see the grain and color of the wood, which aren't revealed until during the surfacing process.

SPECIAL TOOLS NEEDED

Flattening and surfacing boards takes some specialized equipment. We use an 8-inch-wide jointer as well as a pair of thickness planers to surface our stock. All of our machines are equipped with Byrd Shelix spiral cutter heads that have indexed carbide cutters **(2)**.

While they're more expensive than traditional cutter heads, we've found them to be a worthwhile investment for our operation. These professional-grade cutting heads all but eliminate chip-out and tear-out (on even the hardest woods), while reducing the number of time-consuming blade changes. And the machines run quieter with these heads.

ACCLIMATE THE WOOD

The rough-sawn lumber we buy is either kiln-dried or air-dried, but we always allow it to acclimate before

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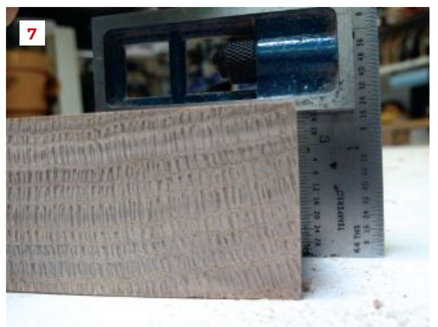
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we start the milling process. We stack the lumber on wall-mounted lumber racks in our shop and try to keep a small inventory of our most commonly used species. The racks are spaced close enough (about 3 feet apart) to keep the stock from sagging under its own weight, and we sticker the boards to allow maximum air circulation.

Acclimating the wood for a few weeks lets the moisture content in the wood balance to the conditions in the shop. This reduces the chance of the stock twisting or warping as it's milled, or worse, after we've finished the project.

FLATTENING COMES FIRST

After making a cut list for each project, we rough-cut the pieces to length for the various components, adding a few inches to the finished length to make up for any checks or planer snipe that might occur on the ends of boards. These defects need to be removed before the boards can be used.

Cutting each piece to length before surfacing also minimizes the amount of material that needs to be removed as the board is milled. Any bow or twist is usually more pronounced the longer the board is.

We begin by flattening one face of the material, to get it ready for thicknessing. We feed the boards face down across the blade of the jointer, letting the edge of the board ride against the jointer fence **(3)**. We take care to "read" the direction of the grain as the boards pass over the jointer knives. Because the top of the cutter head on the jointer rotates toward the operator, the direction of the grain along the edge of the board should angle down and away from the operator to prevent chipping or tearing out.

We make several passes on the jointer, taking off a small amount of wood at a time. With each pass, the rough areas become smaller **(4)** until all roughness is eliminated and the face is completely flat **(5)**. As a last step on the jointer, we smooth the ripped edge of the board **(6)**, which establishes a straight edge that's 90 degrees to the face we just flattened **(7)** and that can be run against the table saw's rip fence. At this point we can finally see the color and figure on the face as well as on the edge of the board.

THICKNESSING NEXT

From the jointer, we run the boards through the first of two thickness planers that smooth and flatten the other face of the board. We make the initial passes on a large, powerful stationary Powermatic planer that hogs material off quickly and easily **(8)**.

We feed each board into the planer with the flattened face placed face down on the planer bed. We make several passes to remove material from the remaining rough face until that side is smooth and parallel to the first side. Next we run the board through a DeWalt planer **(9)**, which is less powerful but makes a finer cut. We alternate passes on each face until we achieve the desired thickness **(10)**.

We mark the best face of each board with chalk so that side is used where it is most visible. Then we either cut the material into components for the project or sticker it in the racks for future use.

Greg Burnet is a JLC Live presenter and owns Chicago Window and Door Solutions, in Lyons, Ill.

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Framing a Two-Pitch I-Joist Roof

BY JESPER KRUSE

In the fall of 2014 my company built an addition to a ski lodge in Greenwood, Maine. The job is close to where I live, so I was eager to get the contract. But I also wanted to stick with my company's specialty: high-performance energy-efficient buildings. I've been trained as a Passive House consultant, and I like to apply the Passive House method to every project. Fortunately, I was able to persuade the owner that spending another 10% of the project cost on improved airtightness and increased insulation would be justified by the reduced heating and cooling costs and the improved comfort in the new building. Working on the plans with architect Eric Sokol, of Winkelman Architecture in Portland, Maine, we added our typical details—essentially, increasing the depth of the roof rafters and the thickness of the walls by using a wood I-joist build-out for super-insulation.

TWO ROOF PITCHES

We used 16-inch-deep wood I-joists for the cathedral roof of the addition, with a supported ridge. The deep joists were overkill for the building's roof span, obviously. But we did have to scratch our heads a little to figure out the framing details for the two-pitch roof system. The roof above the main room of the addition is framed on a 12 pitch, while the roof of the adjacent room has a shallower slope. We framed the addition so the lower roof's rafters would bear on the upper roof system, with the intersection located above the bearing wall that separates the two rooms. After setting the gable end rafter for the lower section, I measured down from the main roof ridge to establish the point of intersection **(1)**. We then set another rafter at the other end of the roof **(2)** and snapped a layout line to guide the placement of the remaining rafters **(3)**.

Photos: Ted Cushman

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CONNECTING AIR BARRIERS

One of the tricky things about building an airtight energy-efficient home is maintaining a continuous air barrier, or "air control layer," around all the occupied space. For this house, the plywood sheathing would form the air barrier for the stud walls, and a layer of Pro Clima Intello smart vapor barrier membrane (proclima.com/systems) on the ceiling would form the air barrier for the roof system. We needed to make the connection between the wall air barrier and the ceiling air barrier as we framed: A layer of OSB taped at the seams formed the joint at the wall plate where the rafters would sit **(4)**, and later the interior Intello membrane would be taped to that wall edge.

CUTTING RAFTERS

To make my pattern for the lower rafters, I first made a seat cut **(5)** and a plumb cut **(6)** freehand, based on the roof pitch. Then we held the rafter in place to scribe for the cut where the lower rafter would intersect the already-framed main roof **(7)**. To make it easier and faster to cut this upper angle on the rest of the rafters, we put together a jig made of OSB: We laid up two layers of OSB cut to fit snugly between the flanges of the I-joists, then screwed on another layer of OSB at the proper angle to guide the circular saw when we made the cut **(8)**.

Where the lower rafter would sit atop the upper rafter at the joint, we applied 1x6 web stiffeners to the I-joists, fitting them snug between the I-joist flanges and aligning them so that they would line up vertically above the web stiffeners in the lower roof and above the bearing wall **(9)**.

TRIMMING THE WALLS

When we had framed the walls for the room that would be under the shallower roof, the upper roof (above the main room) hadn't been framed yet. So at that time, we didn't try to frame the appropriate wall angle to match the gable rafter's slope;

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instead, we framed the wall straight across. But now that it was time to trim the wall to match the angle, we laid our rafter against it and scribed for the cut **(10)**. Then we transferred the line to the outboard face of the wall and cut the scrap part off (through the sheathing) using a circular saw **(11)** and cut the studs using a recip saw. We pulled the little scrap piece off **(12)**, framed in the gable, and then set our end rafter on the new plate **(13)**.

STRUCTURAL CONCERNS

There's no point in making a roof energy-efficient if it isn't structurally sound. So we took several measures to make sure that the rafter system was ruggedly attached and braced.

Bracing the slope transition. At the broken-back angle where the upper and lower rafters meet, we applied pie-shaped OSB gussets to each side of the joint and nailed them with plenty of 8d nails **(14)**.

Rafter connections. At the wall plate, the rafters are attached with GRK structural screws **(15)**. We also blocked between all the rafters with short pieces of I-joist **(16)**. In addition to preventing toppling of the rafters at the plate, these I-joist blocks also provide an attachment point on the underside of the rafters for strapping and the air-barrier membrane.

Uplift connection at eaves. Although we're not close enough to the ocean to have extreme wind loads, wind uplift is still a concern. Our I-joist wall buildout, mainly intended to provide an insulation cavity for the house, also helps address wind uplift: Because the I-joists are securely screwed into the wall with GRK structural screws **(17)** as well as into the roof rafters **(18)**, the wall I-joists help hold down the roof system.

Jesper Kruse owns and operates Maine Passive House, a green building and design company located in Greenwood, Maine (mainepassivehouse.com). For more information about this job, see the interactive slide shows at jlconline.com.

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BY PAUL WINANS

Making Sense of Markup

When I was selling remodeling services, "What's your markup?" was a question I'd periodically hear from potential clients. Here are some thoughts and suggestions about how to handle that question.

1. Be clear. To respond with confidence, you must be clear with yourself that you, your family, and your company are worth what you've decided to charge. If you aren't confident about this, you won't be taken seriously by prospects when talking about it.

2. Reverse the question. A contractor typically will answer any question a potential client asks. But by doing so, he may lose control of the sales interaction. When a prospect asks "What's your markup?" it's best to respond with a softening statement, "Several of our potential clients have asked me that question," followed by a reverse, "Why are you asking that question?"

You need to find out the question *behind* the question. After all, the client may be asking about markup simply because a friend said that's what he should ask. Your potential client might not actually care about your markup. You just need to walk him through the conversation so he feels he's asked all the expected questions.

3. Ask yourself: What step did I miss in the sales process? One of your goals in the early parts of a sales call is to learn about the client's emotional reasons for undertaking a remodel and all the associated hassles and distractions that are inherent in the process. If a prospect is asking about markup late in the sales interaction, it's likely that an earlier part of the sales process wasn't addressed as completely as it should have been.

If that's the case, work your way back. Ask about the problems the homeowner brought up earlier in the conversation, what he or she thinks about your understanding of them, and why that client believes you and your company are the right partners to help solve those problems.

4. Answer the question. After doing all of the above, here is some of what I would then say to the client:

"We don't expand or contract our business as opportunities present themselves. We do only a certain amount of business a year because we want to deliver a consistently good experience and product to the valued clients who choose to work with us.

"At the same time," I then would add, "we know our costs of being in business—what we have to spend even if we have no work going on. This is our overhead, which includes phones, rent, stationery, training, and so on.

"Additionally, we have expected return—otherwise known as profit—which we hope we will generate as a result of shouldering all the risk we take on by providing a fixed total price for our clients' jobs. Since a project's cost can accurately be known only after the project is completed, we need some security to cover the inaccuracies that are inevitable in any estimate. That expected return [profit] helps us with that and also allows us to continue to improve our systems and tools, all of which help make any project we do more likely to be successful."

I conclude with: "What do you think about what I've said so far?"

5. Offer a second response. However the client answers, respond with something like: "I've heard that from some clients. Why are you bringing it up?" Always probe before responding.

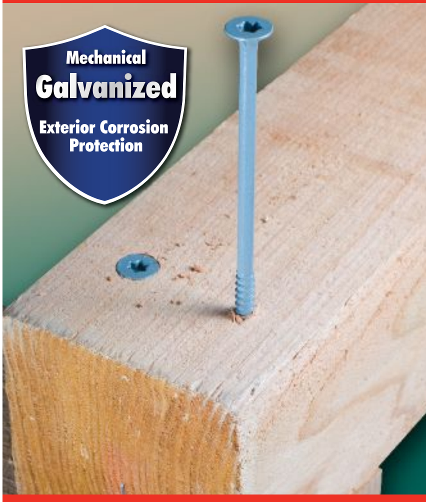
If the prospect is still interested in discussing markup, here's what I would say: "To cover our overhead—the costs of keeping our business open and improving—we charge 30% of the sales price. To provide for the possibility of an expected return, we charge 10% of the sales price."

Notice that I'm not telling him how much we're "marking up" the cost of goods sold. Instead, I'm telling him what portion of the sales price includes the overhead and profit, or in other words, the margin (which in the example I'm giving is 40%).

Now if the prospect says that's higher than what he's heard from other contractors, go back to asking what drew the homeowner to your company in the first place, and ask "To get those characteristics and qualities, do you feel it's worth paying the difference?" If he doesn't think so, wish him well and ask if you can check back in a month or two to see how the project is unfolding.

The main point I hope you take from what I've described here is that you *must* make money when running a business, and to do so, you can't let your potential clients tell you how much to make. After all, *you're* the expert on running the business, not them.

Paul Winans, a veteran remodeler, is a facilitator for Remodelers Advantage and a consultant to remodeling business owners, winansconsulting.com. This article was adapted from a story that originally ran in the August 2014 issue of JLC*'s sister publication,* Remodeling.



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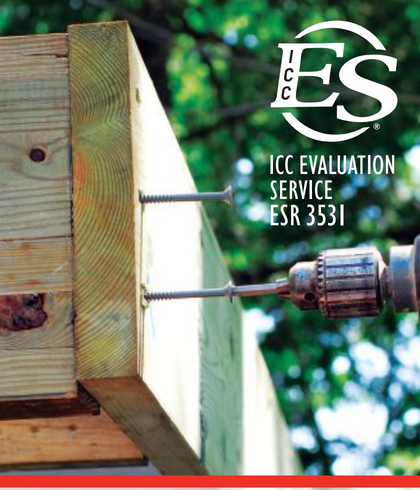


Markup vs. Margin

It's not uncommon for people to use the terms "markup" and "margin" interchangeably, as if they mean the same thing. And, as dollar amounts, they do; but as percentages, they're very different—and that affects your business.

Imagine that you have estimated a project and have totaled all the costs including labor, materials, and subcontractors. That's everything inside the blue box in the diagram, below. Upon leaving the project, everything inside that blue box stays on the job.

If you plan to sell the job at a 50% markup, the correct method will add half the costs (50% x $1,000 = $500) to the estimated project costs ($1,000) in order for you to determine the total selling price ($1,500).

This constitutes a true 50% markup. Many people believe that's also a 50% margin. Here's why it's not:

Margin is a ratio over the selling price:
Margin = Markup / Selling Price
Markup is a ratio over the cost:
Markup = Margin / Cost

Start with the total selling price.
In our example, markup, which is a percentage of costs, is 50%.

If we have $1,000 in direct costs, our markup is set at $500—thus equaling a total selling price of $1,500.

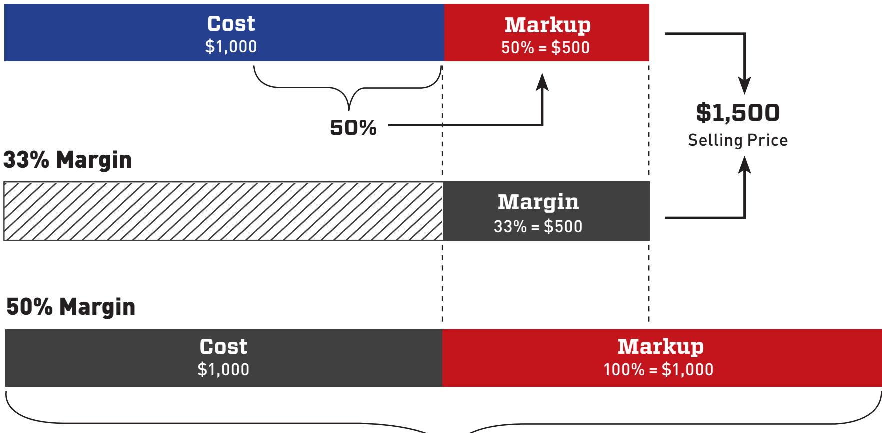
That's paralleled on the margin side. But, whereas the $500 on the markup side is half of the cost, the $500 on the margin side is one-third of the total selling price. Therefore, a 50% markup is equivalent to a 33% margin.

How would you mark up your costs to get a 50% margin?
Starting once again with the total selling price ($1,500): If we expect to earn a 50% margin, we already know that costs will make up half the equation, and the other half is margin.

How much do we have to mark up these costs to get that 50% margin? If we take 100% of costs ($1,000) and add them on top of the total cost ($1,000) in order to determine a selling price ($2,000), that leaves a 50% margin. So, a 100% markup gives a 50% margin.

If you'd like to earn a 50% margin on your next project, you must double the direct cost amount to achieve it.

Adapted from the "Do the Math" video series at jlconline.com



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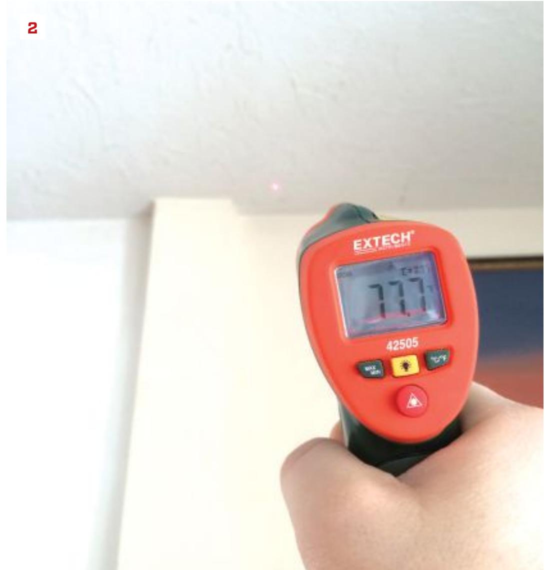
BY NATE ADAMS

Called in to address an attic mold problem, the author was confronted with more mold than just what was growing on the roof sheathing. The owners liked to keep indoor temps high (around 78° F) and ran six humidifiers all night, creating a jungle-like environment rampant with interior mold.



Petri Dish House

The good thing about science is that it is true whether or not you believe in it. —Neil deGrasse Tyson

Several months ago, I was called in to look at a house I had worked on as an insulation contractor earlier in my career. At the time we were not in the business of comprehensive home performance. These clients were used to living in a South Asian climate and wanted to transport that experience to Cleveland. To correct problems in the house created by these conditions, I was essentially asked to defy physics. This is a cautionary tale of what *not* to do in a home if you want healthy clients. Unfortunately, the tale does not have a happy ending, but it did make for a few interesting, albeit ugly, pictures.

On the day of my visit, it was 18°F out. Inside the house, it was 78°F with dew points above 70°F. The central humidifier was set all the way up to 7. (I would bet they'd like one that goes to 11, like a *Spinal Tap* amp.) To keep things moist, they ran three additional humidifiers during the day, and three more (a total of six) at night! It was a jungle inside. Within minutes, I was down to a T-shirt and sweating.

Previously, we had insulated the attic floor of this home, and the clients had become very concerned when they discovered "fuzzy stuff" in their attic **(1)**.

Mold needs three things to grow: a food source (such as dust), moisture, and a temperature in the range of about 40°F to 100°F. In homes, food is almost always present. Surface temperature and moisture are the only real control factors. On any surface in this house cooler than the 70°F+ dew point, moisture will condense. Some surfaces checked out fine **(2)**, but with all those humidifiers running and 18°F air outside, there were plenty of opportunities for things to go wrong. I saw a number of things I probably will never see again.

The bay window in the dining room wasn't well insulated, which was easy to tell because of the mold. In fact, throughout the house, *every* poorly insulated surface was moldy. To combat this, the homeowners had posted a list of weekly chores for their kids that included wiping down many surfaces in the house with bleach. (In addition to walls being wiped down, the room curtains were bleached weekly, too. With all that bleach, there are likely VOC issues in the home.)

The entire interior of the house is repainted every few years with either Drylok or Kilz. The bay window had been freshly painted less than a month before our visit,

Photos: Nate Adams

yet mold was already popping through **(3)**.

Under that same bay window ran the main cold air return for the house. This area was actually used for storage, and when we looked in there, we found pressboard that was coming apart from being soaked **(4)**. All the wood was well below the dew point and was moldy **(5)**. This isn't exactly a nice, healthy place for the return air to pass through, is it?

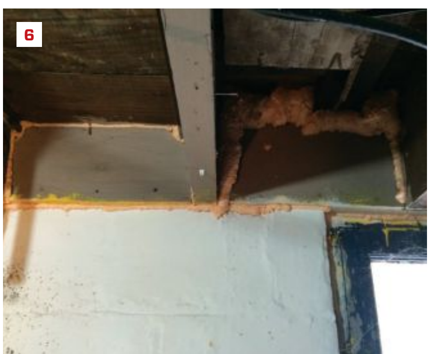
I was pleased with the air-sealing job my guys had done on the rim joists **(6)**. But note the mold, in the bottom left corner of the photo, growing on the concrete-block wall that is above grade. The homeowner repaints this annually with Drylok, and had only just done it a few months before this photo was taken.

It was easy to find the spots where the dense-pack wall insulation was missing or had settled **(7)**—no thermal camera needed. Mold ensued where the surface was below the dew point, and not where the temperature was above the dew point **(8)**.

One spot we found was an omission from our previous work **(9)**. My crew had to work around a ton of stuff in the attic, and the attic above this area of the ceiling didn't get insulated. There was so much moisture in the house that water condensed on the ceiling. Before we came, it apparently condensed across the entire ceiling and woke up the owner's three teenage boys quite frequently when they'd get a big drop of water in the face. The uninsulated ceiling area was about 60° F; the warm ceiling was 72° F.

Even though the windows were decent double-pane replacements, the homeowners had put plastic up on all of them in an attempt to reduce condensation. It didn't help. You could see the condensation on the plastic, and any leaks showed condensation on the glass itself **(10)**.

What was most surprising to me was that with all this mold in the house, the owners had only called me in about the mold in the attic. When we had insulated the attic, we had dropped the attic temperature, so condensation now formed on the underside of the roof, followed quickly by mold **(11)**. The first 6 to 8 feet of the roof was completely soaked by the frost on the nails poking through **(12)**.



THE SAD TRUTH & CONSEQUENCES

The homeowners' three teenage boys all suffer from asthma. It was frustrating that these owners weren't willing to listen to my proposed solution:

1. Reduce humidity levels,
2. Insulate any surfaces that get cold.

I corresponded with them several times after my visit and told them that there could be severe health consequences, but my suspicion is that nothing will change until one of the boys lands in the hospital with a severe respiratory issue.

HUMIDITY—BELIEVE IN SCIENCE

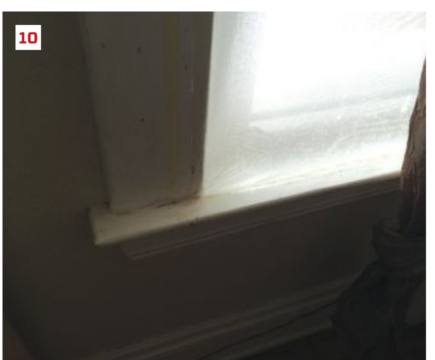
This problem is fixable. But first, behavior must be modified. Short of building a pool house and living in it, humidity levels must come down. I don't care how well you try to insulate and air-seal everything, in an existing home, you're going to miss a spot, and bad things will happen there.

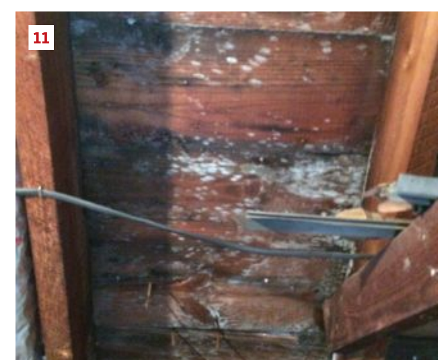
Sure, these clients like it warm. That's OK, if they're willing to maintain 55% relative humidity (RH). This is the upper level of indoor humidity recommendations. At 77°F with 55% RH, the dew point is 60°F. There is a good chance that almost all of the surfaces in the house can be kept above this. Even at 82°F with 50% RH, it's possible; that's a 62°F dew point.

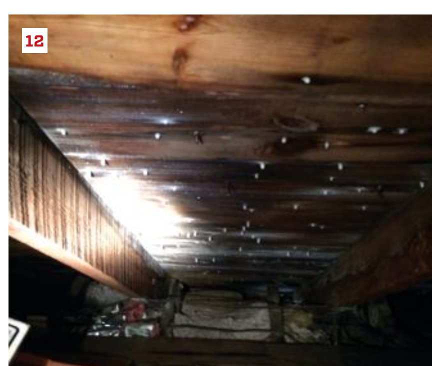
The critical piece is that the humidifiers need to be dialed back as the temperature outside drops. A higher-end humidifier usually has an outdoor-temperature sensor, but I would lean toward my favorite control, the Ecobee thermostat (see "Solving for Comfort With a 'Smart' Thermostat," Oct/14), because I could remotely monitor RH and alert the clients if they again were to forget that physics exists.

SURFACE TEMPERATURES ARE KEY

All exterior surfaces need to be insulated with a vapor- and moisture-impervious insulation, if possible. As long as the surfaces







all stay above dew point, there is a chance of success.

Closed-cell spray foam is probably the best bet for the attic, basement, and bay window in this house. The attic should be brought into the building enclosure, as it is used for storage and will be very difficult to air-seal to the level needed without foaming the roof deck. The basement walls should probably be sprayed to floor level. It may be a good idea to put foam board on the basement floor and pour concrete on top of it.

The missed spot in the closet needs a dose of dense-packed cellulose, and I would want to do an infrared scan of the house with the blower door running to catch any other missed areas. Cellulose may get wet, but at least the plaster and lath of the walls mostly protects it from a drenching.

All the window trim would need to be taken off and foam sealant applied underneath it to prevent condensation.

There are surely many more things that should be considered, and that is what an energy audit, with lots of time to think through problems, is for.

Both clients have fairly high-paying jobs, yet live in a modest house, so heating costs are not their concern. The furnace is substantially oversized—an 80,000 Btu two-stage furnace—so it could keep the home at those high temps even when below zero outdoors. It's an 1,800-square-foot building with a 2,150 cfm50 blower door, so the load is likely under 40,000 Btu. But I would want to run an energy model, trued to actual energy bills.

THE IMPORTANCE OF CONSULTATION

I've written in *JLC* in the past about my sales process and how it's solutions-focused rather than product-focused. During my initial consultation, I ask a ton of questions to find out what homeowners are trying to solve. The clients here need a customized plan if they want to continue on this temperature and humidity path. Unfortunately, they didn't move forward with an audit and plan, likely because it would call for them to change their behavior. I was told in no uncertain terms that was not going to happen. But without at least some behavior change, I can't pursue this project. There is way too much liability. These owners seem to be intentionally stepping in front of a bus here, and I don't want to be a scapegoat for problems caused by reckless behavior.

When I signed off with the clients, I warned them of potential nasty consequences. I am no longer in their employ, so as a consultant I can move on. I can't force someone to do something they don't want to do. Does it still bother me? Of course. Hopefully there will be a change of heart before anyone lands in the hospital.

Nate Adams runs Energy Smart Home Performance, a building-performance consulting company in Cleveland.

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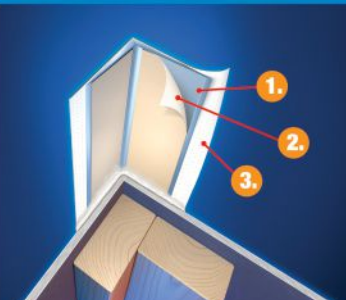

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BY LEE MCGINLEY

Electric Water Heating for a Low-Load Home

Five years ago I read an article in which the author predicted that electricity would become the residential fuel source of the future, displacing on-site fossil-fuel consumption. “Sure,” I thought. “He must be wrong.” But as I designed my house and did more research, I realized that the author who foresaw electricity’s predominance might be right.

In the 1960s and ’70s, many houses were built with electric resistance heating and electric hot-water heaters. The systems were inexpensive to install but very expensive to operate. Not surprisingly, all-electric homes fell from favor.

When I started designing my new, super-insulated home, one of my goals was to provide heat and domestic hot water as economically as possible. My plan was to use R-80 insulation in the attic, R-45 in the walls, and triple-pane windows.

A heat-loss analysis predicted that an electric air-source heat pump (mini-split) would provide comfy room temperatures in our Vermont winters with a projected annual heating and cooling bill of $400 to $500. That was substantially less than the $1,800 to $2,000 I had been paying for heating alone with an oil-fired boiler. Fine, so far.

To further contain utility costs, I needed to decide on an energy-efficient source for domestic hot water. Improvements in electric water-heater design and insulation have enabled some heaters—such as the Marathon heater (marathonheaters.com) with its thick wrap of foam insulation—to keep 50 gallons of water heated for stand-by use. But for a household of just one with a lifestyle that includes laundering in cold water, taking brief showers, and using a dishwasher with a built-in water heater, that seemed both unnecessary and expensive.

1. The author installed a Stiebel Eltron Tempra 24 Plus on-demand water heater, which has a water-temperature dial and LED ridge. He included an Aqua-Pure AP430SS Scale Inhibition System, which has a consumable water-treatment (white) canister.

Photos: Lee McGinley

GAS-FIRED OR ELECTRIC?

I considered a propane-fired tankless water heater, but that would have required using a second fuel source, running a copper line inside the house, and direct -venting the heater through an exterior wall—a disadvantage in this tight house. I’d also have to find a place outside for the 100-pound propane tank. The heaters were noisy, too, and expensive to install.

So I investigated electric alternatives. Electric air-source heat-pump water heaters that work on the same principle as a mini-split are expensive and require a large volume of indoor air to work efficiently. According to a local plumber who installed one in his house, Vermont is too cold to maximize the water heater’s potential. These units are also noisy—a compressor is attached to the heater, unlike a mini-split’s compressor, which is outside—worrisome because the utility room in this house is on the second floor.

Then I researched electric on-demand water heaters. Common in Europe and South America, they’re rarely recommended in the U.S. by HVAC guys, who tend to promote gas-fired tankless heaters that afford them greater profit margins.

At an energy trade show, I saw and instantly fell for a Stiebel Eltron electric on-demand water heater. Made in Germany, it was compact, easy to install, and required no through-the-wall penetrations or second fuel source.

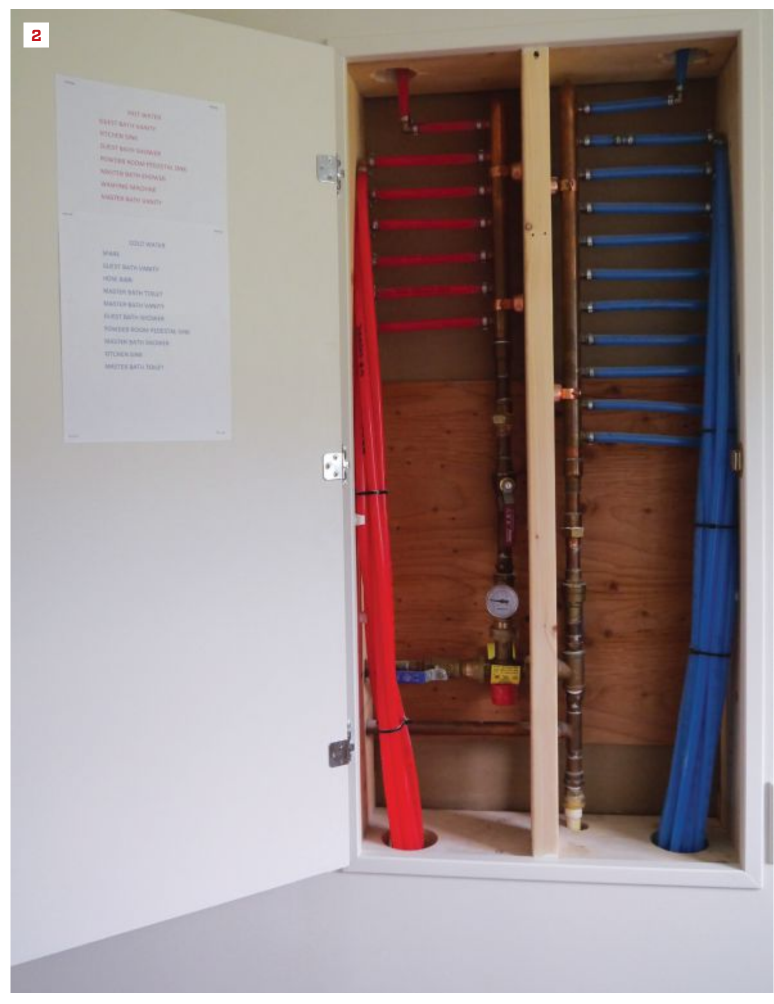
There are three leading manufacturers of electric tankless heaters: Bosch (bosch-climate.us), Rheem (rheem.com), and Stiebel Eltron (stiebel-eltron-usa .com). I did online research focusing on user experience. Stiebel Eltron came out on top for performance and reliability.

Folks who wrote about switching from a traditional electric hot-water heater to an instantaneous one noted

2. The author installed a 7-port closed-end Sioux copper manifold behind an access door. Printed sheets on the back of the door indicate which manifold port is connected to the various plumbing fixtures in the house.

3. The red knob is part of the Watts mixing valve and can be rotated to adjust the mix of hot and cold water to achieve 120° F. Above the mixing valve is the hot-water supply line to the manifold, complete with a dial thermometer to measure the mixed water temperature and a ball valve to isolate the hot-water manifold.

4. Installing the tankless electric heater on a pair of 2x4 cleats made it easier to install using threaded fittings.



reduced electrical bills. One woman claimed a savings of $100 per month.

For retrofit installations, where larger electric tankless units require two 240V/50A circuits, there were many posts from folks who did not anticipate the potential extra expense of upgrading their electrical service or running power cables from the panel box to a distant water heater.

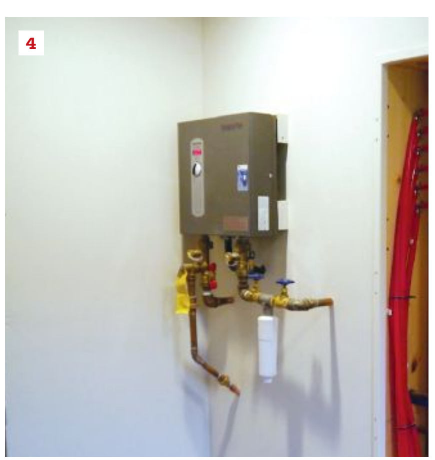
I would have neither of those problems. My house was new, with a 200-amp service, and the distance between the electrical panel and the heater would be 6 feet. A plumbing manifold would separate them.

Some users complained about not having enough hot water, but I suspect that their problems were the result of incorrect unit sizing, rather than any inherent defect in electric instantaneous heaters. Indeed, there were several postings from families with teenage girls who were pleased to report having plenty of hot water. One person posted that he had plumbed his system so he could add a traditional electric hot-water heater should the tankless unit fail to keep up with demand; his plan was to preheat the water to 80° F. Following his lead, I laid out my utility room to accommodate a hot-water tank if it was needed.

TEMPRA 24 PLUS

I chose Stiebel Eltron's Tempra 24 Plus **(1)** model, which has a dial to adjust water temperature between 86° F and 140° F and a digital screen that allows users to read the setting. The whole unit measures just 16 ⅝ inches wide, 14 ½ inches high, and 4 inches deep.

The Plus series also has a proprietary Advanced Flow Control, which maintains the set point temperature but slightly reduces the water flow when demand is greater than the unit can handle—no more sudden blasts of cold water. The company's lower-priced standard Tempra model has



the dial temperature adjustment but not the LED screen or the Advanced Flow Control technology. In addition to the unit, I installed a Watts (watts.com) LFTWH-FT-HCN Service Valve Kit with purge ports that allow regular cleaning to remove scale buildup; the hot-water side comes with a pressure relief valve.

Since scaling is a potential problem with any tankless water heater, I doubled up with an Aqua-Pure AP430SS Scale Inhibition System (aquapurefilters.com), which uses a consumable water-treatment canister (shown at lower right in the photo on page 37) as a continuous method for minimizing scale. Local code requires a mixing valve—or anti-scalding valve—set to 120° F or lower, which I plumbed just before the manifold **(2)**.

I'm not a big fan of plastic manifolds, so I modified a 7-port closed-end Sioux (siouxchief.com) copper manifold **(3)** by replacing the intake PEX barb with a brass union, and I ran rigid copper pipe from the water heater to the manifold. Generally, when plumbing, I like to isolate replaceable components with unions and ball valves to facilitate future servicing and replacement.

LEAK-FREE CONNECTIONS

The electrical wires, tank, plumbing valves, and fittings all reside in close quarters. To facilitate installation, I stood the tank off the wall with 2x4 cleats **(4)**. Since I prefer threaded fittings, close nipples allowed me to squeeze all the parts together.

The challenge came in creating leak-free connections. The Environmental Protection Agency mandated that all plumbing fittings be lead-free after Jan. 1, 2014. The lead component in the old fittings had actually made the brass or bronze more malleable and therefore Teflon tape wrapped around threads typically resulted in a watertight connection. The absence of lead in the new ones and the preponderance of low-quality Chinese fittings led me to seek another solution.

I found it in Oatey's Great White Pipe Joint Compound With PTFE (oatey.com). This white paste "greased" the connection, allowing me to make two to three more complete turns than I could with Teflon tape, assuring me a leak-free connection. I now use it for all threaded connections: brass, copper, iron, chrome.

To run the hot-water lines from the manifold to my appliances, I used AquaPEX, which is made by Uponor (uponor-usa.com) and is a PEX-A tubing that's more flexible and therefore easier to bend than PEX-B. Crimp fittings and stainless steel crimp rings completed my installation. Shutoff valves were placed at each appliance, with no ball valves at the manifold. I protected the tubing with nailing plates wherever an errant drywall screw could easily puncture it.

BACK TO THE FUTURE

My initial impression of electric tankless water heaters is very favorable. For less than $1,000, I was able to purchase the materials (heater, service valve kit, scale inhibition system, electric cable, and fittings) and one hour of my electrician's time to install the Tempra 24 Plus. That does not include my time to hang the unit and plumb the valves nor the time to run the PEX—all of which I estimate to be an additional four to six hours. A comparable propane installed tankless system would run $3,000 or more. A comparable propane installed tankless system would run $3,000 or more.

My utility room is centrally located and all runs to water appliances (sinks, dishwasher, clothes washer, showers, and the like) are short, keeping tubing lengths to 25 feet or less. Hot water arrives quickly: One shower with a home run distance of 16 feet yields warm water in less than 10 seconds and 120° F water in less than 30 seconds. An in-line dial thermometer shows that the outgoing water temperature is within 2 degrees of my set point. I have no stand-by losses (which can consume 15% to 20% of kilowatt hours used) nor am I heating water to a higher temperature than my set point in order to account for stand-by losses.

This system is very quiet; there's no boiler roaring awake to heat my water, no rumblings from a propane tankless heater—only the sound of running water when I need it.

Because my house has a crawlspace, I plumbed the pressure relief valve with rigid copper tubing to an outside wall, hiding the outlet behind a 4-inch screened dryer vent. Next time, I'll use ¾-inch PEX-AL-PEX tubing, which will allow me to zigzag between framing members without fittings.

In a future article, I'll write about my yearlong experience, including annual maintenance and electricity use. Perhaps the all-electric home with low utility costs has arrived.

Lee McGinley is a Certified Passive House Tradesperson who designs and builds high-performance homes. He lives in Addison, Vt.

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Photos: Mark Parlee

Synthetic Stucco Without Failures

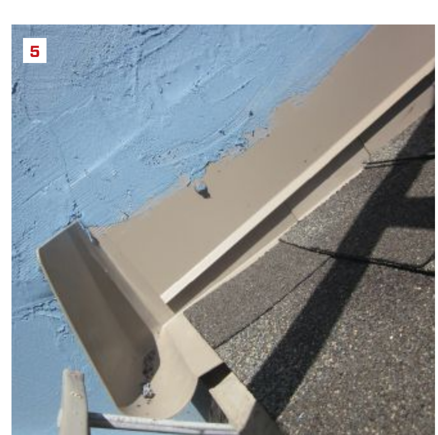
To avoid a lawsuit, build a drainable assembly

BY MARK PARLEE

I started out 38 years ago as a framing and siding contractor in Iowa, and for the last 20 years have worked as an exteriors contractor doing complete exterior renovations and repairs. Over the years, the process of tearing off and replacing complete exteriors has revealed a multitude of poor details that have failed—experience that serves my consulting practice today.

While I still keep a crew busy with exterior work, a big chunk of my business these days is providing forensic inspections and expert witness testimony for litigation throughout the Midwest. Right now we're seeing a rash of failures with all types of cladding materials, but especially with EIFS (exterior insulation finish systems) and DEFS (direct-applied exterior finish systems)—the predominant stucco assemblies used in this region—and with ACMV (adhered concrete masonry veneer) exteriors.

I covered ACMV—which in essence is a variation on stucco—in *JLC* last year (see "Best Practices: Adhered Concrete Masonry Veneer," Oct/13). And *JLC* has covered EIFS a lot in the past, including breaking the story by Richard Piper and Russell Kenney about the earliest EIFS failures soon after the system migrated to the U.S. from Europe ("EIFS Performance Review," Jun/92). Russell and Michael Kenney also wrote a piece in *JLC* ("Success with EIFS," Nov/01), which details a lot of the best practices that are still used today.



These days, however, we have more options for drainage-plane materials, which I'll cover in this article. This time, I'm going to focus on DEFS, which are similar to EIFS, except that the two-part stucco finish is applied over a cementitious or special-OSB base instead of over EPS foam boards.

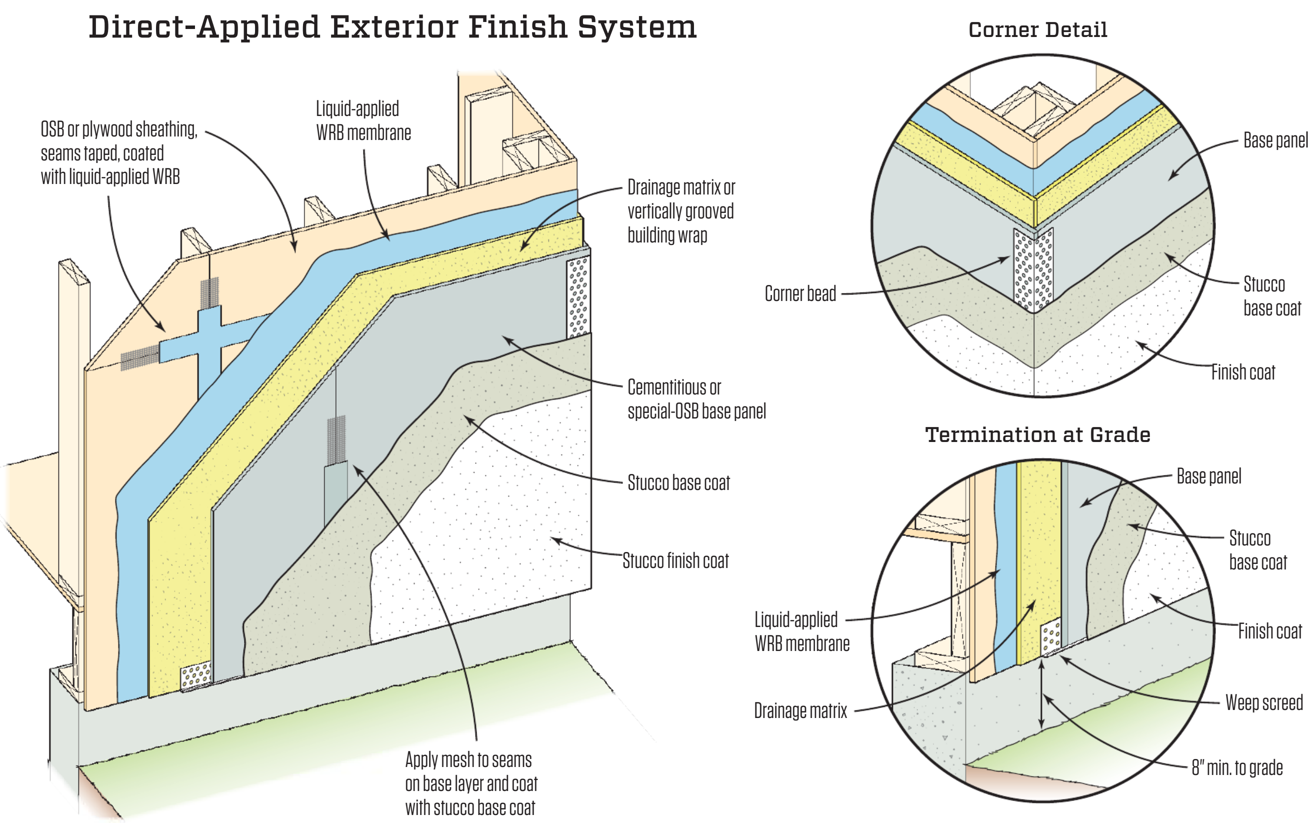
Like EIFS, success with DEFS comes by providing an effective drainage assembly and taking care in detailing flashings and sealing joints. On nearly every job I look at that's in litigation, moisture is getting past the stucco face at critical junctures and is rotting out the framed wall. The damage caused is often extensive. On one recent project, three missing kickout flashings led to some $30,000 in repairs. In another case against a builder, water that was leaking through a single wire penetration sparked an $85,000 lawsuit.

These are the kinds of numbers that you don't want to risk. Spending a couple extra bucks per square foot to get the right materials and exterior details can be viewed as a savings, not an added cost, when compared with being involved in litigation down the road. Don't mess around with low bids unless you're jonesing for a lawsuit or want to trash your reputation as a builder.

THE ESR TRUMPS CODE

I'm confident that the details shown here will work for any DEFS installation. To avoid liability, you need to compare them to the manufacturer's installation instructions and to the ICC-ES Evaluation Report. All the major manufacturers of synthetic stucco systems and the accessory products that are part of the exterior finish assembly have gone through the evaluation service process to get an Evaluation Services Report (ESR). Typically, these reports include language that states that whenever the established building code and the manufacturer's installation instructions or the ESR differ, the installation instructions or the ESR prevails. ESRs are available from the manufacturer or from the ICC Evaluation Service (icc-es.org/reports).

The main purpose of these documents is to assist code officials in determining what details are required to meet code, and some inspectors will require that you have copies of them, as well as copies of the installation instructions, on hand at the time of inspection. This doesn't happen a lot, but it's well within the building department's domain to insist on it. Certainly it's easy due-diligence to collect these reports and make them part of the job file. Take the



time to familiarize yourself with ESRs (you may want to learn how to read one at icc-es.org/Evaluation_Reports). Knowing that you had them on file and that you checked your work against them will go a long way in a court of law if you're ever sued.

OVER SHEATHING ONLY

The illustration above, at right, shows all the layers that make up an effective DEFS assembly. This assembly is built over structural sheathing. In theory, there are "approved" applications that allow you to install the base panels over open-stud framing (provided, of course, that the wall meets the wind-bracing requirements without sheathing).

I don't consider a "direct-to-stud" application best practice. While possible in some perfect world, it's not likely to succeed in the real world. Between the time that the open framing gets covered with a weather-resistive barrier (WRB) and the rest of the cladding system is installed, too much can happen (such as just having the wind blow) to compromise this key waterproofing layer. Without backing behind it, the exposed building wrap is extremely vulnerable. Direct-to-stud applications are put out there to make the price of the finish system more attractive. After all, the base panel seems like sheathing and is certainly more substantial than EPS when compared with EIFS. But that doesn't mean the final assembly will endure.

LIQUID-APPLIED WRB

A more durable and fail-safe application is to use a liquid-applied waterproofing membrane over OSB or plywood sheathing. The first step to applying this membrane is to seal the panel joints with a "wet sandwich" of fiberglass mesh and the liquid membrane **(1)**. We apply this around corners and all the way into the jambs of window and door openings, using a brush to work the liquid into tight corners and seams. Mesh and sealant should be applied to all inside and outside corners as well **(2, 3)**.

The photos in this article show either StoGuard—a gold-colored liquid membrane—or Dryvit Backstop NT—a translucent blue material. Though not shown here, Parex produces WeatherTech WRB for its Armourwall stucco system, and BASF produces Senershield-R, the liquid WRB used with the Senergy finish system.

There are a number of other liquid-applied membranes that

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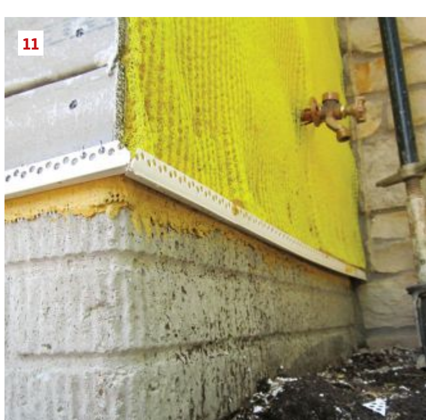
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could work, but be advised that the warranty provided by the stucco manufacturer won't apply unless you're using all the components of one system. I'm not a big believer in manufacturer warranties, as there are too many "outs" a manufacturer can take, but I do generally try to stick to the components of one system as much as is feasible.

After the corners and seams have been sealed, the liquid membrane can be applied over the whole sheathing area **(8)** by either rolling it or spraying it on. Spraying it on is a bit faster, but the over-spray can be messy. Rolling is much easier to control.

INTEGRATING FLASHINGS

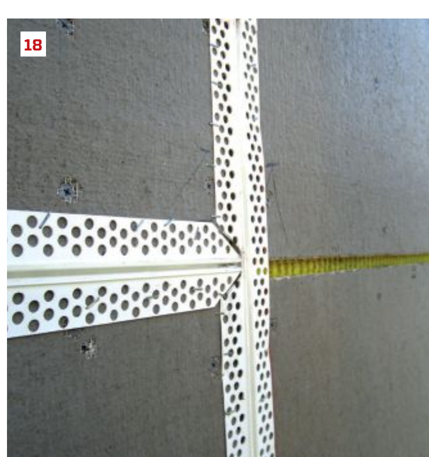
Flashings get integrated at the WRB layer. Generally, they are applied to the sheathing after the WRB is applied, and then the top edge gets another layer of mesh embedded in more liquid membrane.

Sidewall flashing. Roof-to-wall intersections typically see an enormous amount of water, making these critical areas to flash well. These must include step flashing that gets woven in with the roof shingles, and then a counterflashing to protect against water getting behind the top edge of the step flashing **(4)**. At the bottom edge of the roof, sidewall flashing must terminate with a kickout to deflect the water away from the sidewall and into a gutter.

For most builders this is not news, and we're seeing step flashing and kickouts installed more and more. The big problem is that the kickout is usually undersized. The gush of water that comes racing down the roof hits the undersized kickout and simply spills over the edge, soaking the wall below and eventually finding its way into the cladding. To avoid this, we use large, preformed kickouts, like those made by DryFlekt, on steep roofs **(5)**. Shallower roofs don't require as big a kickout **(13)**.

The top edge of the step flashing gets a layer of mesh and liquid WRB **(14)**, as does the top edge of the counterflashing. The beauty of a liquid WRB is that each flashing layer can be made an integral part of the WRB.

Chimney flashing. Just like sidewalls, the roof-chimney intersection sees a lot of water. The first step is to make sure that there's a cricket formed into the plane of the roof to create positive drainage away from the chimney **(6)**. We always use plenty of peel-and-stick on the cricket, lapping it onto the chimney, and (you guessed it)



sealing the top edge of this with mesh and liquid WRB. (Hopefully you're seeing a theme emerging here.)

Siding transitions. Residential exteriors often combine stucco with another cladding. In our area we see a lot of transitions from stucco and synthetic stone, as well as from stucco to a horizontal siding, be it vinyl or fiber-cement. Any of these transitions needs through-wall flashing. We may use a W.R. Grace membrane, such as Perm-A-Barrier wall membrane (the green membrane at the base of the wall in photos **8** and **10**). Again, the top edge of this through-flashing adheres to the wall and is sealed with mesh and liquid WRB.

Wall penetrations. Wiring conduit, plumbing, pipes, exhaust vents, AC linesets, and all other wall penetrations have to be flashed. Flashing panels, such as those made by Quickflash Weatherproofing Products, are our go-to product for sealing these areas. And, like all the other flashing, these get sealed in with mesh tape and liquid WRB.

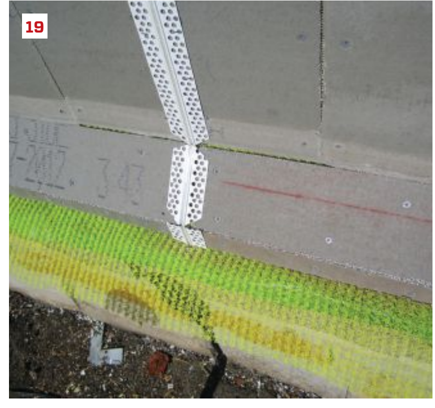
Windows and doors. These should be installed after the liquid WRB has been applied. As noted earlier, the entire rough opening gets treated first. After the unit goes in, the nail fins along the head and side jambs get pasted over with mesh and liquid WRB. But the sills are left open **(7, 15)** so water that might leak through the window or door has a way to drain out.

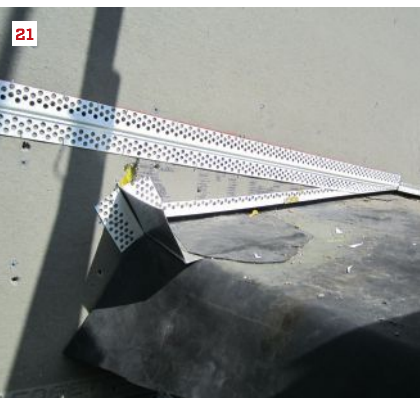
An L-flashing is required by code along the head. We typically use colored metal bent with a 4-inch back leg, and a 2-inch front leg with a 45-degree downturn along the front edge. This can be applied right over the top nail fin and pasted in with mesh and liquid WRB.

DRAINAGE PLANE

The layer that most often gets missed in a DEFS assembly is the drainage layer. I typically use a rainscreen material, such as Keene Building Products' Driwall Rainscreen or Benjamin-Obdyke's Home Slicker, the bright yellow matrix that's shown in the photos in this article **(9, 10, 12)**. I've also used Masonry Technology's Gravity Cavity, which was developed for brick walls but works for stucco systems as well. You could even use a vertically grooved building wrap, such as Tyvek StuccoWrap.

The key is to use a material that creates a three-dimensional separation between the WRB and the base panels that will be





installed over it. The liquid-applied WRBs are somewhat permeable, and if the base panel is pressed tight against them, any water that gets behind the base panel has the potential to wick through the WRB. The separation created by the drainage matrix allows the water to drain down the wall instead.

BASE PANELS

Over the drainage matrix go the base panels **(16)**. This is the key difference in the system between EIFS and DEFS. The DEFS base panel replaces the insulation panel found in an EIFS assembly. The assembly loses its insulation value, but it gains in durability and impact resistance.

There are a number of options for stucco base panels that can be used. We typically use PermaBase, a cementitious panel made by National Gypsum. We also see a lot of James Hardie HardieBacker fiber-cement panels and LP SmartSide, an OSB product that's treated with a zinc borate compound to discourage fungal growth.

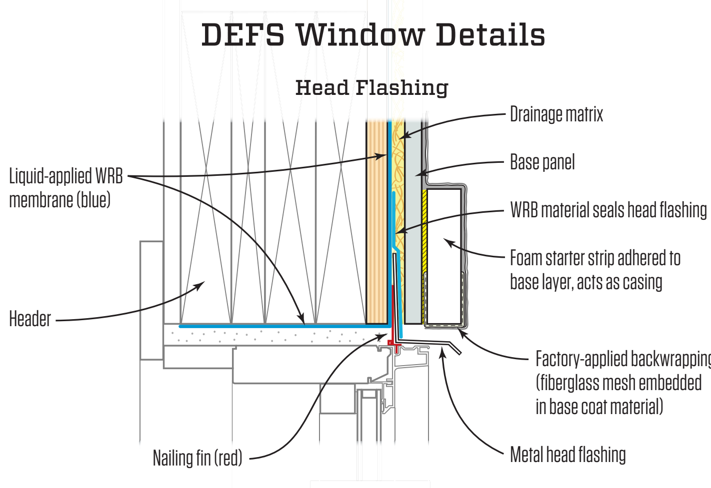
Control joints. As with an EIFS assembly, the wall area needs to be segmented by placing a control joint every 10 to 12 feet, both vertically and horizontally. The purpose of these joints is to force controlled cracks. If the wall area were larger, the stucco coating would pull itself apart due to thermal expansion and the wood framing's swelling and shrinking due to changes in humidity. By installing a control joint, however, you limit the cumulative expansion over the wall area, essentially breaking the wall into a neat matrix of rectangles.

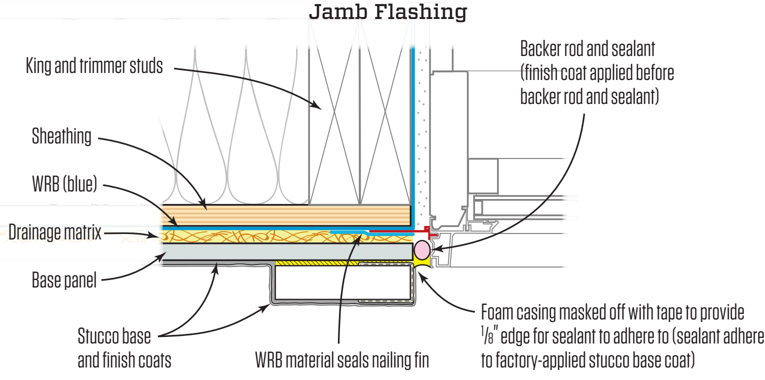
The control joint is fashioned by spacing the base panels ½ inch apart **(17)** and applying a vinyl strip with an "M" profile that will accordion in and out as the wall swells and shrinks **(18)**.

Vinyl stucco accessories, including corner bead and control joint strips, are available from a number of sources; one common supplier is AMICO Building Products.

Vertical control joints should completely divide the wall section. At the base, we bring the joint right through any transition at the wall base **(19)**. Horizontal control joints are typically placed between floors along the second- (and third-) floor band joists **(20)**. Where the horizontal joint intersects a roofline or bump-out, we are careful to integrate the control joint with edge treatments at the base of a wall **(21)**.

J-track and corner bead. We typically use a vinyl J-track (sometimes sold as "casing bead") at the base of walls to finish out the





exposed bottom edges of the panels **(11)**. True to its name, it has a J-profile to receive base panel, and it has weep holes that will allow any water that drains through the assembly to escape. It functions like a screed as well. When the stucco base coat is troweled on, the installer's trowel will ride on the proud, outside edge, revealing a small slice of vinyl that will later be painted over by the finish coat.

Outside corners should get a corner bead to create a crisp edge to define architectural details in the facade **(22)**.

The base panel should finish out at least 2 inches above a paved surface or above a sloped roof **(23)**. Above exposed grade, most manufacturers will allow a minimum of 6 inches, which conforms with the 2009 IRC, but better is the old code standard of 8 inches, to keep the bottom of the stucco out of the splash zone at the dripline.

STUCCO BASE COAT

An EIFS system would typically include an impact-resistant mesh over the entire surface of the foam boards. With DEFS, mesh is applied only at the joints, to help prevent the panel edges from telegraphing through the stucco. Like the mesh applied at the WRB layer, the mesh applied to the joints at the base panel layer is embedded—only in this case the embedding material is the stucco base coat **(24)**.

The stucco base coat is a cementitious material. It's not quite as hard as the scratch coat in a traditional three-coat system, and it doesn't go on as thick. Each manufacturer provides specifications for the thickness. Typically, it's around ⅜-inch to ½-inch per coat. What's critical is that this base coat be applied at a consistent thickness, so there are no sags or recesses. Much like with a plastered interior wall, any imperfections in the base coat will telegraph through the finish coat.

DETAILING WINDOWS & DOORS

As mentioned earlier, the detailing of windows and doors starts at the WRB layer. After the base coat has cured, we apply a foam trim, held ⅜ inch away from the edge of the window or door **(25, 26)**. This creates a channel, which will later be sealed with backer rod and caulk, as shown in the illustration above.

For the trim, we use a pre-formed foam trim. This is sold either as pre-finished trim or as a starter strip for EIFS foam board with a "backwrapped" edge. This ensures that the edge and back are coated

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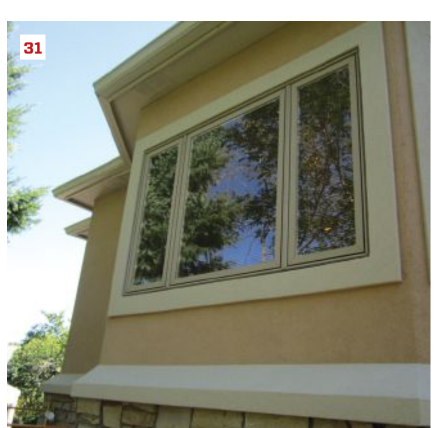
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with an even base coat that will keep water from being absorbed into the EPS trim, and it provides a uniform surface for the caulk sealant, which is applied as a final step after the finish coat. When we finally do apply the backer rod and caulk around the windows, we want the sealant to adhere to the backwrapped edge, *not* to the finish coat. The thinking here is that the contraction of the sealant, which tugs at the ends of its hourglass profile, could cause the finish coat to separate from the base coat. To prevent this from happening, we are careful to tape the windows so that the edge of the tape securing the poly that protects the windows will give us a crisp edge to which we can apply our sealant, free of any finish topping **(27)**.

Along with applying window and door trim, we now can finish the detailing of the transition to the stone base—a common detail in our area. The beveled base was built up with layers of EPS **(28)** and finished over with the stucco base coat **(29)**.

FINISH COAT

The finish coat is an acrylic latex **(30, 31, 32)**. We refer to it as "thickened paint." These days it's a pretty good elastomeric material. And manufacturers continue to improve the formulation. It can be sprayed on, but afterward should be worked to the proper texture with trowels. The guys who do this work are amazingly skilled with a trowel and can create a wide variety of finishes.

SEALANT

The final step, as noted, is applying sealant at windows and doors, per the illustration on page 47. The head should not be caulked, so that any water that leaks behind the stucco and drips down the drainage matrix will have a way to escape. Similarly, the sill should be left open so that any water that leaks through the windows can flow into the drainage cavity in the assembly and out the bottom edge.

These details will work to keep water out of the walls. But remember, check them against the manufacturer's installation instructions and the product ESR. And document all your work. If problems arise down the road, you want to be able to establish the fact that you adhered to the manufacturer's guidelines at every step.

Mark Parlee, a building-envelope consultant and builder in Urbandale, Iowa, specializes in exterior renovations and envelope solutions.

Warm Stone

Installing tile over electric radiant heating

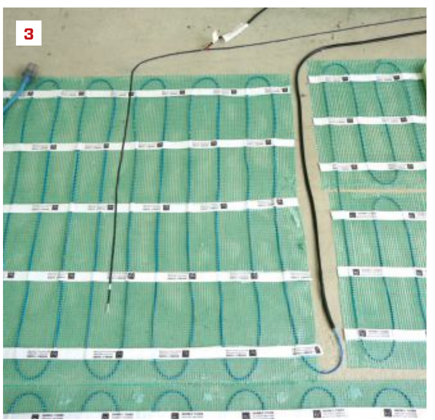
BY KYLE DIAMOND

My remodeling company enjoys working on many unique and historic homes in the Eastern Hudson Valley region of New York. Last month, I described work related to replacing an existing 13-by-18-foot screened porch with a larger, 15-by-22-foot sunroom on a French cottage-style home. In this article, I'll focus on the installation of the sunroom's radiant stone-tile floor system, which was comprised mainly of products from Mapei. The floor was installed over electric radiant heating in a house that would not be used continuously through the winter, and the goal of the electric radiant was only to help temper the room, while primary heating was supplied by a mini-split heat pump. The clients liked the idea of the electric radiant quickly heating the floor surface—a more immediate, and therefore more comfortable, heat.

Photos: Kyle Diamond

MANUFACTURER'S TRAINING

Although we'd been using Mapei's products for about a decade, it wasn't until a few years ago that we found out about its MTI (Mapei Technical Institute) training seminars. Classes include hands-on workshops for surface preparation, repair, and installation, as well as instruction in the industry's newest techniques. My lead carpenter and I drove to the company's Swedesboro, N.J., facility for a



day and a half of training. The cost was $350 per person, but it was offset by a credit that Mapei gave us on the purchase of its products, which paid off on the first job we completed after the training. Making contact with Mapei's reps might have been the most valuable part: I can now contact them with questions, and they get right back to me—something that was a little more hit-and-miss beforehand. This training was not required to qualify for the company's product warranty, but it did drill into our heads the Mapei mantra: "Read the instructions on the bag."

TILE SUBSTRATE

The floor on this project was installed over an insulated slab-on-grade foundation that tied in with the home's existing slab foundation. After waiting 28-plus days for the new slab to cure, we began work on the radiant tile floor by cleaning the new slab's surface—first running a shop vac over it, then wiping it down with sponges and clean water.

Next, we applied Mapei's Primer L acrylic latex primer. We diluted the Primer L to a 3-to-1 ratio of water to primer, then mixed it using a low-speed mixer with a Jiffy mixing paddle in a five-gallon bucket. Using a ⅜-inch nap roller, we applied the mixture to the slab, rolling it on as uniformly as possible to prevent ponding **(1)**. It took a couple of hours to mix and spread. On this floor, we needed to apply only one coat, though we have had jobs where we've needed to install two coats over mortar-setting beds that were pretty porous. The primer took three to four hours to dry. Note that the maximum open time between coats or before applying a leveler is 18 hours.

Radiant mat installation. Usually when we install electric radiant in tile floors, it's for smaller bathroom projects. For the radiant mat on this large floor, we chose TempZone Flex Rolls manufactured by Warmly Yours. It consists of a heating cable secured within a green mesh fabric—the heating element is distributed in serpentine loops spaced at 3 inches on-center to deliver heat evenly throughout the flooring area.

Technicians at Warmly Yours helped us with the mat's layout and power requirements. Their design called for a 3-foot-wide by 70-foot-long mat, along with two 18-inch-wide by 8-foot-long mats **(2)**, which we placed according the installation diagram they provided. As we unrolled the mats, we needed to cut the larger, 70-foot-long roll in order to make three 180-degree U-turns required by the lay-

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out. We made a straight cut through the mesh, being careful not to damage the heating element, then rotated the mat 180 degrees and started a new row in the opposite direction, keeping the cable face-down toward the floor.

The mats were wired in parallel, with two hot legs plus a ground, and were run to a SmartStat dual-voltage programmable thermostat. An in-floor sensor probe **(3)** was also run to the thermostat—the radiant floor could be controlled either by the temperature of the floor or by ambient air temperature.

After completing the wiring rough-in, we tacked the mat rows into place with a glue gun, 12 inches on-center along the edges and 36 inches in the field, to help hold them in place **(4)** while we did the rough-and-tumble work of installing the self-leveling compound.

Self-leveling underlayment. To make it easier to pour a level topping, we drilled Tapcon screws into the slab roughly 48 inches on-center to serve as benchmark elevation heights **(5)**. Using a story-pole stick with a laser level that we placed on the window sill, we tweaked the screw heights to level **(6)**. While it requires a bit of concentrated effort, installing these screws is well worth it, especially for large rooms or on floors that are significantly out of level. Even though so-called "self-leveling" compounds do even out a bit, you run the risk of ending up with floors that are not quite level or that have subtle rolling mounds, usually where the supply buckets are dumped. The gridwork of leveling screws also helps guide where to dump supply buckets during the pour, making it easier to evenly distribute the material.

Once the mats were wired and tacked in place and the leveling screws had been installed, it was time for the fun part: pouring the underlayment. We set up a mixing station outside, where we blended Mapei's Ultraplan Easy self-leveling underlayment with water **(7)**. We mixed two bags per batch in 15-gallon barrels, first adding the prescribed amount of water, which we carefully measured out in a five-gallon bucket to meet the manufacturer's recommended water ratio per bag. Using a high-speed mixer (at about 1,200 rpm) with an "egg-beater" paddle, we blended the materials for about 90 to 120 seconds, being careful not to overmix, until we had a homogeneous, lump-free consistency **(8)**. With a double batch of mixed material in them, the barrels weighed about 125 pounds and took two guys to carry inside and distribute.

We leveled the underlayment using a float-like tool from Kraft

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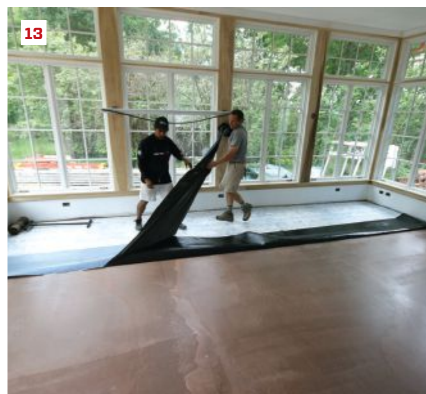
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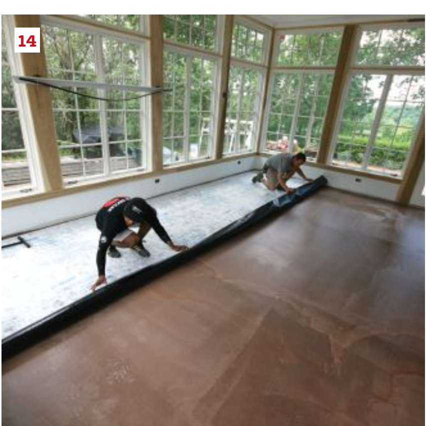
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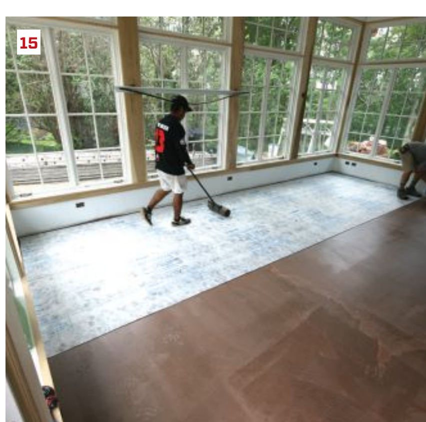
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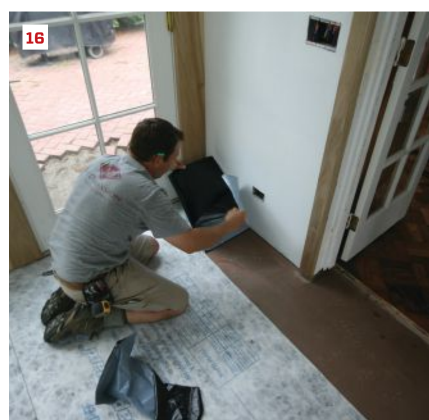
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Tool's Self-Leveling Kit **(9)**. When you're installing the self-leveler, it's important to keep things moving—the material hardens quickly in a couple of hours, throwing off a lot of heat and moisture in the process **(10)**. It took me by surprise when I went to check on its progress: The sunroom had quickly turned into a sauna, and I had to hastily open all the windows and doors to prevent a build-up of heat and moisture that could have played havoc on the woodwork and windows in the room.

In the end, we mixed a total of 13 double-batch barrels (using 25 to 26 bags of Mapei's Ultraplan Easy). This provided an average ½-inch underlayment thickness and took four of us—one floater/leveler, one bucket runner, and two guys at the mixing station—a half day to install. We allowed it to cure overnight before starting in on the next steps—waiting two weeks before turning on the radiant heat system, per Mapei's specifications.

Crack-isolation membrane. The next morning we applied Mapei's SM Primer to the cured self-leveler with a roller **(11)**. This latex primer is for use under the crack-isolation membrane to increase the peel-and-stick's bond to the underlayment. After we rolled it out, it took about 15 minutes to dry.

We had been using Mapei's Aqua Defense liquid-applied membrane, but made the switch to its Mapeguard 2 crack-isolation membrane a couple of years ago. This version is a lightweight, fabric-reinforced 40-mil peel-and-stick that helps prevent existing or future in-plane floor cracks from transmitting through tile, natural stone, or grout. Compared with Aqua Defense, Mapeguard 2 allows for more in-plane movement (⅜ inch as opposed to ⅛ inch for the Aqua Defense). This is cheap insurance, especially when dealing with in-floor radiant heating. We pre-fit the 40-inch-wide membrane, cutting it into lengths and laying them out on the floor **(12)**.

Starting at the easier side of room (opposite the doorways), we installed the membrane. It has a split-release backing **(13)**, similar to Grace Ice & Water Shield, and it was a two-person job to lay out, release the backing, and roll flat **(14, 15)**. The membrane is not super sticky, so you can work it a bit to remove small creases and bumps, if need be. We rolled the membrane flat with a 75-pound roller to ensure full contact with the floor. Around the door opening, we had to piece in the membrane **(16)**, using a smaller roller in the tight spots to burnish the membrane to the floor. Installing the membrane took two guys a half a day to complete.

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FINISH INSTALLATION

The clients chose ½-inch-thick limestone tile that came in four sizes (8x8, 8x16, 16x16, and 16x24) for layout in a modular pattern. When it arrived on site, it was fairly dusty—the stone was polished but not glazed—and cleaning it was laborious. We used sponges, rags, and water to get as much dust off the stone as we could, then we pre-sealed it. We used Enrich 'N' Seal by Aqua-Mix **(17)**, which immediately darkened the stone, making it look wet—a nice change from the dull, factory-polished finish.

We dry-fit the stone around the door openings, then cut and pieced together the tile to conform with the manufacturer's recommended modular pattern **(18)**. It took three laborer-days to clean and seal the tile, and another day for the dry-fit.

We started setting the stone at the doorways, working toward the "easier" side of the room, using Mapei's Granirapid System tile mortar. We mixed two gallons of Granirapid liquid into a clean five-gallon bucket with Granirapid white powder, gradually adding the contents of the Granirapid's 46-pound bag, while slowly mixing. Using a low-speed mixing drill (at about 300 rpm) with an angled cross-blade mixer, we blended it thoroughly until the mixture became a smooth, lump-free paste. We were careful not to overmix or let the mixture stand too long; it needs to be applied fairly quickly.

We used a ¼-by-⅜-inch notched trowel to spread the mortar, applying only as much mortar as could be tiled before the product skinned over **(19)**. We placed the tiles firmly into the wet mortar, pushing each one back and forth perpendicular to the trowel lines in order to collapse the mortar ridges and achieve maximum coverage. Also, to ensure proper contact between mortar, tile, and substrate, we periodically lifted a few tiles to check for acceptable coverage. We then removed excess mortar from the joint to two-thirds the tile depth to allow for grout. As a final step, we grouted the tile with Mapei's Ultracolor grout, then sealed the stone again with Enrich 'N' Seal **(20)**.

All in all, it took two guys one week to set, grout, and seal the stone tile.

Kyle Diamond is a partner with his father, Dale, at New Dimension Construction, in Millbrook, N.Y. The first installment about this project, "A Room for All Seasons," ran in JLC *in November 2014.*

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Building an Eyebrow Dormer

CAD program simplifies layout and creates full-size patterns

BY DANIEL LEWIS

Last year I designed and built a detached garage for a home on Cape Cod. I decided to enhance the garage roof with the graceful curve of an eyebrow dormer, a distinctive architectural element that, sadly, isn't as common as it once was. The difficulties of building the curved and sloped details are most likely the reasons for its decline in popularity.

I started looking around in design books and online for hints on how to build eyebrow dormers and found that most approaches entailed some sort of trial-and-error process involving pencils and string and the fitting of oddly shaped pieces. Often the dormer was assembled or mocked up on the ground before being lifted into place.

I figured that there had to be a better way. The curves, slopes, and concentric layers of trim were certainly a challenge to build, but now that nearly any type of structure can be drawn on a computer, I decided to streamline the building process by designing the dormer and all of its components using my CAD (computer-aided design) program. With my plotter, I could then create full-size patterns of each component.

Photos: Daniel Lewis

RIBS VS. RAFTERS

As with most types of dormer, the roof construction of an eyebrow dormer is a key part of the design. In my research, I found that

Eyebrow Framing and Trim

eyebrow dormer roofs are usually built in one of two ways: Most designs use rafters to support the roof, and some frame the roof with curved ribs that parallel the front face of the dormer.

My first inclination was to go with rafters, but after tinkering with the initial design in my CAD program, I realized that the design process would be more straightforward with curved ribs. With 24-inch-tall laminated veneer lumber (LVL) being readily available, I had material wide enough and strong enough to make the ribs, so that was my obvious choice for framing the roof.

THE DESIGN

Once I'd determined the framing strategy, the next critical step was to create an appropriately scaled and visually appealing design for the dormer. In many of the images I looked at, the windows were semi-circular, but they didn't look quite right in the eyebrow configuration. So instead of a half-round window, I opted for a window where the curve is an arc of a circle and the sill is a chord of that circle. As the initial design took shape in my CAD program, I decided on an arc that spanned 108 degrees (see Eyebrow Framing and Trim illustration, above).

I also noticed that many eyebrow dormers have a flat, one-dimensional facade, probably to make the construction easier by avoiding the need to make multiple layers of curved trim. But I wanted to give the front of the dormer some dimension and visual complexity. So as I finalized the design, I added a layered fascia to the trim around the window.

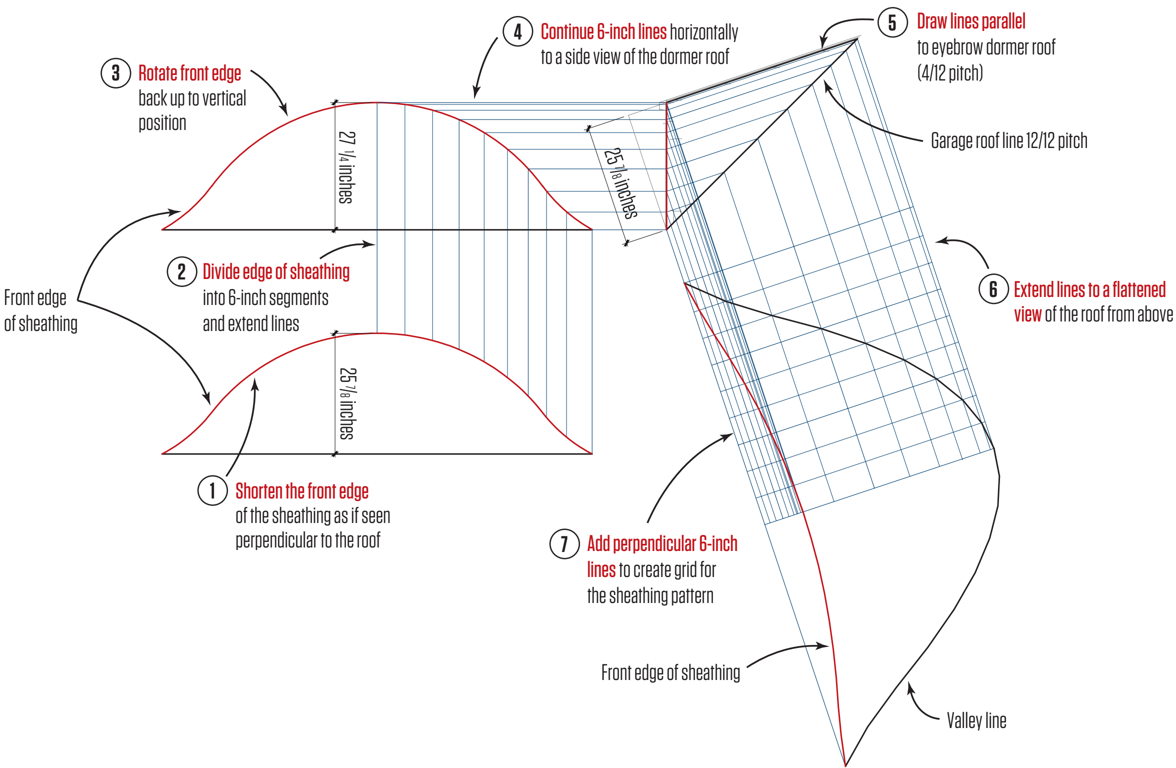
Once I had determined the exact shape and the dimensions of the window, I was able to special-order it from Andersen through my local supplier.

LAY OUT THE PIECES IN CAD

After defining the rough opening, I completed the layout for the rest of the dormer in my CAD program. The easiest of the elements to lay out were the subfascia and the fascia trim. They each had the same outside radius as the front elevation of the dormer and I could project them directly from my design drawings. I decided to use a single piece of trim around the perimeter of the window, reducing the trim's radius by 3 inches to accommodate the subfascia.

For the first LVL ribs, I made the radius ½ inch less than that of the fascias to accommodate the roof sheathing. Based on the roof

Projecting the Roof Sheathing Pattern



pitches of the garage (12/12) and the dormer (4/12), I reduced the height of each subsequent rib, using smaller segments of the same curve for each. For even support of the dormer roof, I spaced the ribs at 10 ½ inches on-center. The first rib (or the front face) was 27 ¼ inches high, so the second rib was 27 ¼ inches plus 3 ½ inches (the rise of a 4/12 pitch over 10 ½ inches) minus 10 ½ inches (the rise of a 12/12 pitch over the same distance), which equaled a total height of 20 ¼ inches. Using this approach, I easily created the patterns for the rest of the ribs.

The sheathing for the eyebrow roof was a bit more challenging to lay out beforehand. It required projecting the lines out in steps to develop the final shape (see Projecting the Roof Sheathing Pattern, above). I started with the front elevation of the sheathing, which in this case matched the curve of the subfascia. The front edge of the sheathing (at a 4/12 pitch) was at a slight angle to the plumb face of the dormer, so to create a flat sheathing layout, I first needed to draw the face perpendicular to the dormer roof, which "shortened" it, as shown in step 1 in the illustration, above. I'd determined earlier that the front face of the dormer was 27 ¼ inches high when measured plumb, but when measured perpendicular to the 4/12 slope, the distance from the top of the face to the plane of the garage roof was only 25 ⅞ inches. This meant that the outline had to be multiplied by 0.949 (25.875 ÷ 27.25) to find the perpendicular configuration.

In AutoCAD I created a block from the shape and typed in 0.949 as the vertical multiplier. I divided the perpendicular curve into 6-inch segments (step 2) and projected lines up to the non-shortened (plumb) front elevation (step 3). From there I projected the lines over to a side elevation of the dormer (step 4). At this point the lines continued parallel to the pitch of the dormer roof, with each line terminating at the pitch of the garage roof (step 5). From there, the lines extended perpendicular to the dormer roof to a flattened view of the dormer roof from above (step 6). In this view I then extended a second set of lines at 6-inch intervals perpendicular to the front edge of the dormer (step 7). In the resulting grid, I simply connected points where the two sets of lines intersected to plot the curved outline of the sheathing that could be used as a cutting pattern.

With the computer doing the heavy lifting, the process was less complicated than it sounds. Because the sheathing was to be made out of two layers of ¼-inch plywood, the upper layer needed to be slightly larger than the lower. I made separate patterns for the two

layers, but there was probably no need to be that fussy. With the patterns drawn on the CAD program, I simply placed them over the outline of 4x8 sheets of plywood. To overlap the seams of the sheathing, I drew the bottom layer to span the curved top of the roof, while the upper layer was split at the top. I included extra material along the front edge of the sheathing for a margin of error, which was trimmed back once the pieces were fit.

After everything was drawn, I scaled and positioned all the framing and trim patterns so that they fit within the dimensions of the material I'd specified. I printed out the full-size patterns on my plotter using the banner print function, but they could just as easily have been printed at any local printing facility.

CUTTING & ASSEMBLING THE RIBS

With all the patterns in hand, I turned the process over to the able hands of the carpenter, Ryan Dangelo. He and his dad, Mike, of M.J. Dangelo Construction, in Centerville, Mass., framed the garage walls and roof, headering off a rectangular opening in the roof with the upper corners angled in **(1)**. To frame the dormer, Ryan cut the ribs out of the 24-inch-wide LVL. He taped the printed patterns onto the face of the LVL and cut the curves with a jigsaw **(2)**. The first rib, at 27 ¼ inches, was too large to be cut from one piece, so he cut a separate sliver from the window cut-out material and then attached it to the top of rib before it was installed.

So that the ribs would sit plumb on the 12/12 pitch of the garage roof, Ryan angled their bottom edges (where they attached to the roof), using a circular saw with the blade set at 45 degrees. The entire bottom edge of the first rib was angled, but just the ends of the next two ribs were angled. Those lines were spelled out clearly on the printed pattern. The uppermost rib bore fully on the roof so it, too, was angled across the entire bottom edge.

Before installing the first rib, Ryan cut a 45-degree angle along a length of 2x4 and tacked it to the roof to hold the rib in position for nailing **(3)**. When the rib was centered properly on the opening, he nailed the rib through the roof sheathing and into the framing below. He plumbed the rib and then tacked a furring strip from the rib to the roof above to hold it in position.

Ryan used spacer blocks to position the rest of the ribs **(4)**. He made the blocks the proper length to space the ribs 10 ½ inches on-center, cutting the ends of the 2x6 stock at the plumb angle for a

4/12 pitch. Three spacers (a top block and two side blocks), were used to space the second and third ribs. To position the small top rib, he used a single top spacer cut from a 2x4 **(5)**.

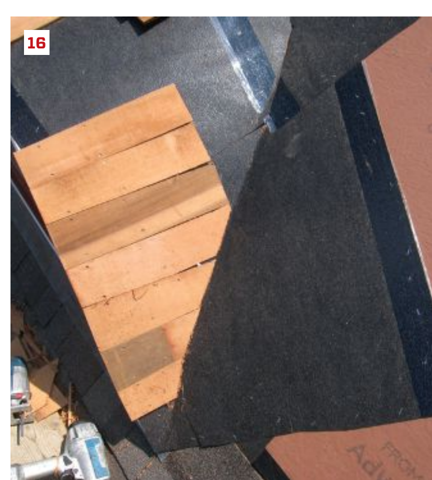
CUTTING & LAYERING THE TRIM

With the frame complete, the next step was weatherproofing and installing the window. Ryan started by wrapping heavy felt paper from the face of the dormer down onto the roof. The felt paper would be woven into the roofing underlayment below the dormer. Next he angled a length of lead flashing that wrapped over the bottom of the window opening of the first rib to act as pan flashing. The lead flashing extended down onto the garage roof about 4 inches. The window finally went in with the curved flange caulked to the rib opening before it was nailed. The final layer was peel-and-stick membrane that covered the rib and lapped down over the flange as well as over the lead flashing on the sides of the window **(6)**.

The trim around the window was done in a total of four layers. Because of the relatively small area around the window on the face of the dormer, I opted to make the window trim from a single piece of ¾-inch-thick cellular PVC with an opening for the window cut out of it. The subfascia was the next layer, followed by two layers of fascia trim.

For the finish trim, Ryan first cut the outer layers of fascia trim that shared the identical outside curve. To lay out these pieces, he cut out the individual patterns from the printout I'd given him and taped the cutouts to the sheet of PVC. He started with the wider fascia trim, cutting the curve and then smoothing it with a small belt sander. When he'd finished with that piece, he tacked it back onto the sheet of PVC next to the curve he'd just cut. He then used the outer edge of that piece as a template to cut the curve for the second layer of fascia trim. To make the cut, Ryan mounted a flush-trim bit with an upper guide bearing in a heavy-duty plunge router. With the bearing riding on the curved edge of the first piece of fascia trim, he was able to quickly and easily cut the curve for the second piece **(7)**. Then it was just a matter of cutting the second piece to width and smoothing the inside curve with a belt sander **(8)**.

The window trim layer was cut out of the rest of the sheet of PVC, again by cutting out the pattern and taping it to the sheet. After dry-fitting all the trim on the ground **(9)**, he nailed the window trim layer into place **(10)**.



The subfascia was the last trim layer to cut out, and I'd laid it out to be cut in two pieces that would meet at the top of the eyebrow. Strength was not a concern with the subfascia, so I opted for dimensional lumber for this layer. Ryan cut out the patterns from the printout, taped them to a length of 2x12, and then cut out the pieces with a jigsaw **(11)**. The subfascia needed to lap over the window trim, so he routed a rabbet in the lower edge of the two sections **(12)**. He then nailed on the subfascia and the first layer of fascia trim. The fascia layers extended past the window trim with space left below for the shingles **(13)**. The final layer of fascia trim went in after the roof was sheathed.

SHEATHING A CURVED SHAPE

For the roof sheathing, Ryan laid the patterns out on sheets of ¼-inch plywood **(14)** and cut them out with a jigsaw. Because the circumference of the dormer roof was more than 8 feet at its widest, each layer of sheathing had to be pieced in at the front corners.

The pieces fit quite well directly from the pattern, although Ryan did some minor tweaking with a jigsaw to get them to sit just right **(15)**. He screwed and glued the first layer to the ribs, starting in the middle and working to each side. Then the second layer was screwed and glued to the first.

After the sheathing was in place, the final piece of fascia trim was installed with the top edge flush with the top of the sheathing. Asphalt shingles were installed on the garage roof up to the front of the dormer. Then multiple layers of roll roofing were put on the dormer, lapping across the valley and onto the garage roof. Ryan ran red-cedar shingles as a starter course on the dormer **(16)** and then wove asphalt shingles across the valleys. The shingle installation was almost more complex than building the rest of the dormer. Getting the shingles to lie flat across the curved valleys took a bit of finesse.

Although this dormer did not require a finished interior, it could easily have been finished as constructed, or the ribs could have been extended down between the doubled rafters on the garage roof to form the interior ceiling. In the end, the eyebrow dormer was an elegant addition to a simple garage structure, and it has drawn many compliments from people passing by.

Daniel Lewis in an architect based in Northborough and Centerville, Mass. daniellewisarchitect.com

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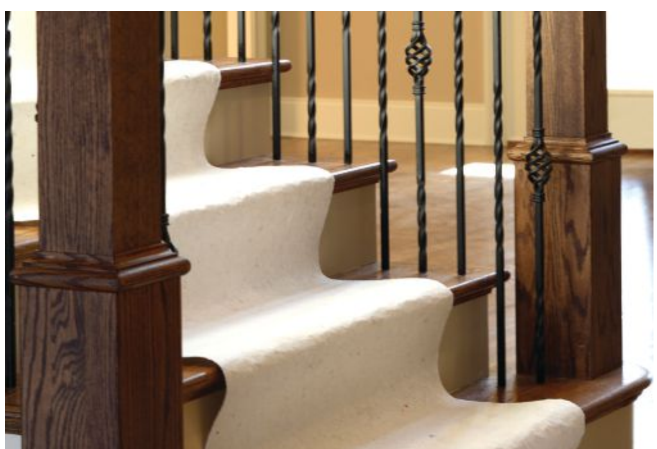
Shim-Free Door Hanger
Alignment tabs and notches in Quick Door Hanger brackets help installers to line up doors along level and plumb lines without nail holes or shims. Malleable tabs reportedly allow the door to be adjusted front to back in the rough opening. Door casing and trim then hide the brackets. A package of six costs $5.25; a box of 60 about $42. thequickdoorhanger.com

Protection & Privacy
ZipWall's new ZipFast Reusable Barrier Panels are made of opaque nylon that allows users to contain dust in construction areas while hiding unfinished spaces from view. Eliminating the waste of single-use plastic sheeting, a ZipFast kit with four panels and a carrying case costs $260. zipwall.com

Modern, Minimalist Windows
The Contemporary Collection from Weather Shield offers a minimalist look with narrow stiles and rails, streamlined hardware, and more exposed glass. Seven woods are available for the interior, and 12 colors for the aluminum-clad exterior. The line includes direct-set corner, crank, and push-out casement and awning windows, and hinged patio doors. weathershield.com



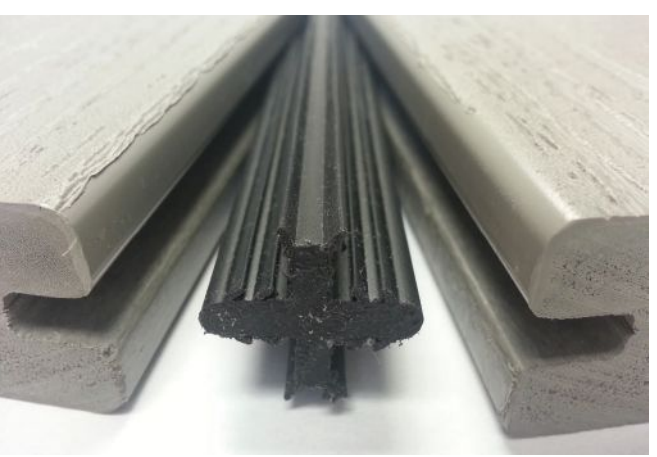
Breathable Floor Protection
Clean & Safe's SurfacePro floor covering protects newly installed floors against spills, scratches, and dents while allowing floors to breathe or cure and jobsite work to continue. Reusable and skid-resistant, use SurfacePro over hardwood, tile, stone, or concrete. Available in 32-inch or 40-inch widths, the 82-foot-long rolls cost about $107 and $135, respectively. dropcloth.com

Sturdy Stucco Tapes
Designed to stand up to the scraping of a trowel, Shurtape stucco tapes can be used for masking on rough stucco surfaces. According to the maker, the PC 622 "duct" tape (for masking window and door frames) and PE 44 tape (for securing poly) provide a watertight seal and a clean release. Both tapes feature a red backing for high visibility. shurtape.com

Clever Corbel Converter
Federal Brace's Corbel Converter mounting hardware allows decorative wood corbels to be used to help support countertop overhangs. According to the maker, the hardware can be easily installed from outside the cabinet, even with countertops in place. Choose from two sizes; prices range from $25 to $30 each. federalbrace.com

Updated Stainless Steel Sinks
Moen's 1800 Series sinks feature 18-gauge stainless steel with 90-degree corners, in single, double-equal, offset-double, and prep configurations (both undermount and drop-in formats available). Rear-positioned drains provide additional flat space in the sink. List prices range from $230 to $980 (not including accessories). moen.com

Push-Button Access
The Schlage Touch electronic lock is an affordable keyless entry. Prices start at $129 for a device that stores 19 unique access codes. The numeric touchscreen LED illuminates when needed, and the screen reportedly works in the rain and when users are wearing gloves. Dedicated icons signal low-battery and programming modes. schlage.com

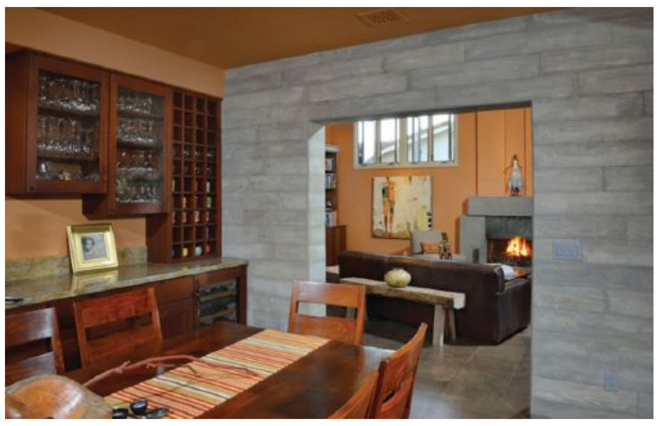


Quick-Switching Drivers

Maximize the functionality of your hand tools by adding Klein's Switch Drive Handle System to your toolbox. The system's quick-release mechanism lets users switch between a power drill and a hand tool with a 1/4-inch hex. Available in two sets—a $20 Power Driver Set with a #2 Phillips- and #2 Square-Drive, or a Power Nut Driver Set with 1/4-, 5/16-, and 3/8-inch magnetic power nut drivers for $39. kleintools.com

Waterproofing Deck Spacers

If you're looking to create dry outdoor space below a deck, add a rubber mallet to your toolbox to install Dexerdry as part of your next deck project. These above-joist flanges act as spacers for grooved deck boards that form a watertight seal between boards. The rubber flange strips are reportedly UV-resistant, remain flexible in freezing temperatures, and can withstand 3,000-psi powerwashing. dexerdry.com



Condensation Control

Panasonic's Condensation Sensor Plus operates by detecting hot air and humidity based on dew point. Recognizing this measurement allows the sensor to turn on ventilation fans when necessary, keeping problem moisture from causing damage no matter the season or climate zone. Part of the WhisperControl collection, the Condensation Sensor costs about $60 per unit. panasonic.com/ventfans

Wood-Look Stone Veneer

In the masonry veneer category, Creative Mines is introducing Monsoon Craft Board Form. Handcast from boards that expose natural woodgrain, the 6-by-36-inch planks have the look of weathered wood. Barnwood and grayscale colorways are also available. The production process uses natural pumice pozzolan to enhance compressive strength, minimize efflorescence, and reduce permeability. $5 to $7 per square foot. creativemines.us

EDITED BY BRUCE GREENLAW

Photo: Steve DeMetrick

Makita 8 ½-Inch Sliding Compound-Miter Saw

BY STEVE DEMETRICK

In the October 2013 issue of *JLC*, I reviewed Makita's 7 ½-inch model LS0714 sliding compound-miter saw. Compact, accurate, versatile, and durable, the LS0714 has been my go-to miter saw since 2005 for cutting everything from light framing to interior trim.

Makita recently replaced the LS0714 with the 8 ½-inch model LS0815F, which promises to stretch the saw's cutting capacity without sacrificing portability. After field-testing one of these saws with my crew for several months, I definitely think it's an upgrade.

STILL AN EASY CARRY

My old LS0714 saw weighs just 28.9 pounds, or about half as much as a comparable 10-inch or 12-inch slider. We routinely jump between several jobsites with it and don't hesitate to carry it from the truck for making just a couple of cuts. When we're trimming interiors, it is usually faster to move this compact saw from room to room than it is to pitch a fixed high-capacity miter-saw station somewhere and hike back and forth for each cut. We can lift the saw with just one hand, so we can easily carry it up a ladder and prop it on staging for cutting siding and trim.

Thankfully, the new LS0815F weighs just 2.2 pounds more than the LS0714, and we can barely tell the difference. The maximum cutting capacity of the LS0714 is 2 1⁄16 by 11 ¾ inches when the saw is set to a 0-degree miter and bevel, and 1 9⁄16 by 8 ⅜ inches at a 45-degree miter and bevel. For the new saw, the figures have expanded to 2 9⁄16 by 12 inches and 2 by 8 ½ inches, respectively.

The slightly wider cutting capacity of the new saw is almost irrelevant, but the added depth of cut has definitely helped. For instance, when we screw a tall wood facing to the aluminum fence of the LS0714 for added vertical support, we can cut crown moldings up to about 3 inches tall by nesting them against the facing in the usual upright, upside-down position and adjusting the miter angle for a perfect fit. With the new model, we can cut crown up to about 3 ½ inches tall that way. When crown exceeds those limits, it must be cut on the flat, which forces you to adjust the bevel angle every time you tweak the miter angle. That's no problem for us if we're only making a few cuts, but we use one of our bigger sliders when running taller crown in an entire house.

MITERS & BEVELS

My old LS0714 can miter 47 degrees to the left and 57 degrees to the right, while the LS0815F adds 4 degrees in both directions. Although a detent override allows both saws to bevel up to 5 degrees to the right (a feature we often use to back-cut wide pieces for a perfect fit), they are both essentially tilt-left, single-bevel saws that can require you to flip the stock end-for-end when cutting bevels or compound angles. (Dual-bevel models, on the other hand, let you tilt the cutting head to either side instead of flipping the stock, which can be helpful when cutting long pieces in tight quarters.) But this beveling limitation isn't an issue for us, because we plan our cuts so we seldom need to flip the stock. More significantly, the LS0815F

can bevel up to 48 degrees to the left versus 45 degrees for the LS0714, which can be a big help when trimming rooms that are a bit out of square.

OTHER FEATURES

My LS0714 has two separate pairs of rails that ride on linear ball bearings to extend the cutting head. The LS0815F has one pair. We prefer the latter because it's slightly smoother, uses fewer wearing parts, and has one locking screw instead of two. Sometimes I forget to lock both pairs of rails on my LS0714; when I pick it up, the unlocked rails slide until they slam to a stop, which probably isn't good for the saw.

Unlike the LS0714, the LS0815F has a soft start, which we really appreciate. When hooked to my tool-triggered Festool CT Midi vacuum, the old saw sometimes trips a fussy circuit breaker, while the new soft-start saw has yet to do that. On the other hand, the old model has a rubber shroud behind the blade that directs significantly more dust into the vacuum. I highly recommend that Makita add this shroud to the new model.

Makita did add an LED work light with a dedicated on/off switch to the new saw. We don't work in dim spaces, and the light doesn't illuminate the cutline all that well anyway, so we never use it. The LED also adds a tiny wire at the back of the saw that's bound to catch on something and rip out as we load or unload the saw from our work truck.

Finally, the new saw is considerably quieter than the old one, adds an inch to the height of the fence, has better grips for setting the miters and bevels, and has a more secure depth stop for making grooves and dadoes.

THE BOTTOM LINE

I wish the LS0815F emitted less dust when hooked to my vacuum, and I don't use its marginal LED work light. But the compact, lightweight 8½-inch saw is even more useful and easier to use than its 7½-inch predecessor and currently costs about $100 less. I'll soon be replacing my weary 9-year-old 7½-incher with this welcome new model.

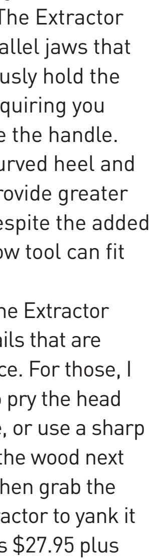
LS0815F Specs

Blade: 10 inches; 5/8-inch arbor
Weight: 31.1 pounds
Amps: 10.5
RPM: 5,000
Cutting capacity, 0° miter/bevel: 2 9/16 by 12 inches
Cutting capacity, 45° miter/bevel: 2 by 8 1/2 inches
Maximum miter angle: left 51°, right 61°
Maximum bevel angle: left 48°, right 5°
Price: $350
Included with saw: blade, blade wrench, vertical vice, two extension wings, dust bag, triangle rule
Warranty: 1 year, 30-day satisfaction guarantee

Steve DeMetrick is a residential remodeling contractor in Wakefield, R.I.

With a tall wood facing screwed to the fence, the saw can cut crown up to about 3 1/2 inches tall in the standard upright, upside-down position.

The saw bevels up to 48 degrees to the left, which is helpful when trimming out-of-square rooms.



MIGHTY NAIL PULLER

I regularly take apart walls, decks, and other structures, and I have an arsenal of tools that make the work less strenuous while preserving materials for reuse. The Extractor is one of my favorites. It lives to pull nails—even headless ones—and is great for pulling finish nails through the back of salvaged moldings so you don't damage the face. For years, I used end-cutting nippers for this purpose, but The Extractor works better because it reduces the chance of cutting through the nail shank. Unlike my nippers, which have sharp edges designed to cut wires and nails, The Extractor has serrated parallel jaws that grab and tenaciously hold the shank without requiring you to tightly squeeze the handle. Also, the tool's curved heel and 11-inch length provide greater leverage. Still, despite the added length, this narrow tool can fit into tight places.

Like nippers, The Extractor doesn't dig out nails that are flush to the surface. For those, I use a cat's paw to pry the head above the surface, or use a sharp chisel to remove the wood next to the head, and then grab the nail with The Extractor to yank it out. The tool costs $27.95 plus shipping at nailextractor.com, but it's also sold by Amazon.com and others. *—John Carroll is a remodeler in Durham, N.C.*

Photos: top, Bill Phillips; bottom, Steve DeMetrick

DeWalt Bluetooth Radio Adaptor

BY ROBERT SHAW

My crew and I listen to the radio almost every day while building our custom decks and outdoor living spaces, but we get tired of all the commercials on the local radio stations. We can stream the music of our choice directly from my smartphone, but that forces me to plug it into the radio's 3.5-mm auxiliary input and leave it with the radio. I've missed plenty of calls because I can't get to my phone fast enough, and for privacy, I have to unplug the phone and walk away.

I recently bought Milwaukee's new Bluetooth-enabled M18 jobsite radio/charger, which allows me to wirelessly stream content from my phone from up to about 100 feet away. But my older Bosch PB360S jobsite radio sounds better and delivers more complete jobsite coverage, so we often use it instead.

DeWalt's DCR002 Bluetooth Radio Adaptor has solved our problem. The simple, compact receiver can plug into any radio equipped with a 3.5-mm auxiliary port (including our Bosch), so you can stream from your phone or other mobile device without tethering it to the radio. A single push button makes it easy to pair the adaptor with the mobile device and turn the unit on or off. An internal battery delivers about eight hours of runtime and takes about four hours to fully recharge. To recharge, you plug the adaptor into an AC outlet or a USB port using the accessories included with the kit. An LED indicator light tells you all you need to know about the charging and operating status. The adaptor also comes with a great docking clip that easily mounts to a radio.

According to DeWalt, the DCR002 has a range of up to 100 feet. I've found that I can keep my phone in my pocket or toolbag while moving around the jobsite. It doesn't always stay connected when I go to the truck, but it's easy to reestablish the connection. The adaptor costs $40 and comes with a two-year warranty and a 90-day money-back guarantee.

Robert Shaw owns Colorado Deck and Framing, in Colorado Springs, Colo.

WIRELESS TOOL CHARGER

The Bosch wireless charging system consists of an inductive charger and specially equipped 2-amp-hour Li-ion batteries that fit the company's 18-volt tools.

Inductive charging has been around for years and is used to charge small devices such as cellphones without removal of the battery. Wireless systems rely on a pair of coils—one in the charger works as a transmitter, while one in the battery is a receiver. Bosch's new batteries get charged by plopping the tool on the charger. Do this every time you put the tool down and the battery will charge whenever the tool isn't being used. The tool must be able to stand upright on the charger, or you can remove the battery and charge it by itself. The battery can reportedly be charged to 100% capacity in 50 minutes—a charge time that's in line with that of the average battery system (though slower than Makita's, which claims a 20-minute charge time for 2.0-Ah packs). While the charging speed of the wireless system may only be average, that may not matter: It's likely the pack will be charged intermittently throughout the day. Read more online at toolsofthetrade.net.
—David Frane is editor of Tools of the Trade.

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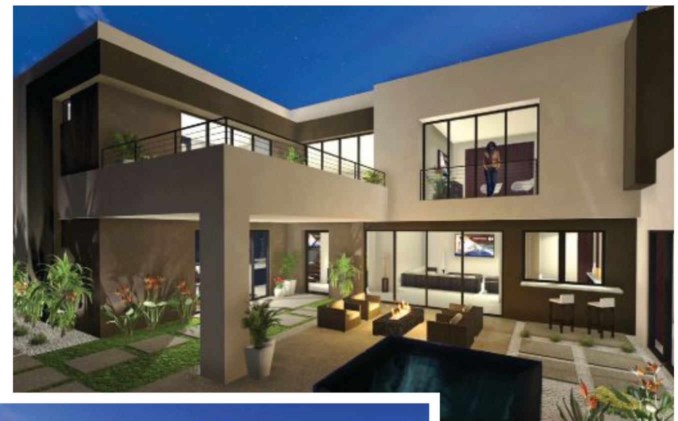

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BY JON VARA

Ornamental ranch-house dovecotes run the gamut from ornate cupolas **(1)** and wall-hung structures tucked beneath a gable-end roof peak **(2)** to simple "pigeonholes" that might also help provide attic ventilation **(3)**. In its most pared-down form, a dovecote may consist of a few decorative holes bored into finish blocking between rafter ends **(4)**.

Photos: 1 & 2, Atomic Ranch; 3, Tiki Lisa; 4, Coco Owen

For the Birds

From the early 1950s into the '60s, ranch houses—especially in California—often included ornamental dovecotes. They were a common feature on so-called Rustic- and Storybook-style homes, which were also characterized by windows with diagonal muntins, scalloped bargeboards, and other Disneyesque details.

But the roots of the ranch-house dovecote seem to lie in medieval Europe, where freestanding masonry dovecotes, often in the form of cylindrical towers, were used to attract wild pigeons (which were identical to the feral pigeons that now infest cities worldwide). Once they'd taken up residence in the cote, the birds could be harvested for meat as needed, and their manure spread on fields to improve crop yields.

The right to a dovecote, however, was limited to the nobility. Commoners were barred from raising pigeons of their own, even though their grain crops provided much of the food that fattened the free-ranging birds for the local nobleman's table.

In 1950s America, of course, those old rules no longer applied. The owner of even the humblest ranch house was now free to assume the trappings of nobility by keeping pigeons himself or herself—or at least to seem to keep them.

In reality, few suburban home buyers had a taste for roast pigeon, and fewer still wanted to share their homes with live pigeons. To deny the birds themselves any sort of a foothold, the seemingly inviting openings in housing-development dovecotes either were closed off with screening, led to impossibly small cavities, or were simply painted-on imitations of actual holes.

But they weren't always completely nonfunctional: Some resourceful builders found that screened pigeonholes were a fine way to provide code-required attic ventilation.

JLC contributing editor Jon Vara lives in Cabot, Vt.

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