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Contents

On the cover: Matthew Anderson of Anderson Framing & Remodeling, in East Sandwich, Mass., and his foreman, Peter Legacy, measure the length of a garage sidewall while laying out mudsills for a complex new-home foundation. Photo by Roe Osborn.

FEATURES

DEPARTMENTS

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"Tips for Soldering a Lap Seam," by Kyle Diamond (video, Feb/14)

My unfortunate experience with soldered copper gutters is that the joints are stressed by expansion and contraction and are likely to fail, unless they are either locked or riveted in addition to being soldered. (Also, they should be relatively short, and have expansion/contraction joints and other movement details as needed.) The Copper Development Association publishes details for many copper applications, including joints in copper gutters. [In "Gutters and Downspouts: Built-in Gutter Linings," paragraph F, "Transverse Seams in Gutter Lining" it says] "Where seams occur in the copper gutter lining, a locked and soldered seam is required to maintain a watertight gutter condition. The seam should be locked and soldered or riveted and soldered so as to allow the water to flow away from the joint. Rivets are installed in a staggered pattern at 3" O.C." —*ThingOfBeauty*

"Cool Tools for 2014," by Bruce Greenlaw (Mar/14)

I always like looking through the Toolbox section that Bruce Greenlaw compiles. His reviews keep me up to date on what's new. But there's one product in "Cool Tools for 2014" that needs some clarification—the Deck Harness from GRK. I examined the Deck Harness at the Deck Expo last fall and spoke for a while with GRK reps in the booth. Despite what the company says, the IRC lateral load connection detail using tension ties is not a hassle to install when the house joists and deck joists don't align. I've installed dozens of these lateral load connections on decks since 2009 and haven't run into an offset joist configuration that can't be easily handled.

When the house joists are perpendicular to the deck joists, double blocking is needed for the Deck Harness, as well as for Simpson StrongTie's DTT and USP's DTB hardware, so there's no difference there. When the joists are perpendicular, it takes me about one hour to install the blocking and hardware; when the joists are parallel but offset, it takes me about 30 minutes to install one tension tie assembly. Though I haven't installed a Deck Harness yet, it doesn't look any quicker than what I'm doing now, and it certainly won't cut the installation time in half.

Potential users of the Deck Harness should also consider a note at the end of the installation instructions that says, "Minimum ... ¾ inch Plywood Floor sheathing." So if the subfloor is sheathed with OSB, solid wood planks, or plywood less than ¾ inch thick, you can't use the Deck Harness.

GRK's Deck Harness costs $150 for one assembly; it costs me less than $20 for a pair of DTBs or DTTs and a bolt or threaded rod. Now if the Deck Harness installed itself, I might consider it—otherwise, it's way overpriced.

The horizon is changing regarding the deck lateral load connection. In June, the 2015 IRC will be published and it includes a new lateral load detail—a simple angle bracket that can be installed from the outside of the house. This alternative may render the Deck Harness and tension tie lateral load connections obsolete. —*Mike Guertin*

"Save the Trades," by Clayton DeKorne (Web-only, Apr/14)

In his Web post, JLC executive editor DeKorne describes how students in Ottawa, Ill., protested the closing of their high-school building trades program, sparking a wider debate about vocational training.

Good for them! All over the States as well, programs like this are being cut or reduced, often in favor of more math and science. While these are important, of course (in the trades as well), a well-rounded and economically stable society requires workers of all types and skills. And especially now, when the codes and other technical requirements are getting ever more stringent and complex, a solid educational foundation is critical. As an architect, I'm overjoyed when I see that the builder or his crews are properly educated, since they bring the skills to the table to make our designs come to fruition. —*Anonymous*

I am a product of a Vocational Industrial building trades program from high school and represented my state at the national level my senior year. I went on to college and have a bachelor's degree in construction management. A few years later, that high school program was cancelled. Industrial arts classes are being scrapped across the country. Our leaders wonder, "Why don't we have a skilled workforce?" and "Why are so many people paid a low wage?" Here's a news flash: [Untrained workers] ... are only worth a lower wage until [their employer trains] them to produce at a level where they are worth more. Building trades programs do that. Give these kids a chance to learn while they're still "under their parents' roof" and not out trying to learn a trade and make a living at a lower wage. You want to help the economy? Keep these programs going so that the "non-college track" kids actually have a skill that's worth a higher wage. —*Jonny B*

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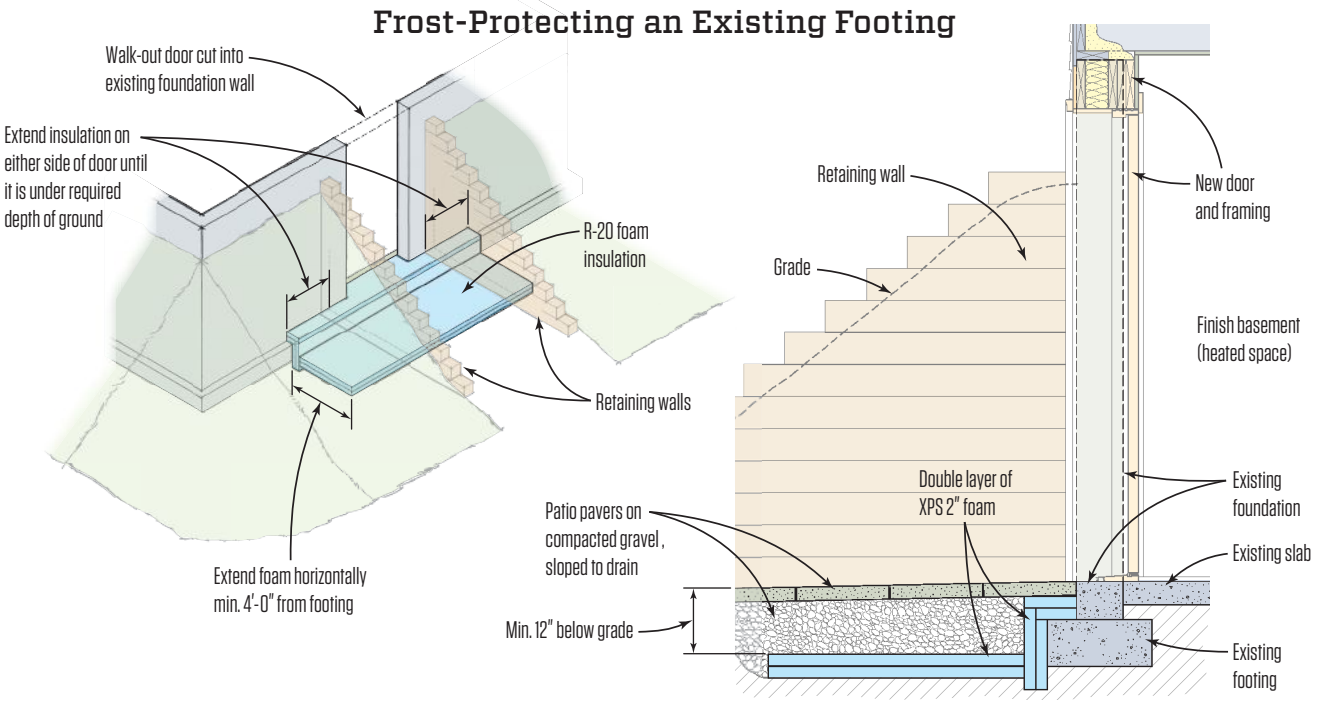
Q I was recently asked about finishing a basement in a home located in a very cold climate. Plans would include cutting a doorway in the foundation for a walk out, with the grade retained on both sides of the opening. Is there a way to protect the footing and foundation from frost using exterior insulation once the opening is cut?

A Steve Baczek, a residential architect from Reading, Mass., who specializes in building science, responds: The detail you would need to protect the door exit is not unlike a frost-protected shallow foundation. In this case, you'd have to excavate and insulate the foundation and the footing below the doorway. But one of my building mantras is "Don't do anything stupid." Creating a walk-out basement in the situation you describe gets pretty close. Here's why: The insulated foundation and footing at the doorway would rely on heat loss from the house through the basement slab to keep it above freezing. So while gaining the convenience of a walk-out basement, the client would be incurring the cost of heating the outside ground at the door location.

That being said, I'd wrap the foundation and footing below the opening with a minimum of R-20 rigid insulation (a double layer of 2-inch foam), letting the foam extend outward horizontally at least 4 feet from the foundation. (Check out "Revised Builder's Guide to Frost Protected Shallow Foundations," at toolbase.org. Use the Air Freezing Index to determine the exact thickness and horizontal distance of the insulation.) Put the top of the horizontal insulation at least 12 inches below grade and extend it to either side of the doorway until it is into the grade at least 12 inches. The insulation below the door opening will break grade and require a protective covering. Or you could run the walkway over to the foundation and sacrifice the top inch or so of insulation, but that would make the whole system less effective.

Frost-Protecting an Existing Footing



Q My clients want to install a gas fireplace "stove" as part of a living room renovation. What's the best way to create a non-combustible surface behind the stove? And how close to the wall can the stove safely sit?

A Ettore Bonfini, a mason who lives and works in Lindenhurst, N.Y., responds: My first recommendation would be to use 4-inch-thick brick because most bricks have a 2-hour fire rating. Leave at least a 1-inch air space behind the brick and tie the bricks to the wall with wall ties no more than 16 inches on-center. The same approach should work with a layer of stone.

If the 5 inches of space that this assembly occupies is more than you're willing to give up, an alternative would be to install a manufactured-stone veneer, which is much thinner. Manufactured stone also gives you a lot of choices as far as the look you're trying to achieve, and it's pretty easy to install.

If you go this route, apply the stone to cementitious backerboard that the manufacturer has approved for fire resistance. To create an air space behind the wall, mount the backerboard to metal furring strips attached to the wall horizontally. (I prefer attaching them perpendicular to the wall studs because it makes the structure a bit sturdier and gives me the option of attaching the backerboard with screws 12 inches on-center instead of 16 inches—perhaps a bit of overkill, but I'd rather be safe than sorry.)

Keep in mind that you will also need a non-combustible hearth surface under the stove. The easiest way to do this would be to remove the finish flooring down to the subfloor to get the hearth surface as low as possible. If you're installing brick or flagstone, nail a layer of metal lath to the subfloor before you put down the mortar. For an even simpler hearth, use a single slab of marble or granite. In either case, beef up the floor framing below the hearth to make sure it can handle the extra weight.

As for clearances between the wall and the stove, check with the stove manufacturer for recommendations. It's also crucial that you address how to properly vent combustion gases in accordance with the stove manufacturer's requirements. Improper ventilation can create a carbon monoxide risk. You may be required to provide make-up air for proper combustion and ventilation. Have your local building department approve your plans before you start.

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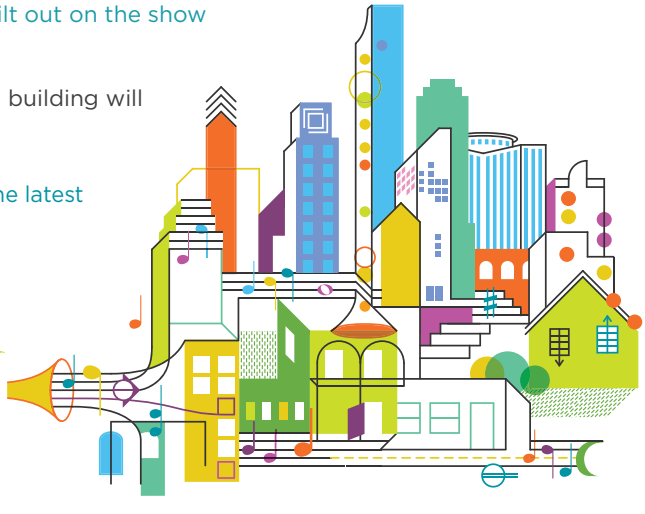

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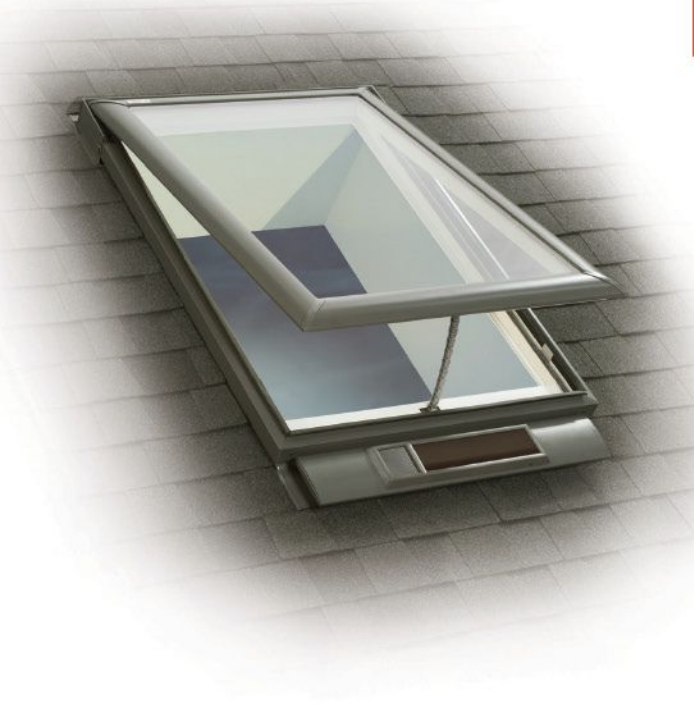

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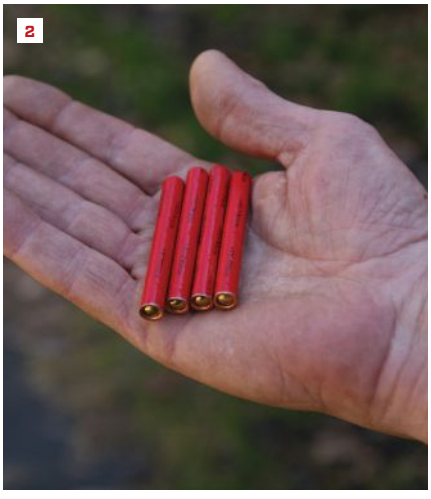

1. The required 5/16-inch hole can be drilled with a gas- or battery-powered rotary hammer on a site with no power.

2. A single power cartridge requires a 10-inch-deep hole; each additional cartridge adds 2 inches more (up to a maximum 16 inches for 4 cartridges).

Rock Breaking With Micro-Blaster

I recently built a new shop for my custom woodworking business near Lewisburg, W.Va. The site I chose is not quite typical for a woodshop—it's within an old limestone quarry—but the price was right, it's within walking distance of our historic downtown, and the natural soundproofing of the quarry walls lets me run my chainsaw and band saw mill without bothering the neighbors.

The relatively flat bedrock floor also offered a solid base for a slab foundation. But before I could proceed with the formwork, I was faced with the challenge of removing about 10 cubic feet of limestone in a rear corner of what is now my shop, as well as taking out several ridges that ran through what would become my slab.

The John Deere 710B backhoe couldn't budge them, so I turned to an approach that my family's general contracting business has been using successfully for several years: A rock-breaking system called Micro-Blaster, manufactured by a Frankford, W.Va., company called Ezebreak (ezebreak.com).

The Micro-Blaster system is quite inexpensive, easy to use, and requires no license or special training. It's very safe, and the force generated by the small explosive cartridges can be targeted so accurately that we've used it to break up concrete within the basement of an occupied home during a remodeling project.

PLACING THE CHARGES

One of the best things about Micro-Blaster is that it requires only a 5/16-inch hole—easily within the capability of an electric rotary hammer with a carbide bit. Where there is no power on site, a gas- or-powered drill will work for this step **(1)**.

Different types of rock fracture differently, but in general it's best to drill at a fairly shallow angle, with the goal of breaking loose a 6- or 8-inch–thick section of rock

Photos: courtesy Ezebreak

3. In addition to the three-head kit shown here, the manufacturer also offers an air-operated single-head kit, as well as a lower-cost single-head kit that's activated with a pull cord.

4. Three holes are charged and ready to fire. The uppermost portion of the outcrop had already been broken free by a previous round.

5. This is an example of rock in which an exploding charge has bisected the drill hole, revealing the pocket at its bottom that held the power cartridge.

with each charge. It's important to drill the hole to the proper depth—a single charge requires a 10-inch–deep hole. If the hole is too deep, the firing pin won't be able to engage the cartridge.

Also, the hole must be clean to prevent dust from gathering between the charge and the firing mechanism. Any stone dust in the completed hole has to be blown out with an air compressor or a bulb-type syringe provided by the manufacturer. Then a stiff small-bore wire brush with a long handle is worked up and down in the hole to loosen any remaining dust, after which it's blown out one last time.

One or more paper-wrapped power cartridges—which look something like medium-size firecrackers **(2)**—are then inserted into the hole, followed by the tubular section of the blasting unit, which holds the firing pin. Pushing with 10 to 15 pounds of pressure until you feel it bottom out ensures that the firing mechanism is firmly seated against the cartridges.

THREE HEADS ARE BETTER THAN ONE

For smaller jobs, we sometimes use our original Micro-Blaster, a single-head version that is activated with a 25-foot pull cord, but we mainly use the newer Micro-Blaster IIx3 kit, which has three separate heads that can be detonated separately or simultaneously **(3)**.

Rather than relying on a pull cord, though, the three-head version is activated by compressed air supplied to the heads through three 25-foot lengths of ⅛-inch air hose **(4)**—a smaller-diameter version of the hose used to power pneumatic nailers. The individual hoses connect to a three-way quick coupler that incorporates a key-operated lockout valve. A short length of hose from the valve is coupled to an air compressor or a portable air tank.

Once hoses are connected and the area is secure, unlocking and opening the valve activates the firing pins and fires the charges. When three charges are ready to fire, you have the option of setting them off individually by connecting only one of the hoses to the valve at a time. In general, though, I find that it's best to fire all three at once, since that seems to provide the most breaking power. A portable 10-gallon tank like the one I used on this project holds at least enough air for several dozen shots before it needs a refill.

SAFETY & EFFICIENCY

The explosive in the Micro-Blaster cartridges is active only at high pressures. Once the charge fractures the rock surrounding it, the pressure is relieved and the explosive reaction essentially comes to a stop **(5)**. As a result, there's not a lot of surplus energy to fling rock around. Setting off a charge from 25 feet away—the length of the air hoses—feels perfectly safe **(6)**. I've occasionally seen golf-ball size rocks travel 10 or 15 feet, but with no more velocity than you'd get from a gentle underhand toss. If there are vehicles close by or we are working close to a house, we will drape a section of old household carpet over the area to prevent any damage.

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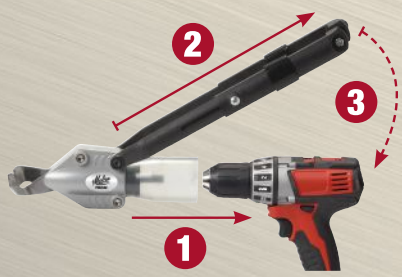

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Although it seems counterintuitive, hard rock such as limestone usually fractures more easily than sandstone or other softer materials. Depending on the rock and how much fracturing you want, you can insert as many as four cartridges in each hole. The secret is to find the minimum number that will give you a satisfactory result. Multi-cartridge shots require you to drill 2 inches deeper for each additional cartridge, which means more time and more wear and tear on bit, drill, and operator. Cartridges themselves cost about $2 apiece, which also adds up over time.

On the other hand, a charge that isn't sufficiently powerful may fail to break the rock or concrete enough to free it from the surrounding material, leaving you with an area of cracked fragments that are so tightly interlocked that they can't be removed.

Drilling another hole and placing an additional charge in the same area may not provide much additional fracturing because the cracks created from the first charge relieve the pressure produced by the later one.

6. With the Micro-Blaster, debris rarely travels more than half the length of the air hoses, so blasting is much safer than with traditional charges. In close quarters, a scrap of carpet is enough to contain blast debris.

I found that double charges gave good results with the limestone under my shop. Breaking up and removing the problem outcroppings took me less than a day and cost much less than hiring a blasting contractor or renting a hammer attachment for the backhoe.

Once the problem rock was out of the way, I was ready to build the slab forms. Fitting them to the sloping surface so the tops were level throughout was the next challenge, but that's a story for another day.

Timm Schleiff (timmschleiff.com) practices sustainable woodworking and cabinet and furniture making near Lewisburg, W.Va.

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Structural Brackets for a Balcony Deck

BY MIKE RAND

For 30 years I've provided local builders with specialty building components that I fabricate in my shop in Narragansett, R.I. Last year, Pariseault Builders handed me plans for a pair of structural brackets intended to support a 5-by-8-foot second-story balcony **(1)**. Although the plans specified custom-laminated mahogany, I had serious misgivings about the quality, workability, and ultimate performance of the rough lumber that the builder provided. Instead, I proposed laminating a thick tropical-hardwood veneer over a core of Parallam and AdvanTech.

Given the go-ahead, I located some African sapele at Dwyer Hardwoods and had them plane it to a uniform 15⁄16-inch (4/4) thickness. The material looked so nice that, despite this being a paint-grade project, I decided to go for appearance grade just to please myself.

ENGINEERED LUMBER CORES

I began by cutting an accurate pattern for the curved segment of the braces out of ¾-inch AdvanTech, including inch-long tenons at either end. For the first piece of the five-layer layup for each bracket, I cut the prescribed 4-foot-2-inch radius using a router mounted in a trammel arm; this piece served as a pattern for the remaining ones, which I cut on a router table fitted with a bottom-bearing pattern bit.

I coated the layers with waterproof West System 105 epoxy (the only adhesive used for this project), then stapled them together using 7⁄16-inch by 1½-inch galvanized staples on 4-inch centers. Next, I glued a double layer of ¼-inch poplar to the inner and outer curved surfaces **(2)**; this conserved the more costly sapele, which would form only the outer ¼-inch layer on the curves.

For the straight legs of the brackets, I cut 4x6 Parallams to length, then epoxied solid sapele blocks to the ends **(3)**. This would simplify the veneering process because the finished ends would later be chamfered at 45°. On the opposite ends, I used a band saw to cut forks for a saddle joint of the horizontal members, and to cut reciprocal tongues on the verticals **(4)**.

Photos: Mike Rand

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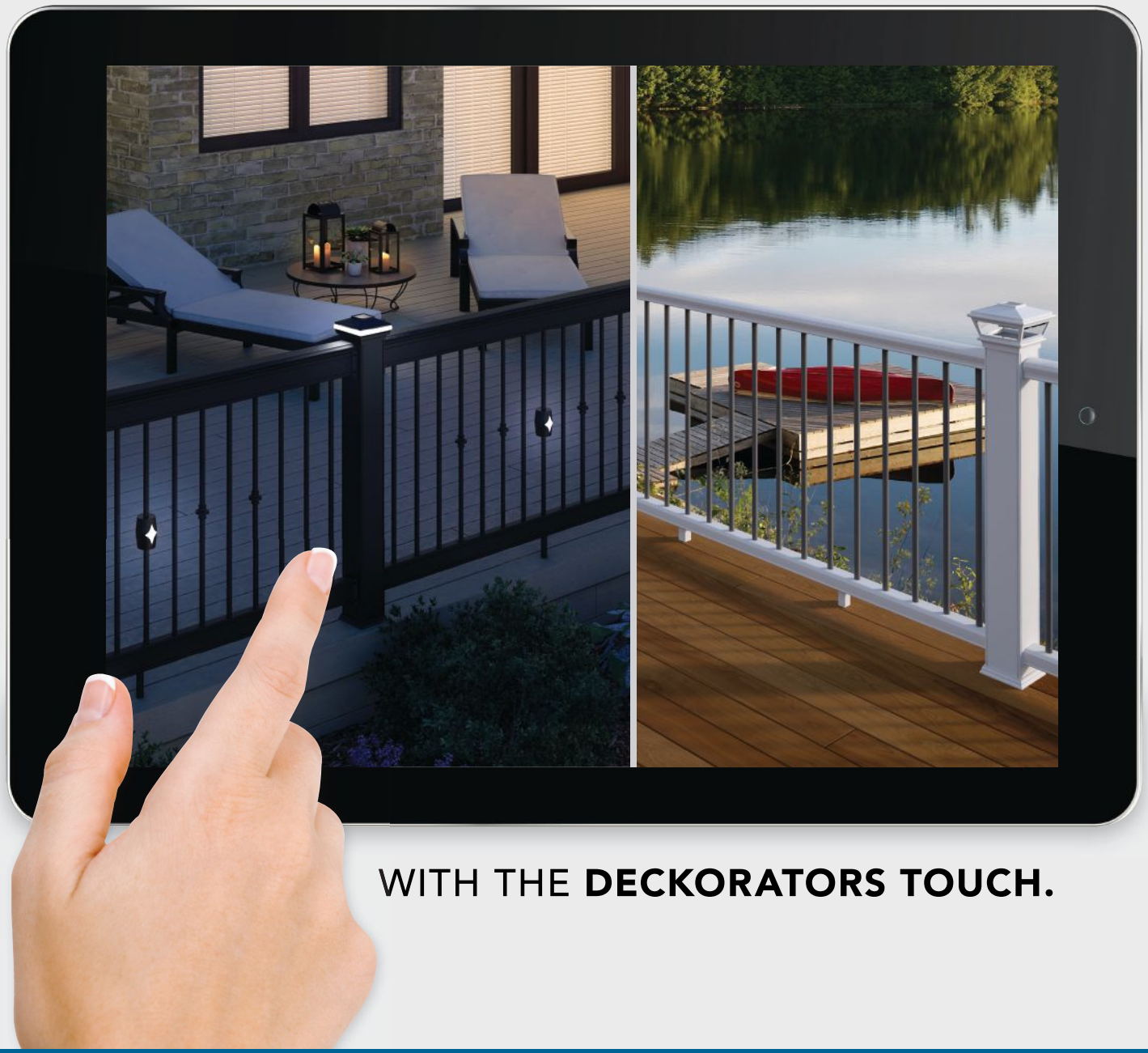

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13

FINISH LAYERS

With the aid of a plywood routing template, I cut the sapele slightly oversized for the side panels for the curved braces. To guide alignment during glue-up, I added sacrificial shoulder cuts to the ends of the template **(5)**; a few carefully placed brad nails held them in position for clamping. After the epoxy set, I trimmed the edges flush with the core, using a bearing-under router bit.

For ease of dry-bending, I had Dwyer plane the veneer lumber for the curve laminations to a ¼-inch thickness. Using plenty of clamps, I epoxied the outer curves first **(6)**. I also glued solid lumber to the ends of the braces to provide a weatherproof cap.

I then dressed the side and front faces of the posts and beams with 4/4 sapele, again routing the edges flush with the core before applying the adjacent overlapping pieces. I ran these pieces long on the tongued ends and short on the forked ends to provide an additional structural overlap at the corner joint **(7)**. Rather than using sapele for the unseen backs and tops of the brackets, I overlapped the sides by a generous ¾ inch, and did the same with the solid end blocks **(8)**, creating a recessed surround into which I would later epoxy ¾-inch MDO plywood.

To help rout pockets in the posts and beams to receive the brace tenons, I made a plywood template that fit slightly loosely around the tenons. I then used a top-bearing straight bit to cut the pockets **(9)**. The loose fit ensured struggle-free assembly, and the epoxy filled any gaps. (Proprietary thickeners change the consistency of epoxy from "maple syrup" to "peanut butter," or anywhere in between, so it will stay where you put it.)

The plan called for bolting the finished brackets through solid posts in the first-floor wall framing. To avoid bungs or other weather-vulnerable surface marring, I encapsulated the 1-by-12-inch galvanized machine bolts within the bracket verticals. During bracket assembly, I set one bolt at the top in a pocket cut into the saddle joint **(10)** and passed another through the brace tenon at the bottom **(11)**. I bedded all the tenons in thickened epoxy and screwed them from the back using 3 ⅜-inch LedgerLok screws. For good measure, I also capped the bolts with a custom mix of sawdust and epoxy.

Now I could glue and clamp the finish faces to the inner curves **(12)**, rout the edges flush, and fill the backs with glued-in MDO plywood. Ultimately, the engineered core material was completely encased in truly weatherproof material. A final sanding to a 150-grit surface completed my part of the job. I made an extra set of MDO infills to serve as drilling guides for installation and slipped them over the bolts for delivery **(13)**.

Given the brackets' final appearance, I made a pitch for a natural finish, but paint won the day.

Mike Rand owns Narragansett Housewrights, in Narragansett, R.I.

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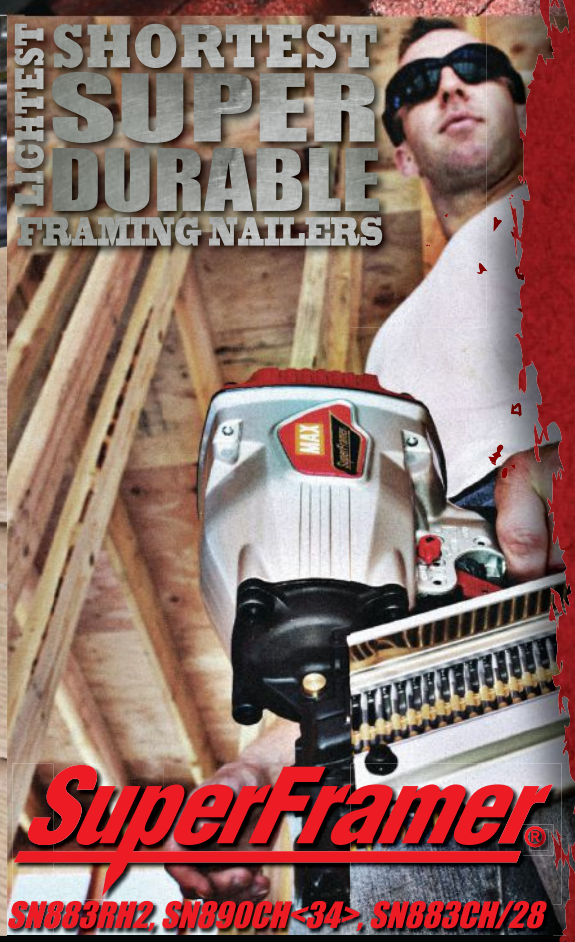

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BY JOE STODDARD

Tips for Conducting a Job Start Review

Miscommunication is the No. 1 reason why projects and relationships go sour. And the No. 1 miscommunication issue has to do with whether the builder or remodeler produced what the client thought they purchased in the time frame they were expecting.

If you're small enough that you are both selling and producing the work yourself, then a good written contract with complete specifications along with a thorough pre-construction meeting to review the project one last time before you start it might be enough. But as soon as you add employees or subcontractors to the mix, you need a better process. If someone else will be supervising the work, you need to make sure that they understand the project as well as you do, including budget, schedule, subcontractors, and the rest.

For every job, large production-oriented contractors conduct an "EPO review," short for "Estimate-to-Purchase Orders." The name might be a little odd—let's just call it a "job start review"—but the purpose is crystal clear: The job start review conveys exactly what was sold from the sales/design/estimating department to the project manager and production team. The review is one last chance to uncover any errors, omissions, or special conditions that could send the job into a sinkhole of delays and cost overruns. It also serves to hand off responsibility for the job from sales to production.

Production builders actually perform a "trial" run of purchase orders and compare it with the estimate. This is more than most small companies need, but the job start review can be easily adapted to practically any size operation doing any type of projects. It has two main purposes: to ensure that what is about to be built or remodeled is exactly what the customer actually purchased; and to give the lead carpenter or project manager the opportunity to catch estimating errors and potential cost overruns while there is still time to do something about them.

At a small-volume company, the process involves a meeting between the lead carpenter or project manager together with the designer and estimator (and sometimes the salesperson) to compare the "job start package" (see sample list, left) with the final direct cost estimate and preliminary schedule. If issues are discovered during the review, the project manager can then adjust the schedule (within reason), modify estimates and trade agreements (before they're signed), and fine-tune anything affected by these changes.

Don't confuse the job start review with a "pre-construction" meeting where the customer is present. Both are important communication tools that help to put everyone on the same page, but the job start review gets deep into the nuts and bolts of the job at a level of detail that most contractors wouldn't want their customers involved with. (For example, a historically accurate addition may require spending more on high-quality subs to save money and headaches over the long run, while a pole barn may just need "fast and loud.")

The project manager or lead carpenter should review the job start package at least 24 hours before the job start review is to take place, and note any changes or questions that need to be addressed with the rest of the team. Any issues discovered should be resolved during the job start review meeting (see sample agenda, page 28), and new, clean copies of the modified items made available to everyone. Retain the originals, but make sure that there is only one version active at any given time.

Joe Stoddard consults with contractors about business systems. jstoddard@mountainconsulting.com. Download a detailed Job Start Package from this article at jlconline.com.

LIST OF ITEMS IN THE JOB START PACKAGE

Section 1: Contract Documents
- ☐ Agreement
- ☐ Sales addenda
- ☐ Change orders
- ☐ Selection sheets

Section 2: Purchasing Information
- ☐ Complete set of purchase orders (POs) or accepted subcontract bids
- ☐ Job cost reports
- ☐ Written variances to-date

Section 3: Plans
- ☐ All plans, construction drawings, and details for the project

Section 4: Site Information
- ☐ Map with directions to jobsite
- ☐ Plot/site plans with elevations

Section 5: Customer Information
- ☐ Contact information, profile
- ☐ Buyer orientation checklist (for project completion)

Section 6: Communications/Misc.
- ☐ "Daily Walk" quality control log
- ☐ Quality control forms
- ☐ Customer communication log
- ☐ All correspondence to-date

This list applies to new construction or a structural remodeling job. Your Job Start Package should be customized to the type of work your company does.

Job Start Review Sample agenda for a Job Start Review meeting

1. Initial estimate: Review the direct cost estimate for incorrect or missing prices, making certain 100% of the job is represented. Also verify that indirect costs, such as sales commissions, are included.

2. Project overview and sales documentation: Review and look for errors and omissions in the specifications, sales agreements, owner selections, and any other known details about what was sold to the client—for example, a spec for an "upgraded fireplace mantle and surround" when a fireplace was not selected.

3. Option/upgrade/allowance check: Scrutinize selection sheets and the sales agreement for any and all customer-selected options, upgrades, and allowance items. Make sure that each item is correctly identified in the cost estimate, vendor agreements, POs (if you use them), and the like. This is one of the most important "checks" in the job start review and is the best way to ensure that what was purchased by the client will match what is built.

4. Lot/site check: Unforeseen site problems are a major source of cost overruns (extra drainage required, unplanned retaining walls, extra hauling), not to mention a major source of disappointment for the customer (the addition "sticks too far out" of the ground, the stairs are too steep, and so on). If the project requires a site plan and an existing drawing with cut/fill elevations is not available, use photographs and shoot the grade yourself (or sub it out). A surveyor may charge a few hundred dollars to provide all of the elevation points necessary, but considering that a single cubic yard of crusher-run gravel is now pushing $40 delivered, and machine time to move it around is another $100 per hour, shooting the grade is a minor expense.

5. Vendor review: Review the preliminary list of subcontracted trades and vendors. Are all a good match for the locale and project scope? It's better to know for sure what your costs are going to be than to assume a low-ball quote will hold up. If you think there's a chance that prices for lumber or other items are going to substantially increase, negotiate a price lock for the duration of the project, even if it's a bit more than your initial estimate.

6. Scope-of-work check: For every direct and indirect cost code on the estimate, there should be a specific scope-of-work indicating exactly what is expected of each vendor before its invoice or PO will be approved for payment.

7. Foundation check: Review that the foundation plans are complete and correct, concentrating on the size and location of all footings (especially deep frost footings), reinforcement, top-of-wall elevations, and support shelves and ledges for all slabs, steps, and other constructions that could settle toward a foundation wall. Reference all items to the cost estimate, making sure nothing is left out.

8. Lumber and sheet goods check: Check the lumber list for obvious omissions and sizing errors (for example, at headers or beams), making sure that any structural options (such as a deck) or interior finish items (such as soffits or landings) have been included in the estimate. Pay special attention to any engineered lumber and the truss package, looking for extra items or omissions. Sill plates and anchor bolts are another source of problems, as are estimates for bracing, blocking, backing, and other lumber that is "burned up" during framing but never seems to make it into the estimate.

9. Window/door check: For windows, interior and exterior doors, and all other openings, check any structural options (including finished basements) selected that may require additional openings that may have been overlooked. Compare the following list of attributes on the plans to corresponding "schedule" and section of the direct cost estimate:

a. Unit counts
b. Unit sizes
c. Window styles/hinge location
d. Door style/hinge location
e. Door and window hardware
f. Special finishes/special-order items
g. Special flashing or other unique installation requirements
h. Extension jambs, sills, and other millwork

10. Schedule check: While a thorough schedule review should be done separately by the project manager prior to actually starting construction, the job start review meeting is a good time to catch glaring errors or omissions, such as critical path items with a "0" day duration, any scheduled resource or trade that does not show up in the cost estimate (for example, a painter is scheduled, but no painting is in the estimate), and any missing inspections or other milestones.

11. Past problem/error check: This is a final catch-all that should be a focus for continuous improvement. Examples of often-missed items include: tubs or toilets requiring joists to be cut; no place for ductwork or mechanical equipment; improperly sized stairs or landings; requested lighting or plumbing locations that didn't make it onto the drawings; interior finishes with no corresponding estimate item; final caulking and paint touch-up; and costs for any between-trades prep or cleanup.

Documenting the Job Start Review

Whether you use one of the several construction-specific services (such as BuilderTrend or Co-construct) or build your own with generic services such as Dropbox or Evernote, the Internet provides an easy way to keep members of your team supplied with up-to-date documents, as well as a place to store updated versions for use during construction. Next time we'll look at how you can use the "cloud" to collaborate on and document your job starts package.

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Paid in Full?

BY ALEXANDER BARTHET

A customer disputes your claim for extras in some change orders you've submitted. You explain that the scope of the contracted work has been changed, but the owner isn't seeing it your way. You complete the punch list work and receive a check—marked "payment in full" in the memo line—for less than the invoiced amount, along with a letter from the homeowner explaining his position. You wonder: If I cash the check, will I still be able to make a claim for the unpaid balance?

Unfortunately, in many jurisdictions, the answer is no. When parties mutually intend to settle an existing dispute regarding an amount due by accepting a certain payment amount (such as a check marked "payment in full"), then that payment will result in the discharge of the prior disputed obligation (an "accord and satisfaction" in legal terms). One court found that a claim for additional payment wouldn't be allowed even though the claimant wrote on the marked check that he reserved his right to further payment. That said, a customer cannot simply claim that partial payment constitutes payment in full for a project halfway through a job and expect the contractor to fully perform the balance of the contract.

The lesson is clear: When a dispute arises and a customer marks a check "paid in full," the best practice—especially when the check is accompanied by a letter explaining why it is to constitute full payment—is to avoid cashing the check and attempt to resolve the dispute for the correct amount or an agreed-on lesser amount. Simply cashing the check and expecting you can argue about it later would be a big mistake.

Alexander Barthet (alex@barthet.com) is a principal of The Barthet Firm (thelienzone.com), a 12-lawyer commercial law practice focusing on construction-related matters.

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BY DOUG HORGAN

Photos: Doug Horgan/BOWA

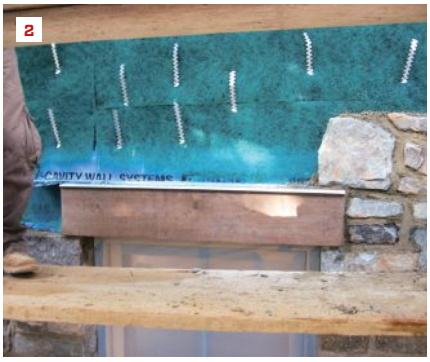
Masonry Through-Wall Flashing at Windows

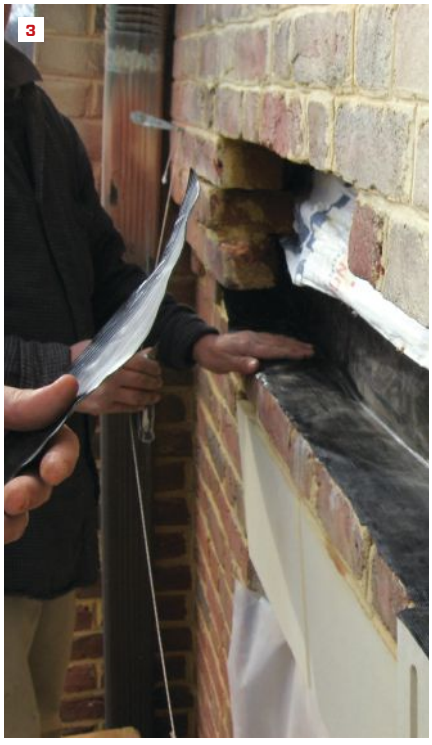
As a high-end remodeling firm in the Washington, D.C., metro area, our company works on many homes that have brick and stone exteriors. We sub out most of the masonry work, and getting the details right sometimes requires careful supervision. We pay particular attention to through-wall flashing, especially at roofs and above and below windows. The through-wall flashing at the head and sill must be planned before the masons are even hired, and we have to be sure the masons follow our plans closely because getting the details wrong is a sure-fire path to water problems.

That was the clear case on one recent job. Our work involved enclosing an open second-story deck above a kitchen. When scoping out the job, we learned that there was a leak: Water was coming through the recessed light in the soffit above the sink, which faced a large window. This window had previously been fixed by another contractor, and from the exterior it appeared to have a good weep system at the header. So, like everyone else, we assumed that the leak was in the roof and that enclosing the deck would solve the problem. But after we finished our work, the leak persisted. Whenever there was a long, windy rainstorm, water still dripped through the light.

So we investigated more closely, starting with water-testing the wall above the window. After soaking the brick with a hose, sure enough, water began flowing through the light. Still, before launching into a multi-thousand-dollar masonry project, we inspected further by taking off the casing above the window. We could see that there was through-wall flashing at the header, but we could also see plenty of water getting around it.

When we finally opened up the wall, we discovered that the through-wall flashing had been pieced in, with





the seams simply lapped, not sealed. Water was draining off the housewrap and onto the head flashing, but it was leaking through the seams. Plus, there were no end dams, so water was spilling off each end of the flashing and finding its way past the housewrap, past a layer of foil-faced polyiso insulation, and into the wall **(1)**.

ABOVE OPENINGS

To repair the problem, we opened up four courses in the wall—enough so that we could pull up the existing housewrap and install a one-piece, 18-inch-wide through-wall flashing. We typically try to use purpose-made rubberized asphalt "thru-wall" flashing materials. These are similar to the self-adhered flashings made for roofs or windows but have a stronger polyethylene face layer. The thicker material stands up to abrasion from masonry and tends to come in wider widths, so we can get a good lap behind the housewrap and still bring the flashing all the way out to the face of the brick.

This last point is important because it prevents water from soaking back into the masonry below the flashing and finding its way into the framing. There are purpose-made flashing materials with metal drip edges, but they are expensive, difficult to work with, and aren't stocked in our area. On some jobs, we have fabricated stainless steel drips along the outer visible edge **(2)**. Most of the time, however, we just have the masons bring the flexible through-wall flashing all the way out to the face of the brick **(3)**.

If you try to be clever and hide the edge of the material, know that holding it back any more than a tiny bit will allow water into the veneer. On existing work, we often find through-wall flashing cut back to the middle of the brick, which dumps water directly into the core of the brick and into the open back half of the head joints. Pulling the flashing all the way out to the face is a good way to ensure quality—and it isn't very noticeable once it's trimmed off.

The other critical detail on any through-wall flashing is the end dam, which is simply a fold at each end of the flashing that brings the material up into a vertical head joint **(4)**. This detail allows the flashing to function more like a collection channel, or spout, than a flat membrane. Creating an end dam is also more reliable than trying to seal overlapping pieces of flashing: Whenever we need a mid-span joint in flashing for a long run, we create end dams, turning the ends of each piece up into a head joint.

Through-wall flashing needs to run longer than the jamb flashing on each side of the window, so water won't find its way back into the opening. To ensure that water can escape, weep holes should be placed at each end dam and at every third brick to provide ample drainage (see photo, page 33). Weeps are commonly created by open head joints, or by fitting head joints with cotton rope

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purpose-made plastic devices (although tubes tend to clog or become insect nests), or drainable mesh (visible at the bottom of the wall in photo 7).

On this house we also reworked the window wrap and casing, and added an aluminum head flashing. By pushing most of the water through the masonry and protecting against wind-blown and incidental moisture, we were able to stop the persistent leak.

BELOW OPENINGS

We are careful to flash around windows, using high-quality butyl-rubber flashing and properly integrating it with the housewrap and window flashing **(5)**. (For examples of details using a variety of different flashing materials, see "Flashing a Flanged Window," Nov/12, and "Flashing and Trimming a Window," Aug/12.)

A key feature of a good window flashing is a drainable sill pan, which gathers the water leaking around a window unit and directs it to the outside. We find that a lot of masons, if left to their own devices, will let the sill pan drain into the air space behind the brick, leaving the through-wall flashing at the base of the wall to do all the work. However, we feel that best-practice should include a through-wall flashing right below each window that is integrated with the sill pan **(6)**. Any water leaking from any window needs a clear path out of the wall as quickly as possible.

It's important to run the through-wall flashing long enough so that the jamb flashing, as well as the sill pan, lap over it. This includes the jamb flashing between windows **(7)**. (Make sure to lap correctly; reverse shingling is the bane of every flashing job.) And as with every through-wall flashing, each end must be turned up to create an end dam so that water is channeled out of the wall. Otherwise, it is likely to dribble back into the masonry and find its way inside.

Doug Horgan is vice president, best practices, at BOWA, a design/build remodeling company based in McLean and Middleburg, Va.

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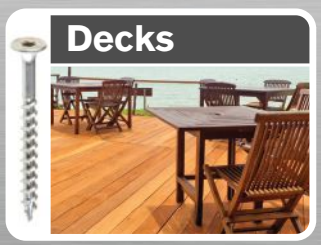

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BY TED CUSHMAN

Heat Pumps for Cold Climates

Mini-split heat pumps were a major topic at the Northeast Sustainable Energy Association (NESEA) BuildingEnergy 14 conference in Boston this year, and with good reason: Heat pumps have grown beyond their roots as a southern-state solution and are making in-roads in cold climates from Idaho to Minnesota to Maine.

Heat pumps don't use electricity to create heat; they simply transfer heat from outdoors to indoors (or vice versa). In mild climates, where the difference in temperature between inside and outside the house is relatively small, heat pumps are a no-brainer. As the air gets colder, though, air-source heat pumps lose capacity. Until recently, this has limited their usefulness in cold climates.

The newest mini-splits, however, can keep pumping out heat (although not at peak efficiency) even when outdoor temperatures drop below 0°F, and on a seasonal basis can supply nearly three times as much energy in the form of heat as the energy they consume in the form of electricity. They're not the answer for every house. But with installed prices starting at around $4,000 and capacities ranging from 12,000 Btu per hour (1 ton) to 30,000 Btu per hour (2.5 tons), mini-split heat pumps hit the sweet spot in a growing number of situations. Let's take a look at scenarios where mini-splits shine in cold climates.

Photo: Ted Cushman

ReVision Energy's Dave Ragsdale connects the control circuit of the outdoor unit of a 1-ton Fujitsu mini-split on a home near Portland, Maine. In combination with a wood stove, the mini-split will mostly idle the home's existing oil boiler, except during the coldest part of the year.

HEAT FOR SUPER-INSULATED HOUSES

For some Passive House builders, mini-splits are becoming routine. The affordable Passive House home built by Chris Corson in Knox, Maine, (see "An Affordable Passive House," Part I, May/12, and Part II, Jun/12) relies on a single one-ton (12,000 Btu) Mitsubishi "Mr. Slim" mini-split (mitsubishielectric.com) to heat about 1,600 square feet. In Oxford, Maine, a 2,016-square-foot house under construction by Passive House builder Jesper Kruse will be heated by the same appliance. And mini-splits heat all four of the New England homes featured in "Building Above-Code Walls" (Dec/13).

Mini-splits work well for these projects because they come in capacities close to the loads in a Passive House, and they deliver AC and heating in one small, easy-to-install package. Good ones are extremely quiet and also extremely efficient—according to one Idaho study, their seasonal average coefficient of performance (COP) is 2.8.

SUPPLEMENTAL HEAT FOR OLD HOUSES

It takes a lot of work to get a home's total load down to 12,000 Btu in the dead of a Maine winter, and not many Maine houses are built to Passive House standards (or even to code). Still, heat pumps have found a niche in Maine's existing homes. The state's energy efficiency utility, Efficiency Maine, has used Recovery Act funding to organize a mini-split retrofit program, offering mini-splits to homeowners in northern Maine, with a small rebate incentive to sweeten the pot.

"We had funding for 1,000 units, and Mainers put in 1,000 units very quickly," says Efficiency Maine manager, Andy Meyer. The average installed price for the appliances—mostly Fujitsu units (fujitsugeneral.com)—was $3,230. Customers were offered 7% financing for the cost, with payments automatically included in their electricity bills, but about four out of five customers chose to pay up-front instead.

Efficiency Maine surveyed all 1,000 customers to find out whether the buyers were satisfied, and more than 90% said they would recommend a mini-split to their friends. Calculated payback for the up-front cost,

based on heating cost savings, averages around five years. Efficiency Maine is showcasing the example of a couple living near the Canadian border whose heat-pump investment was paid back in two years, thanks to a 50% savings on their annual heating cost.

Heat pumps pay off best when they're displacing a heat source that is inefficient, expensive, or both. Where the heat pump substitutes for electric resistance heat, oil, or propane, it competes well. The advantage is not so clear-cut, however, when a heat pump goes head-to-head against natural gas, which has dropped in price as new "fracking" techniques boost U.S. supply.

But rural Maine is unlikely to ever see widespread distribution of natural gas. In Maine, 70% of homes are heated with oil—an expensive fuel burned in, typically, an inefficient appliance. The beauty of teaming a mini-split with an oil boiler is that the heat pump carries most of the heating load during the fall and spring "swing seasons"—times when heat requirements are moderate because the weather is relatively mild. When the heat source—the outdoor air—is relatively warm, heat pumps show their best efficiencies. That's also when stop-and-start operation tends to degrade the performance of an oil boiler or furnace.

By contrast, during the coldest part of the year, when the heat pump is relatively inefficient and may struggle to achieve its rated output or to produce comfortably warm air, the oil furnace functions at its best. Because it will tend to operate for longer periods, an oil system will spend more time operating at top efficiency and less time losing energy to "standby losses." Plus, the electricity that a heat pump consumes may be partially offset by the savings from not running the pumps and fans that are part of oil-burning equipment. In a case reported by energy consultant Marc Rosenbaum at the NESEA conference, 32 tons of heat-pump capacity (in the form of multiple 8-ton Mitsubishi commercial split systems) was installed in a public school building in Plainfield, N.H. The school has been saving more than 8,000 gallons of oil a year, Rosenbaum says, without any increase in electricity use.

Chris Blaisdell of ReVision Energy mounts an indoor unit in a finished basement. Compared with the blower needed to move air through a ducted system, the small fan in this unit uses very little electricity.

Photo: Ted Cushman

DRAWBACKS & CAUTIONS

Mini-splits account for a large proportion of heating and cooling worldwide, but they're new to the northern U.S. Early adopters in this country are still learning lessons (see "Lessons Learned on Energy-Efficient Affordable Housing," Jul/13). HVAC installers may lack the experience to install the systems correctly, and homeowners sometimes don't use them to best advantage. (For example, Andy Meyer says, it's worth advising homeowners to set the units on "heat only" in winter, not on "auto"—otherwise, the system may switch over to cooling if the house hits 72°F on a sunny winter day.)

The most efficient mini-splits are the models with no ducts or air handlers. Units with fans and ducts waste a small amount of wattage on air movement. But without heat distribution, single-point mini-splits may fail to satisfy some customers. Both Jesper Kruse and Chris Corson install a few hundred watts of electric heat in some rooms in their Passive House homes—mainly as backup in case a heat pump breaks, but also in case the owner wants more heat in a room that's remote from the indoor head of the heat pump.

That's the same strategy recommended by Fortunat Mueller of ReVision Energy, in Portland, Maine. Mueller runs room-by-room heat-loss calculations to estimate in advance whether a mini-split head located in a central room will pack enough punch to warm rooms near the periphery. He expects backup heat to be used rarely, if at all; usually, experience bears that out. But when in doubt, Mueller's company wires remote rooms for a bit of supplemental resistance heat, even if the company doesn't actually install any electric baseboard. Says Mueller, "Ten feet of Romex cable is cheap insurance against having a ticked-off customer if one room won't come up to temperature."

Ted Cushman, a regular contributor and former JLC senior editor, is a freelance writer based in Peaks Island, Maine.

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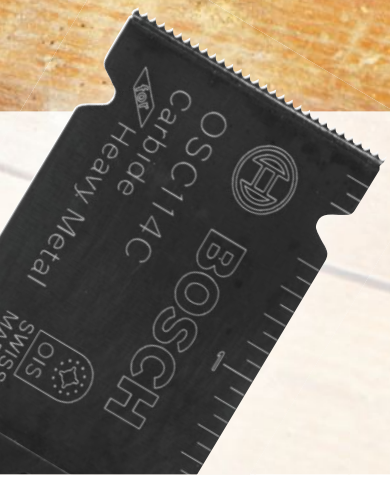

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Photo: Dave Malloy

Roofing With Asphalt Shingles

Details and best practices for installing durable roofs

BY JLC STAFF WITH MICHAEL CHOTINER

More than 80% of homes in the U.S. have asphalt-shingle roofs. Asphalt shingles are popular for several reasons: for the money, they offer good value to homeowners; there's a wide, good-better-best range of materials to choose from; and of all prevalent roofing materials, asphalt shingles are easiest to install.

But you still have to do it right. In this article, we'll cover the essentials of roofing and reroofing with asphalt shingles, including techniques and details for tear-off, layout, underlayment, flashing, and shingle installation.

The fundamental material choice is between strip-type and laminated shingles, both of which are built on fiberglass mats. (We know of no U.S. manufacturer that still makes organic-mat shingles.) Visually, most strip shingles have a flat, three-tab design (no-cutout designs are also available), while heavier laminated "architectural" shingles exhibit variations in thickness, shading, and butt-edge design that produce more random or irregular patterns similar to wood singles or shakes. Length of warranty is widely considered a measure of quality, with heavier shingles carrying longer warranties. Most warranties cover prorated material cost, but not tear-off or replacement labor (some manufacturers offer more generous terms to their certified installers).

TEAR-OFF

Consider local recycling of both the existing asphalt materials and any metal flashing and fasteners. To avoid damage from falling debris, cover shrubs and garden beds with tarps, and tack up tarps under roof overhangs to protect siding and other exterior surfaces. After tear-off (and at the end of each day during reroofing), use a magnet to "sweep" nearby pavement, lawn, and landscape beds to pick up stray nails.

Tear off asphalt shingles from a seated position (photo, right). Start at the peak and work down toward the eaves using a shovel-like, serrated stripping tool such as the Shingle Eater (shingleeater.com) to get under shingles and pry out fasteners. Workers should wear safety harnesses secured to a stable anchor point. Three workers can typically tear off about 4 squares of roofing per hour.

Strip only as much area as you can cover with underlayment the same day. Replace unsound sheathing, re-nail loose sheathing, and drive flush any protruding nail heads.

FALL PROTECTION

In March 2013, OSHA issued a directive (STD 03-11-002) that rescinded and replaced its Interim Fall Protection Compliance Guidelines with a standard that requires residential construction workers who are working 6 feet or more off the ground (or within 6 feet of a roof edge or opening) to be prevented or protected from falling by means of a net, a harness, or a guardrail.

As a practical matter, harnesses and guardrails are most feasible for residential projects. Harnesses, which arrest a fall before the worker hits the ground, are less expensive and are easier to set up. Ideally, they are anchored to framing at the highest point on the roof to minimize the need for repositioning (see "Fall Protection for Roof Work," Dec/13).

Guardrails prevent a fall by creating a physical barrier. When used instead of harnesses, they must be installed at both eaves and rake edges, and around any roof openings that are 6 feet or more above the floor below. Manufactured guardrail systems, such as those from Acro Building Systems (acrobuildingsystems.com), are probably the easiest and least expensive option. Acro's Steep Pitch Guardrail (for eaves) and Open-Edge Guardrail (for rakes) include steel base plates that are fastened through keyhole slots so they can be interleaved with shingles, then removed without creating leaks (right). The posts have integral brackets sized to receive OSHA-compliant curbs and rails.

Asphalt Shingle Classification

Max. Wind Speed (mph)	Required Class	Impact Resistance	Fire Resistance
150	D	Class 4	Class A
120	C	Class 3	Class B
90	B	Class 2	Class C
60	A	Class 1	

< most resistant least resistant >

Wind: ARMA (Asphalt Roofing Manufacturers Association) has developed a classification system for selecting shingles based on the wind zone designation for a specific region. **Impact:** UL 2218 ranks shingles in four classes, from least resistant (Class1) to impact damage from hail and flying debris, to most resistant (Class 4). **Fire:** Most laminated asphalt shingles carry a Class A fire rating; most strip shingles are Class C. **Algae:** Shingles with "–AR" appended to the product name resist staining from organic growth for eight to 15 years.

UNDERLAYMENT

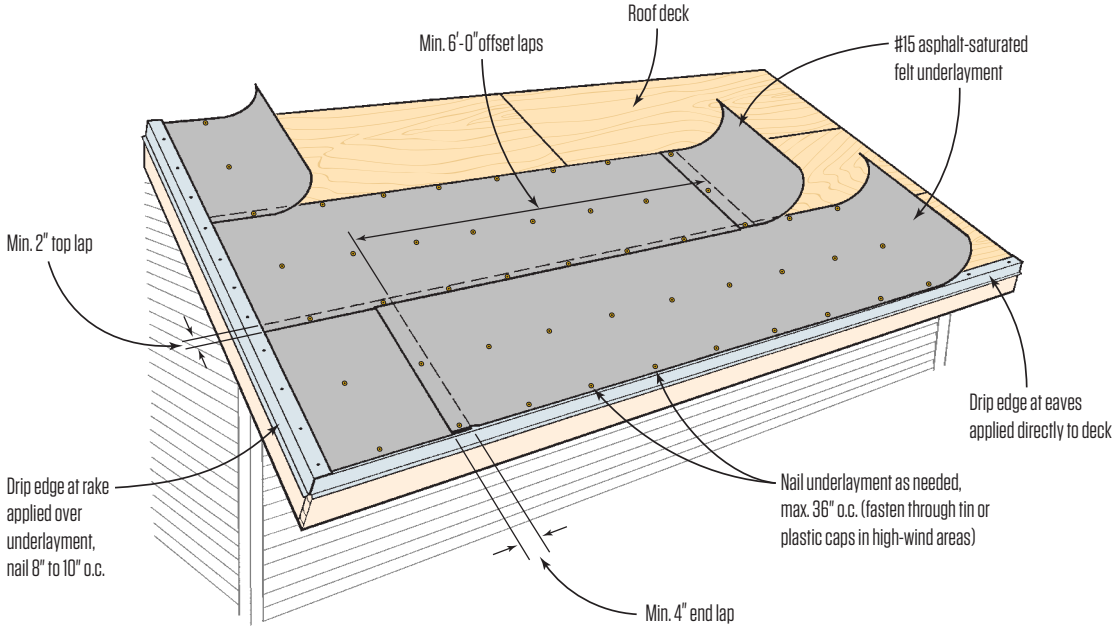
A variety of materials, including asphalt felt, synthetic sheeting, and self-adhering membranes, may be used under asphalt shingles, either separately or in combination.

Asphalt felt is the most economical underlayment material. Those who still use #15 or #30 felt value its vapor permeability, which they claim enables moisture to dissipate through evaporation (see "Whatever Happened to 30# Felt?" Jan/13). The downside is that paper-based felt is prone to tearing and puckering when left exposed and subject to wet/dry cycling. Fiberglass-reinforced asphalt felt is said to be more tear-resistant and less slippery.

Synthetic underlayment is made from polyethylene or polypropylene, is stronger and lighter than asphalt felt, and comes in wider, longer rolls that cover the roof faster (see "Do Synthetic Underlayments Make for Better Roofs?" Jan/13). Synthetics don't soften or wrinkle when exposed to moisture and are said to offer better footing than felt, even when wet. Most synthetics can be left exposed to sunlight for up to a year. A couple of brands—GAF's Deck-Armor and VaproShield's SlopeShield—are vapor permeable and are recommended for unventilated roofs. Impermeable or not, all synthetic underlayments are at least twice as expensive as felt.

Self-adhering membranes have a continuous adhesive backing that is self-healing, which means the material seals around fasteners that puncture it. However, any of the three basic formulations—rubberized asphalt, butyl rubber, or acrylic—may be incompatible with some other building materials, including caulks. sealants, and underlayment (see "Working With Flexible Flashing," Apr/14). Because of their high cost (about $100 per square), peel-and-stick membranes are usually applied in "problem areas," such as eaves and valleys, and in combination with metal flashing at chimneys, vents, and other roof penetrations (see pages 50–51).

Standard Underlayment for Roofs 4:12 and Steeper



DRIP EDGE

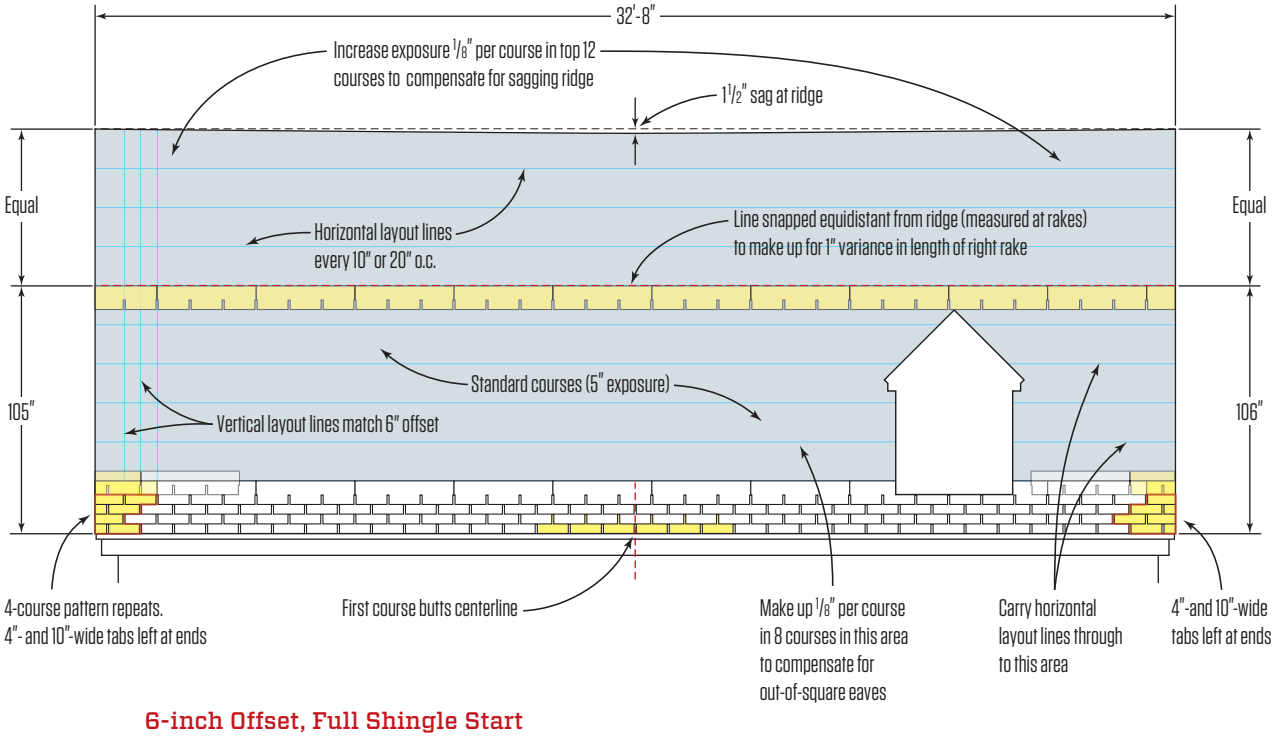
Prefabricated metal drip edge is designed to protect the absorbent edges of sheathing and to drain water away from fascia and rake trim. For a custom look, bend drip edge flashing from copper, aluminum, or other corrosion-resistant metal that matches or complements other roof flashing or trim color.

There is some disagreement about whether drip edge should be applied under or on top of self-adhering membranes. While we recommend following manufacturer instructions to preserve product warranties, best practice at the eaves is to install drip edge directly on the sheathing, apply any self-adhering membrane on top, then overlap that with a compatible underlayment. Along the rake, apply underlayment first, then fasten the drip edge on top, making sure it overlaps the drip edge at the eaves.

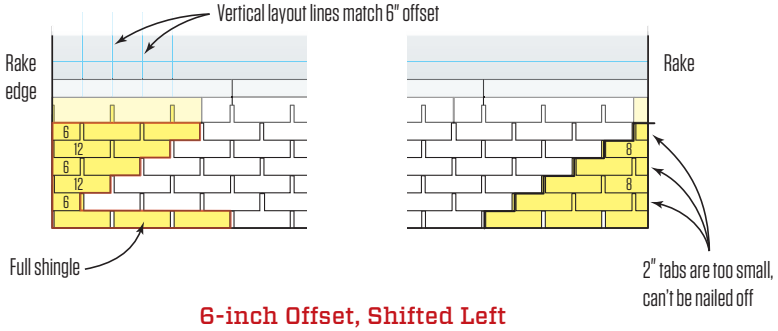
When a single length of drip edge isn't long enough, overlap end joints at least 1 ½ inches. At the rake, pieces higher on the roof should overlay pieces lower on the roof to promote drainage. Fasten drip edge flashing with compatible 1 ½-inch nails spaced 8 to 10 inches apart.

Laying Out 3-Tab Shingles

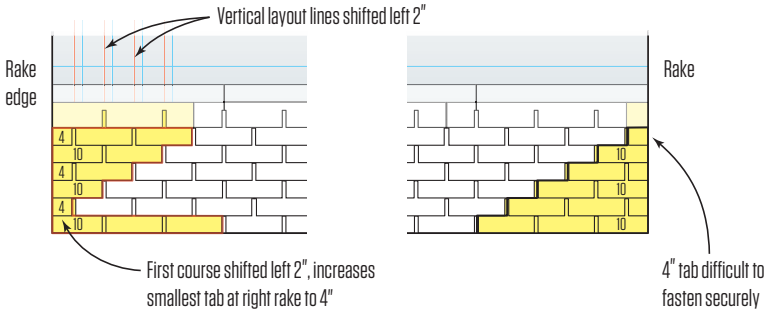
6-inch Offset, Symmetrical Rake Layout



6-inch Offset, Full Shingle Start



6-inch Offset, Shifted Left



First finish course. In this example, if shingle layout begins with a full shingle (left), it leaves a too-narrow 2-inch tab every other course on the other rake. Shifting the layout 2 inches to the left solves this problem, but 2 courses in the six-course pattern still require a narrow, difficult-to-fasten 4-inch tab (below left). The best layout (shown on roof) is a four-course pattern laid out from the centerline.

Out-of-square roof. Courses are parallel to eaves until they reach the dormer. To make up for the out-of-square roof before reaching the top of the dormer, increase exposure for eight courses by 1/8 inch in the area left of the dormer. Transfer course lines to infill the right side of the dormer.

Sagging ridge. To prevent cap shingles from exaggerating the 1 1/2-inch sag in the ridge, increase course exposure by 1/8 inch (from center to rakes) in 12 courses in the upper portion of the roof.

SHINGLE LAYOUT

Most roof dimensions are not an even multiple of standard shingle sizes, so fractional shingles will be needed to fill out courses. Tabbed shingles will look better if the fractional pieces are the same size at each rake. (This is less critical for laminated shingles because the finished appearance is meant to be more random.) Determining where to begin requires some preliminary measurements (see "Shingle Layout," opposite page).

Horizontal alignment. First find the midpoint along the eaves and, using the 3-4-5 triangle method, snap a line to the ridge at a right angle. (If dimensions at the ridge differ from that of the eaves by no more than an inch, you may be able to cheat the drip edge flashing at the rakes to split the difference.) Next, measure along the eaves from the centerline to each rake, then divide by the length of a shingle (typically 36 to 40 inches). Divide the remainder in half, and if the result is less than 3 inches, arrange for all fractional shingles to run along one side of the roof. Otherwise, arrange for fractional pieces at each rake to be approximately the same size. This may require using a different offset and working the first course from the centerline out to the rakes (see "Shingle Layout," opposite page). Ensure that starter strip seams are offset from seams in the first finish course. Once the first course is in place, install subsequent courses beginning at the rake.

Vertical alignment. Although exposure marks are printed on many shingle brands, best practice is to snap a horizontal line every three to five courses to ensure that your shingle line isn't wandering. Also measure from the eaves to the ridge to see if you need to make up for a bowed or sagging ridge line that will be accentuated by the cap shingles (see "Shingle Layout," opposite). You can shrink or stretch shingle exposure ⅛ inch per course, so calculate the number of courses you'll need to make up for any discrepancy. (For example, you can make up 1 ½ inches by adjusting the exposure ⅛ inch in 12 successive courses.) As with many remodeling details, best appearance may be achieved when materials are installed out of square to match existing visual lines.

SHINGLING AROUND A DORMER

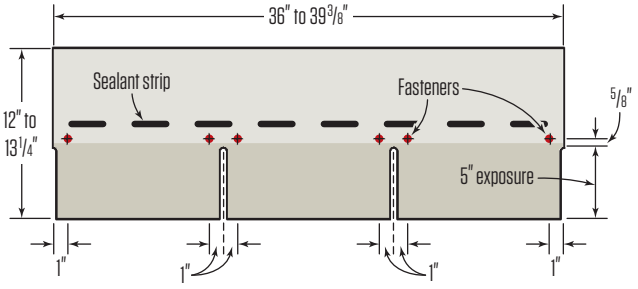
Install courses normally on the larger adjacent roof area, snapping lines frequently to ensure proper exposure (see "Shingle Layout," opposite). When shingle courses clear the dormer ridge, snap a horizontal line to the rake and measure down to align the remaining courses on the other side of the dormer.

To improve speed, production roofers snap a line above the dormer ridge first, then install shingles above and below simultaneously. This requires one infill course.

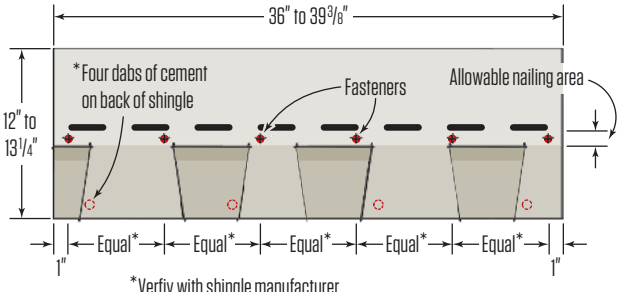
Six-Nail Method

(For High Winds or Steep Slopes)

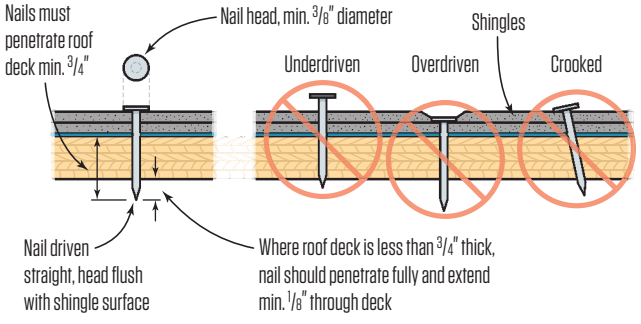
3-Tab Shingles



Laminated Shingles



Properly-Driven Nails



NAILING

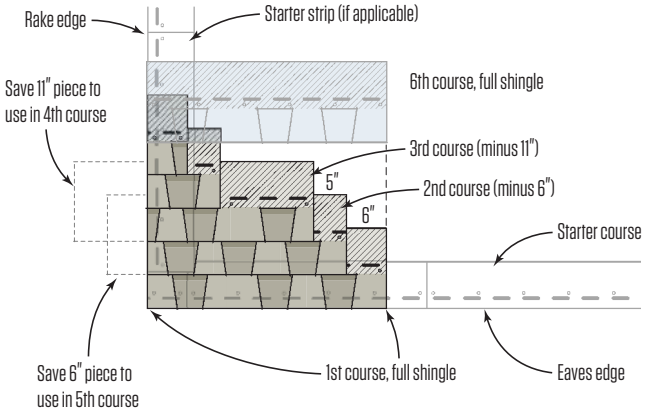
Use hot-dipped galvanized nails; stainless steel nails add cost, but are ideal for coastal areas. For most installations, four nails per shingle are required; in high-wind zones, fasten with six nails per shingle (see "Six-Nail Method," above).

To prevent blow-offs, drive nails straight and flush. Pneumatic nailers improve speed but can affect quality unless used with care. Seal an over-driven nail head with roof cement and drive a new nail next to it. For a mis-driven, angled nail, drive the head flush, then repair it as you would an over-driven nail.

INSTALLING SHINGLES

After installing drip edge and underlayment along the eaves and rakes, apply one course of starter strips. You can buy precut starter strips or make them by ripping shingles in half lengthwise. Starter strips should overhang the eaves drip edge by about ½ inch. Follow manufacturer instructions to determine shingle offset to avoid alignment of joints (see illustrations at right). Avoid pieces narrower than 6 inches at rakes, and don't drive nails closer than 3 inches to the roof edge. For added wind protection at rakes and around penetrations, bed shingle "tabs" in a quarter-size dot of roof cement applied at regular intervals about 1 inch in from the edges (to avoid squeeze-out).

Offsets for Laminated Shingles



VALLEY FLASHING

Open valleys (right) feature a prominent strip of metal flashing (typically copper or aluminum), which easily sheds water and snow and provides protection from wind-driven rain when properly fabricated and installed. For long valleys, overlap flashing at least 12 inches (lower piece under upper) and avoid seams near eaves where snow, ice, and debris can accumulate. In high-wind areas, caulk flat seams or hem and interlock seams—especially on shallow-pitched roofs. To allow for expansion and contraction, fasten copper using copper tabs clipped to hemmed edges.

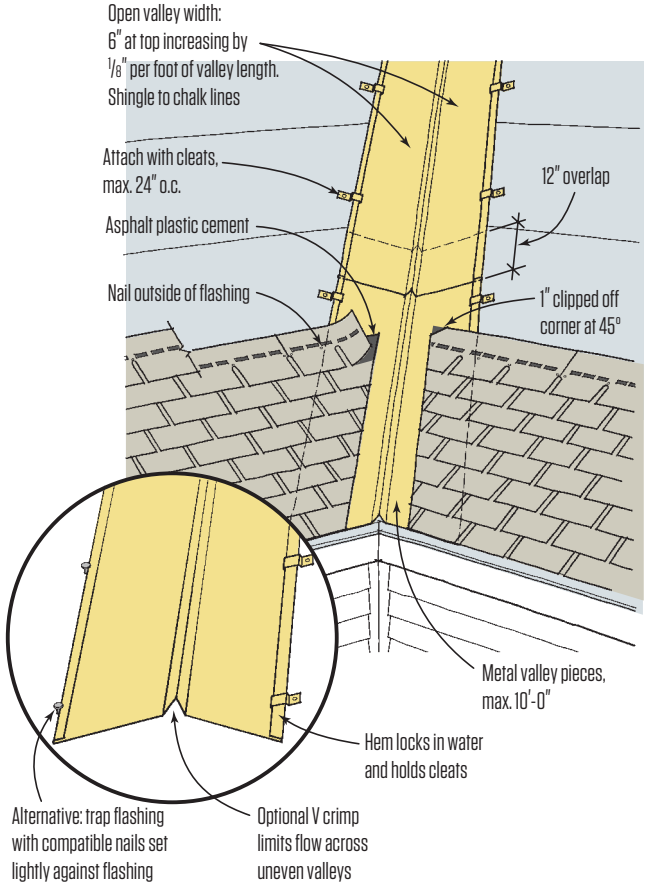
Where steep roofs of unequal pitch meet, use a W-shaped valley flashing; the raised ridge running down the center slows the flow of water and reduces the chance of leaks from overwash.

Closed-cut valleys (opposite page) install faster because they require cuts on just one side. Where roof planes are of unequal size or pitch, locate the cut edge on the larger, steeper roof plane where possible to avoid driving water between shingle layers. Seal layers along the cut edge with roof cement for added protection.

In the "Tamko" closed-cut variant (far right, opposite), shingles from one side of the roof are laid through the valley. Then full shingles are laid end to end along a line offset 1 inch from the center of the valley. The remaining roof plane is shingled, with square-cut shingles forming a sawtooth pattern at the valley.

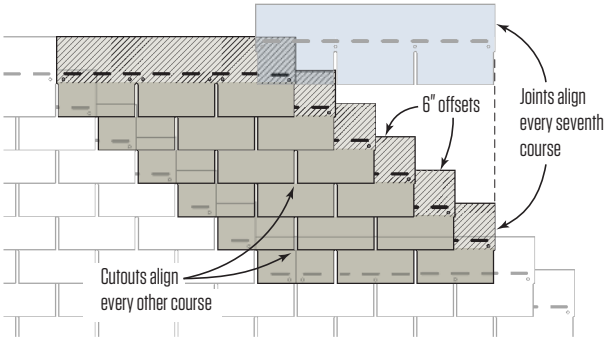
Woven valleys (not shown) are sometimes used with tabbed shingles and require the most installation time. They are not recommended with heavier laminated shingles, although they are sometimes appropriate for short, shallow valleys at crickets and small dormers.

Open Valley

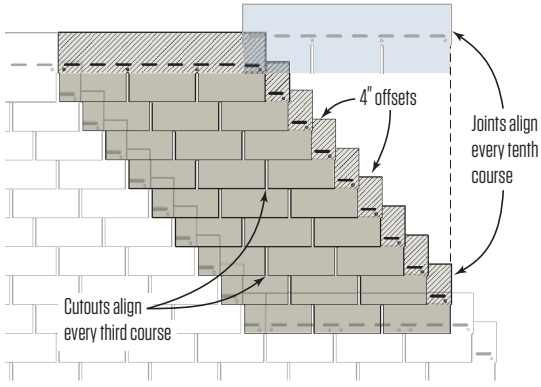


Offsets for 3-Tab Shingles

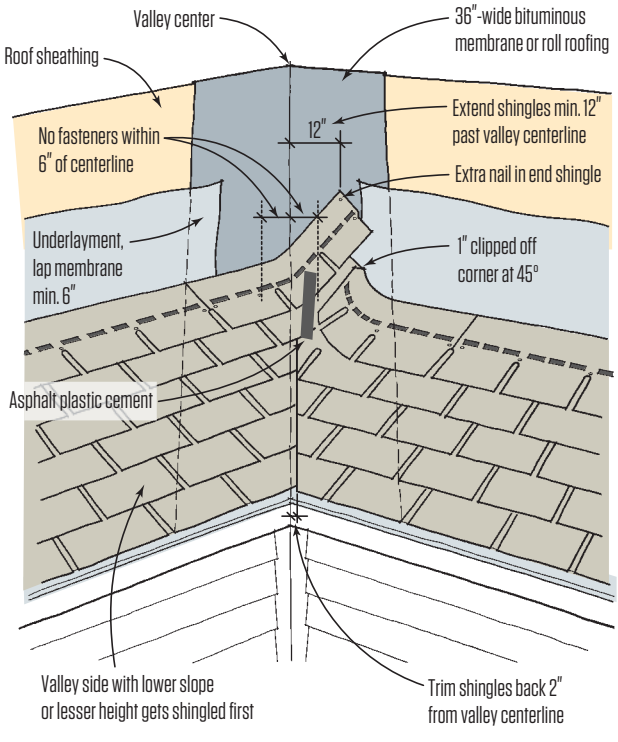
6-inch Offset



4-inch Offset



Closed-Cut Valley



'Tamko' Valley

In the "Tamko" valley, one slope (the shallower, if applicable) is completed first, with its courses running through the valley by at least 12 inches **(A)**. Next, full shingles are nailed end-to-end along a chalk line; a bead of roofing mastic adds insurance against uplift **(B)**. The opposite slope is completed with square-cut corners toeing the valley line **(C)**. A dab of mastic glues the sawtooth tips to the valley starter **(D)**.

EXISTING FLASHING

Best practice is to replace existing metal flashing with new material rather than rely on someone else's workmanship. The exception is copper through-wall counterflashing at masonry—provided it is properly installed, shows no signs of corrosion, is compatible with new step flashing metal, and is of a heavy enough gauge that it can withstand temporarily being bent upward while other flashing work is completed under it. Otherwise, install new counterflashing (see "Chimney Flashing Details," page 51, bottom right).

CHIMNEY & DORMER FLASHING

Joints where a dormer or masonry chimney penetrates the roof deck will leak if not properly flashed (see illustrations at right).

If there is no cricket behind a chimney, build one that matches the roof pitch. Make sure that cricket valleys are properly flashed (see "Valley Flashing," page 48) and that they channel water away from the masonry corners.

Take care to ensure that new and existing flashing is compatible to avoid corrosion from galvanic reaction (see "Galvanic Series," below).

Use a self-adhering membrane as a first layer (some manufacturers may require a primer to improve adhesion to masonry). When retrofitting masonry step flashing and counterflashing, follow the details shown to ensure secure fastening and proper drainage.

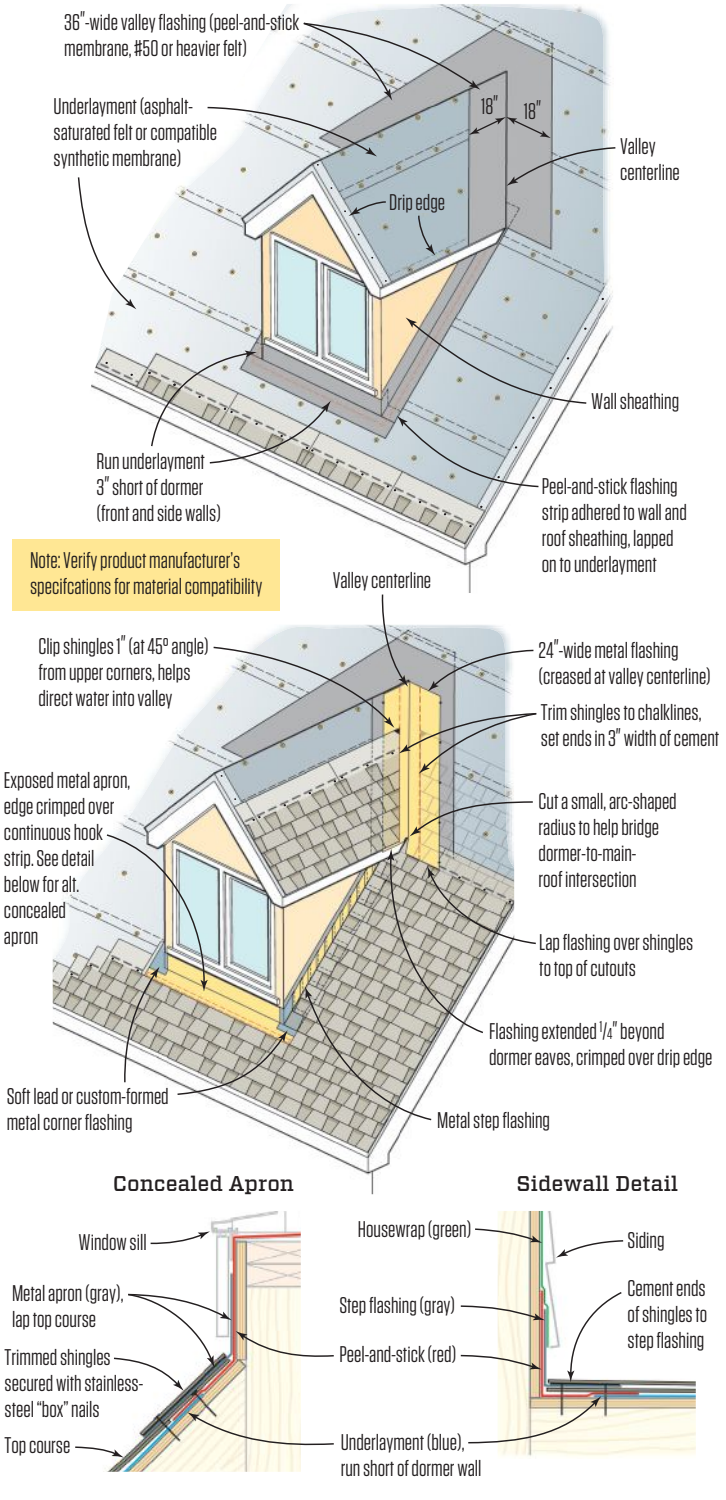
GALVANIC SERIES*

When different metals come in contact, the more "active" metal will corrode. The farther apart metals are in the galvanic series, the greater the potential corrosion.

Zinc, galvanized steel	Active
Aluminum	
Cast iron	
Carbon steel	
Lead	
Tin	
Brass, bronze	
Copper	
Silver solder	
Stainless Steel	Passive

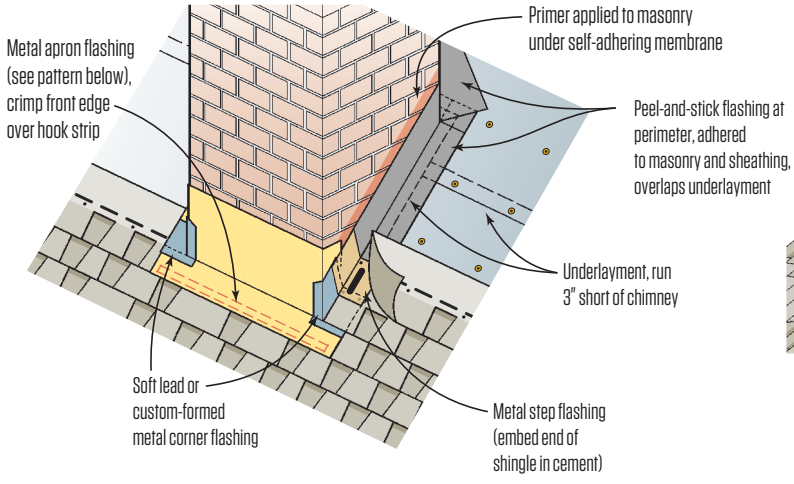
*only common construction metals listed

Dormer Flashing Details

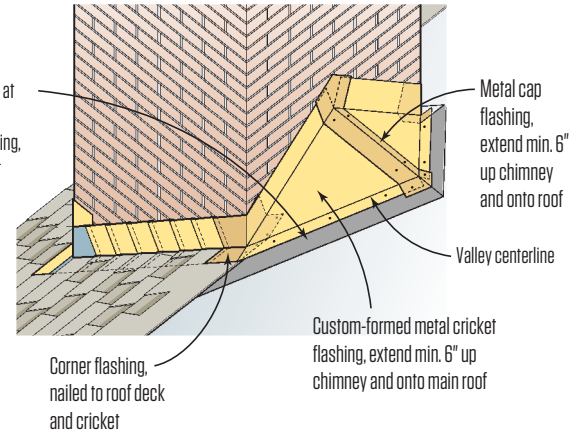


Chimney Flashing Details

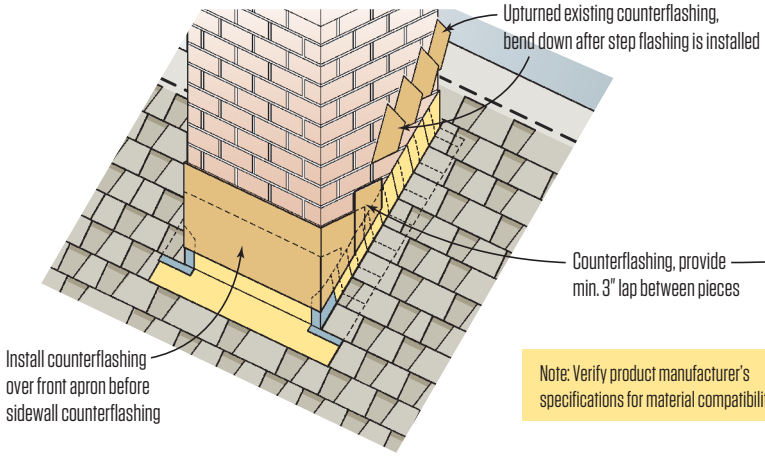
1. Base Flashing, Front and Sides



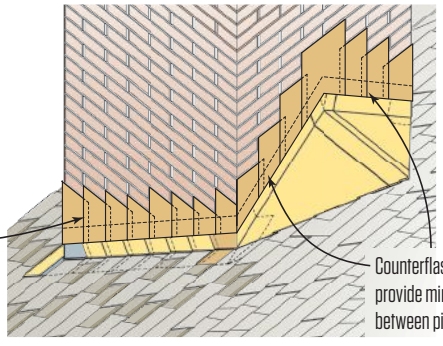
2. Cricket Flashing



3. Counterflashing, Front and Sides

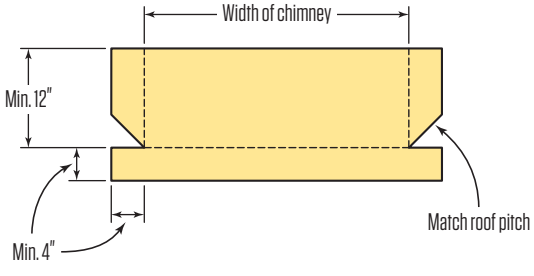


4. Counterflashing, Rear

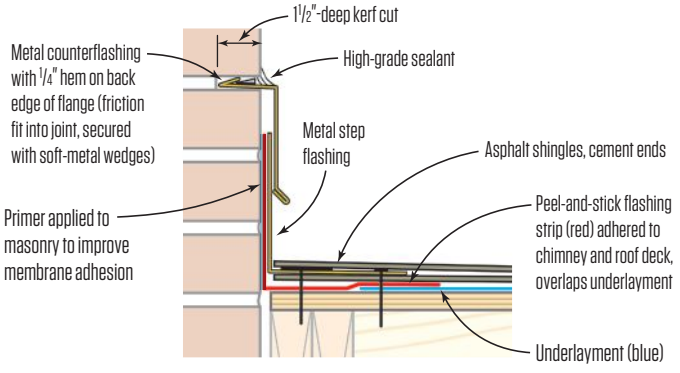


Note: Verify product manufacturer's specifications for material compatibility

Front Apron Pattern



Roof-to-Chimney Flashing

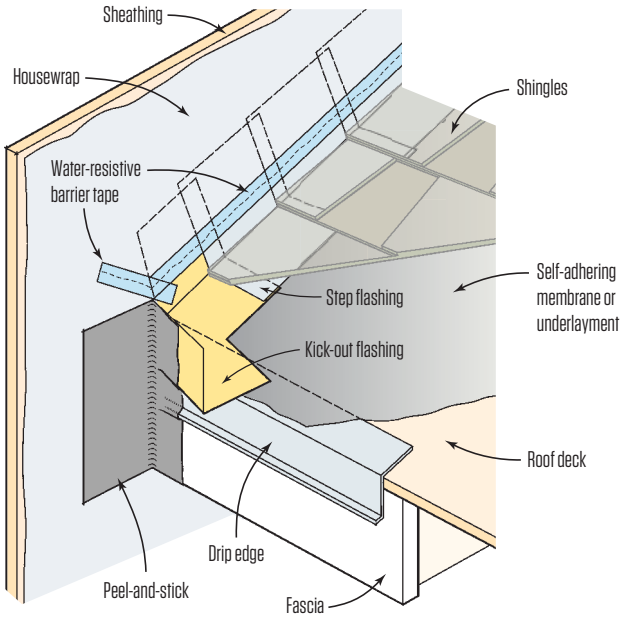


FLASHING VENT PIPES

Every roof has at least one vent stack (usually PVC or ABS) poking through it. The inexpensive boots commonly used to flash these penetrations rarely last as long as the roofing does. A better solution is to wrap the pipe with a compatible peel-and-stick flashing, then cover it with metal that both integrates into the roofing to promote drainage, and also hides the pipe. One of the best premade solutions we've seen is a metal "plumbing vent flange" (above) from F.J. Moore Manufacturing (fjmooremfg.com, 800.658.2331).

Available in copper or in galvanized or painted steel for a variety of pipe diameters, it can be used for new work or mounted over an existing rubber boot. The base can be adjusted on site to match the roof pitch. The company also makes a "special pitch" model for new work, which consists of a sleeve and base plate of galvanized steel or copper custom-soldered to match a specified pitch.

Kick-Out Flashing at Roof-to-Wall Connection



KICK-OUT FLASHING

Kick-out flashing diverts water away from siding and trim where roof eaves intersect with exterior walls. While it is possible to site-bend metal into a workable kick-out flashing—especially when also flashing with self-adhering membranes or tape—prefabricated plastic or metal kick-out flashing is inexpensive, looks good, and is easy to install.

RIDGE VENTS

Contrary to conclusions drawn during the 1990s, recent research suggests that venting has less effect on asphalt roofs than do shingle color and site orientation of the roof. There are, however, many good reasons to vent a roof (see "Roof Ventilation Update," Oct/07), but one of the most compelling is to meet the manufacturer's warranty requirements. Check the shingle wrapper: If venting is required for the roofing you are using and the roof you are considering is unvented, raise the issue with the homeowner before you start the roof work.

Where ridge venting is used, extend and cap the vent material across the entire length of the ridge (right) to avoid a pinched look at rakes or gable ends (inset).

Michael Chotiner is a contributing editor to JLC.

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Mudsill Layout for a Complex Foundation

Attention to detail makes the rest of the house easier to frame

BY MATTHEW ANDERSON

As a residential framing contractor on Cape Cod, I see many different styles and sizes of homes. Present design trends seem to be making the homes my crew and I work on increasingly complex—all the way down to the foundations, which, we are frequently finding, are no longer simple rectangles with an attached garage.

We recently framed a home, for instance, that included a walkout basement with a stepped foundation, an angled bay off the back of the house, and multiple spaces in the home that required jogs in the foundation.

Regardless of style, size, or complexity, however, one thing has remained constant: The frame must start off level and square to ensure an accurate build throughout the rest of the project.

BEFORE FRAMING BEGINS

The first thing we do—before we begin our layout—is clean the top of the foundation. Most of our projects are backfilled before we arrive, and the clean, sandy Cape soil limits the chances of foundation damage during backfilling. But the excavator always manages to leave sand along the tops of the walls. We sweep off the sand and then go over the concrete with a leaf blower so we're left with a clean, dry surface.

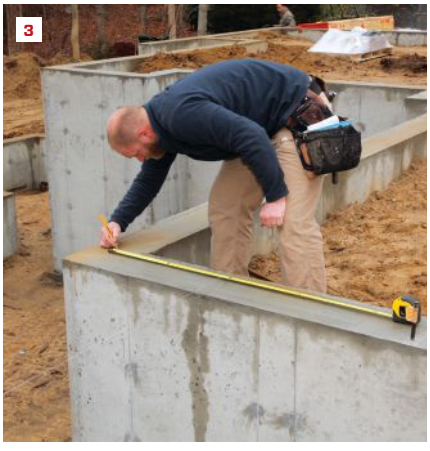
Photos: Roe Osborn

Once the foundation is ready, we decide where to begin the layout to ensure the house will be square. On this project we were fortunate enough to be following a foundation contractor I've worked closely with in the past. After stripping the concrete forms, he checks every foundation with a rotary laser and lets the builder know if there are any areas of concern. This particular foundation had just one low spot, in a corner of the garage, that we easily corrected by adjusting the length of a couple of studs when we framed the garage walls.

ESTABLISH A BASELINE

A good rule of thumb for beginning the squaring process is to establish a baseline along the longest wall of the house. This particular house was basically a Cape with an addition off the left side, as well as a large garage with a connecting addition on the right-hand side. With most houses like this, the back wall runs in a straight line for the length of the building, and we simply snap a chalk line along the whole length of that wall to establish our baseline. But the natural slope of this lot caused the builder to drop the back wall of the house to create a walk-out basement. With the back wall at a different elevation from the rest of the house, we came up with an alternative strategy for our baseline. Because of the many jogs in the front wall of the house, my foreman and I decided it would be best to stretch a string along its entire length to establish a baseline, and then pull parallel measurements from the string and snap lines for the various jogs in the front elevation.

To anchor the string, we tacked two blocks to the front left corner of the house using a powder-actuated nailer **(1)**. The block along the side wall was for attaching the string, and a perpendicular block on the front wall located the exact position of the string. (We always use the inside edge of the plate for our baseline.) At the other end of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the house, we tacked a length of plate stock to the farthest wall of the garage. Because of the unusual jogs in the front of the house, the front of the garage was 3 feet in front of the end of the house where we'd attached our blocks, but 2 feet in back of the center section of the house. We measured back from the corner of the garage and marked the baseline location, which fell in the opening for a side door to the garage. Now we were able to stretch the baseline string over the entire length of the house **(2)**.

Once we had this line established, it was easy to pull parallel measurements for each of the four walls along the front elevation **(3)**. We then snapped chalk lines between each set of measurement marks.

PLUMB DOWN FOR THE DROPPED WALL

We also used the baseline string to establish parallel measurements for the back walls of the house. The back and front foundation walls of the garage were at the same elevation, so we were able to follow the same process of pulling measurements and snapping a line for that wall. Laying out parallel lines on the dropped foundation wall, however, was a bit more involved, but extra sets of hands and a laser level made the process go quickly.

My foreman hooked a tape on a 2x6 block aligned with the baseline string. Standing on the back wall, I held the other end of the tape, keeping it level. Another crew member positioned the laser on a block on the dropped wall and moved the block until the plumb line was at the exact measurement **(4)**, then marked the spot on the dropped wall. We repeated this process at the other end of the wall, which gave us two accurate points for snapping a second baseline along the dropped wall **(5)**. We used this line to pull parallels for the other rear walls at that same foundation height. With parallel marks at the ends of all the front and back walls, we finished snapping our chalk lines along them.


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PERPENDICULAR WALLS

The next step was to establish lines for the walls that ran from the front to the back of the house, perpendicular to the lines we just snapped. We first checked the overall width of the house at the front to make sure the foundation didn't grow or shrink during the pouring process. Then we marked that width at the two front corners of the building. The garage was the largest part of this house with foundation walls at the same level on all sides, so we first squared its side walls to its front and back walls.

After removing the temporary sill that held the baseline string, we measured the side wall and marked the position of the inside edge of the plate **(6)**. Then, making the assumption that the foundation contractor had gotten the dimensions correct, we did the same with the front wall of the garage **(7)** and marked the opposite corner. With the corners of the garage marked out, we pulled diagonal measurements to ensure the layout was perfectly square **(8)**.

CHECKING FOR SQUARE

Before the days of mobile-phone apps, we checked for square by plotting out a 3-4-5 triangle in three simple steps: 1) measure the longest multiple of 3 along one wall; 2) measure the same multiple of 4 along the wall you're trying to make perpendicular; 3) mark the point where the diagonal distance between the two marks intersects the same multiple of 5.

But with a mobile-phone app or a construction calculator, you can simply enter the exact measurement of both walls, and the program gives you the diagonal measurement. On this foundation, the diagonals were off by only ¼ inch—a pretty small amount in the scheme of things. Nevertheless, we corrected by shifting the back corner slightly, then double-checked our diagonals until they were perfect **(9)**. Once the four corners of the garage were properly marked, we snapped chalk lines for the two side walls of the garage **(10)**. We now had our perpendicular guidelines for the rest of the house.


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LAYING OUT THE REMAINING WALLS

As had been the case earlier, pulling parallel measurements along the front of the house—where the foundation height was consistent—was easy. To make the process go more quickly, we refastened the mudsill for the garage sidewall using the line we'd just snapped **(11)**. Then it was simply a matter of one crew member holding the tape on the mudsill, while a second person marked the measurement on the foundation at both ends of each wall **(12, 13)**. Where those marks intersected the lines we'd snapped earlier were the corners for each jog in the foundation.

We had already marked the front left corner (at the opposite end of the house from the garage), so we marked the same measurement at the back just before the foundation began to step down **(14)**. To locate the back corner of the house on the stepped foundation, we again used three sets of hands and a laser **(15)**. One person held the end of the tape on the back corner of the garage, while a second crew member stretched the tape. Then a third crew member set the laser on a block and moved it until the plumb beam was at the exact measurement for the overall width of the house. With this final step, we had now established the major corners of the house, and we focused our attention on laying out the rest of the details.

FINISHING UP THE LAYOUT

One way we sped up the final part of the layout was to attach the sill stock to the foundation of the walk-out wall before locating the key points on the wall. We let the stock run by the corner of the foundation so that we could mark the exact length of the wall directly on the sill **(16)**.

Having this sill in place was also handy when it came time to lay out the angled bay on the walk-out wall. We pulled a measurement from the corner of the house (on the stepped foundation) to the center of the bay, and again plumbed down with the laser level and


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marked the center on the sill stock that extended through the bay. Then I transferred the center mark to the outside wall of the bay with a framing square against the sill stock. With accurate center points, it was easy to lay out inside and outside dimensions, and then connect the points.

The walk-out wall extended across the entire back of the house, except for a rectangular volume that bumped out behind the garage. To lay out that area, I worked off the mark that we'd made earlier at the corner of the foundation where the rectangle began. We had used the original reference line along the walk-out wall to lay out the rear wall of the rectangle, so we just needed to lay out the two perpendicular walls. As with the garage, I used a mobile-phone app to get the diagonal measurement to locate the two outside corners **(17)**. Then it was just a matter of pulling parallels from these two points to complete the foundation layout.

We finished snapping the sill lines and installed the remaining sill plates with the sill seal already stapled to the sill stock as it went down **(18)**. (At this stage, we temporarily fasten the sills to the foundation with a powder-actuated nailer. Later, after the floor framing is complete, we'll use special bolts to permanently attach the sills.)

We run continuous sill everywhere the framing will touch the concrete foundation, including on vertical walls where the foundation steps down **(19)**. We make sure those sills are plumb before they are anchored. When all the sill stock is attached to the foundation, we saw off any overhanging extra where we'd left the stock long **(20)**.

An efficient crew—like this one—that specializes in layout and placement of sills can do this work in only a couple of hours. By lunch time that day, we'd already gotten a good start on framing the lower walls.

Matthew Anderson is the owner of Anderson Framing and Remodeling, a building company based in East Sandwich, Mass.

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A Drywaller's Approach to Air Sealing Homes

One air barrier is not enough

BY MYRON FERGUSON

Photos: courtesy Ferguson Drywall Innovations

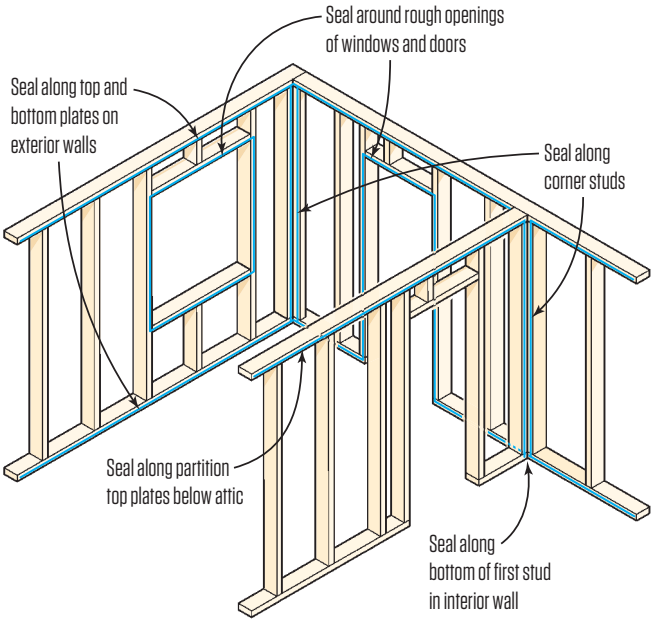
Air leaks through the building shell can have a significant effect on a home's durability, energy use, and indoor air quality. You've heard this before, or at least I hope you have by now. But I'm a drywall contractor. What do air leaks have to do with my work? Well, I believe that drywall can be an important part of the air barrier of an enclosure. Once I recognized this, it changed the way I do my work.

NOT JUST ONE AIR BARRIER

For most houses, I don't think it makes sense to consider the air barrier as a single plane. It's typically described that way, and folks get hung up about continuity, thinking there needs to be a single perfect plane on either the inside or the outside of the enclosure. In the 1980s, the Airtight Drywall Approach was developed as one answer for creating an air barrier on the interior. It sounded good in theory, but it didn't get a lot of traction, perhaps because no one seriously believed that you could ever get the drywall guys to install gaskets and sealants. Though this might sometimes be true, there's a real opportunity to significantly improve the air barrier when the drywall is hung. The only mistake is thinking that the drywall alone is the ultimate solution.

Think of the whole assembly as the air barrier. You can have both

Sealing the Drywall Perimeter



The top and bottom plates of exterior walls, all exterior room corners, and the perimeter of window and door openings need sealant—preferably a flexible one. (Adapted from BSC Information Sheet 401: Air Barriers—Airtight Drywall Approach.)

air-sealed exterior sheathing and airtight drywall on the same enclosure. Remember, we're talking about an air barrier, not a vapor retarder; there's no harm in having a double-sided air barrier. In fact, Energy Star requires that insulation be installed "in full contact" with *both* a sealed interior and an exterior air barrier.

For most jobs, we need to stop thinking of different locations as separate air barriers. Instead, I recommend that GCs think of the entire assembly as the air barrier, and I urge them to build tight at every opportunity. Tighten up the outside, in the wall or ceiling, and along the inside. That's your air barrier.

Air sealing throughout the assembly slows the movement of pressure-driven air. Air sealing on the exterior will limit wind-washing, which can reduce insulation effectiveness. And air sealing on the interior will reduce convective looping in building cavities. All these efforts together will reduce infiltration and exfiltration—the stuff that air changes are made of.

Certainly it's possible to make one single, perfect plane your air barrier. Passive House builders do it all the time and are creating very tight envelopes (0.6 ACH50 is the standard to qualify). But I'm talking about a more conventional approach—what's "usual" for the building industry on the kind of jobs I most often get called in for.

This is a world that builders are starting to have to pay attention to: The 2012 International Energy Conservation Code (IECC) requires blower-door testing along with a "visual inspection" of the air barrier. In climate zones 1 and 2 (hot, humid places), a house needs to reach a 5 ACH50 threshold, down from 7 ACH50. In all other climate zones (including the one where I work), homes need to reach 3 ACH50, which is a monumental leap from 7 ACH50. While not every state has adopted this code yet, it's coming, and builders who haven't started complying will eventually have to get on board.

1. The cutouts for every switch, outlet, and light fixture need to be sealed before the drywall is hung.

2. A foam Energy Block provides an efficient way to seal all the little holes in an electrical box. Before installing the drywall, the author will apply a thick bead of caulk to the stud and the block's wide forward-facing edge to seal the outlet perimeter.

3. Recessed lights in an unconditioned attic can be sealed at any time before insulation with site-made boxes.

4. Recessed lights in a cathedral ceiling must be addressed before the lid is hung. Here, the author surrounds a fixture with a box made of foil-faced foam.

5. Use expanding foam to seal around the electrical feed and the mounting brackets.

Photos: courtesy Ferguson Drywall Innovations

AIR SEALING WITH DRYWALL

It's important to distinguish between an air-barrier material, such as drywall, and an air-barrier assembly. The assembly may be the exterior wall, which includes the drywall as well as isolation boxes for electrical boxes, caulks, sealants, insulation, and, typically, exterior sheathing. If I wanted to talk about drywall as an air-barrier material, this article would be just about hanging and taping the drywall.

When I'm talking about air sealing the assembly with drywall, my focus is on caulking and foaming the drywall panel edges, sealing electrical boxes and recessed lights, and sealing the intersections where interior partitions attach to exterior walls and ceilings. (Air leaks in hidden places such as the rim-joist and ceiling-joist areas should also be addressed, but those places are usually beyond the scope of my work.) All this attention to detail helps the drywall work become part of the assembly that serves as an air barrier.

To create a good air barrier, two things must happen: The drywall must be attached to the framing in an airtight manner; and all possible air leaks around holes cut into the drywall must be properly sealed. The combination of the drywall, framing, caulks, and sealants makes up the air-barrier assembly.

PREPARING FOR DRYWALL

A sheet of drywall by itself is a good air barrier. But as you know, it isn't very often that a piece of drywall is hung without a lot of holes for electrical boxes, ductwork, windows, doors, and the like **(1)**.

Before the drywall is hung, attention needs to be paid to sealing electrical boxes and other penetrations. Caulk or a non-hardening clay, such as the acoustic outlet backer from Kinetics Sound Control (kineticsnoise.com), can be used to plug the holes in electrical boxes. But applying either product is exacting work, and it's easy to have gaps in the seal if you aren't meticulous.

I prefer to isolate electrical boxes with Energy Blocks (energyblock.com). These are fairly quick to install, and when I'm installing the drywall, I can caulk the thick edge around the box to create a tight seal **(2)**.

Isolating fixtures in ceilings is especially important because of the stack effect in a building. In a home with an unconditioned attic, recessed lights can be isolated with site-made boxes sealed to the drywall either as the lid is hung or from the attic-side after drywall **(3)**. This is recommended even for so-called "airtight" fixtures. In most cathedral ceilings, however, the fixtures need to be sealed before drywall. I like to use a box made of foil-faced foam insulation board to isolate the fixtures, and once the box is in place, use spray foam to seal around the wire penetration and mounting brackets **(4, 5)**.

To complete the seal around the perimeter of each cut-out, I apply a thick bead of caulk to the edges of the isolation box just prior to hanging the drywall. If you have to seal around a box or fixture after the drywall is hung, a good tape such as one from Siga (sigatapes.com) will work much better than caulk **(6)**.

You don't have to seal around electrical boxes and other openings in interior partitions. Air will still be able to move through these assemblies, but this is okay as long as any penetrations through the thermal boundary—namely, electrical wires and plumbing vents—are sealed **(7)**.

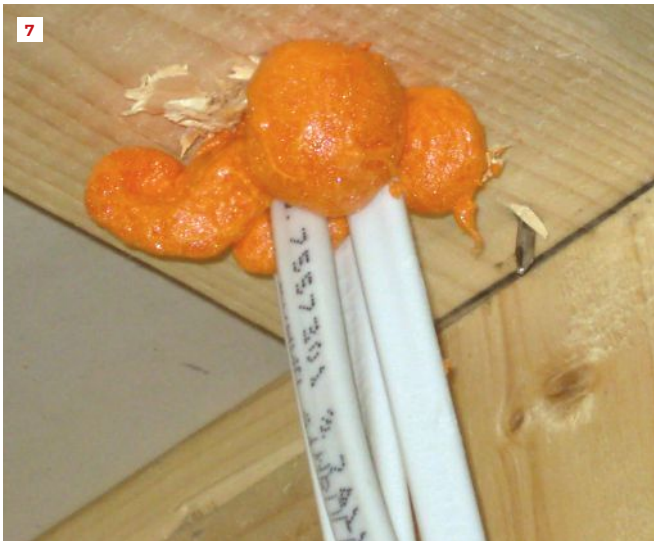
AIRTIGHT PERIMETER

Turning the drywall into an air barrier requires a tight seal at the room perimeter (see "Sealing the Drywall Perimeter," page 68). Drywall adhesive can be used, and most production crews will prefer this out of convenience, but they need to slow down and apply a continuous bead along the perimeter of each wall, as well as around the framing of window and door openings. (Typically, crews only apply beads along the framing in the center of panels.)

One of the most important locations to seal is along the shoe plate. Usually there is about a ½-inch gap at the bottom of the wall that is not covered by drywall. Running the adhesive or sealant along the top edge of the shoe plate will pick up the drywall, but the joint between the floor and the bottom of the shoe plate also needs to be sealed.

When I can, I prefer to apply a flexible caulking or an acoustical sealant, which remains elastic over time. Just make sure that the bead is continuous.

Because of the way that ceilings are constructed, it's usually more difficult to seal the perimeter of the ceiling than it is to seal the perimeter of the walls. Where trusses cross an interior partition, there's no continuous framing to seal against. In theory, if the wall panels are properly sealed to the top plates, and the wall panels are tightly butted to the ceiling and are taped, very little air will find its way past the ceiling. But this relies heavily on the paper tape and cured drywall compound as the corner seal, which is not enough. I suggest sealing the perimeter of the ceiling with expanding foam. This must be applied after the lid has been hung, but before the walls are hung.



In an unconditioned attic, the sealing can be done from above any time before the insulation is installed **(8)**.

IT ALL COMES DOWN TO MONEY

I also install insulation, but typically I'm called just to do the drywall work. I generally stop by the project to measure for drywall materials before any insulation is installed. I see this as a chance to talk about what is being done for air sealing. I also ask about what types of insulation are going to be installed, who is insulating, and where the GC or owner sees the air-barrier location. Depending on the answers I get, I may then pitch my experience with air sealing, or what I simply call "getting ready for insulation." I explain that this prep work, combined with air sealing at the drywall surface, will help complete a good air barrier. If the house is already insulated and I determine that very little air sealing has been done, or if it doesn't appear to be continuous, I offer

Photos: 6, Terry Nordbye; 7-9, courtesy Ferguson Drywall Innovations

6. Taping the edges of a fixture is easier than applying caulk, but will do nothing to seal holes in the fixture itself.

7. All wire penetrations through framing next to unconditioned spaces must be sealed before drywall. This applies to penetrations in exterior walls as well as interior partitions.

8. To seal the drywall perimeter, a helper applying sealant needs to stay in front of the crew hanging the panels.

9. Any penetration into the attic should be sealed with spray foam. This needs to happen before insulation.

airtight drywall as the next and maybe last chance to establish a good air barrier.

I know that the drywall phase of the job is often not given much thought. Typically, the contractor gets some bids, works out schedules, and gets it done as soon as possible so the finish work can begin. But I come in with all my ideas—saying this needs a level 5 finish (see "Specifying Drywall Finishes," Nov/09), and asking about decorative beads, decorative finishes, and the like (see "Drywall Upgrades," Jul/10). You can imagine the response. There is seldom money allotted for any of the upgrades, and on top of that I am suggesting some air sealing before insulation and this crazy idea of airtight drywall. I'm not just trying to run up the price, but that's often the reaction I get.

The drywall contractors you've always used may not be interested in doing the extra air-sealing work, or you may judge that they are not capable of doing the job. I have run into this when subbing out the hanging. The answer is most often about money; you can't expect this extra work to be done for free. One technique that I have often used is to supply the hanging crew with a helper. It doesn't have to be a highly paid employee, just someone who understands the air-sealing work that must be done and who can stay ahead of the hangers.

The cost of establishing the drywall as an air barrier is not huge, but there will be a cost. To air seal the drywall only with caulks and foams is cheap—from $300 to $800 per house. To air seal before drywall, including the electrical boxes, light fixtures, and wall-plate penetrations (what is typically "getting ready for drywall"), usually costs more and takes more time—with a skilled helper, it will take me two days or more depending on the size of the house. The key is to plan for it early and to make the process part of the work scope right from the start.

Myron Ferguson is a drywall contractor in Galway, N.Y.

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Kohler's Tailored Vanity collection includes five vanity styles and hundreds of drawer/door configurations, hardware pieces, finishes, and countertops. Interiors can be fitted with bamboo storage trays and dividers, adjustable shelves, and roll-out drawers. Prices start at $650, but Kohler expects the average order to be around $1,500. Kohler, 800.456.4537, kohler.com

Fogless Shower Mirror

A low-voltage heating pad on the back of a ShowerLite mirror warms the glass, eliminating steamy shower fog while also activating a pair of soft light strips. The 12-inch square mirror mounts permanently to the wall; the heater and light strips are thin enough that the mirror surface can be made flush with the tile. Cost: $545. ClearMirror, 877.242.5327, clearmirror.com

Hail-Resistant Tile

Because monster hail can crack even concrete roof tiles, Boral has introduced a concrete tile with a class 4 rating; that is, it can withstand hail balls up to 2 inches in diameter at impact speeds of up to 70 mph. (The company's class-3 product is rated to withstand 1¾-inch balls at that speed.) Cost is around $85 per square foot. Boral, 800.669.8453, boralroof.com

Concrete Framing

Concrete Lumber posts, beams, joists, and decking are made from lightweight concrete reinforced with pre-stressed wire. It's half the weight of standard concrete and flexes like wood. Cut it using a masonry blade on a circular saw, and fasten it with screws or bolts. A 2x6 runs about $2.50 per linear foot. Concrete Lumber Co., 215.369.1520, concretelumber.com

LVL Core Doors

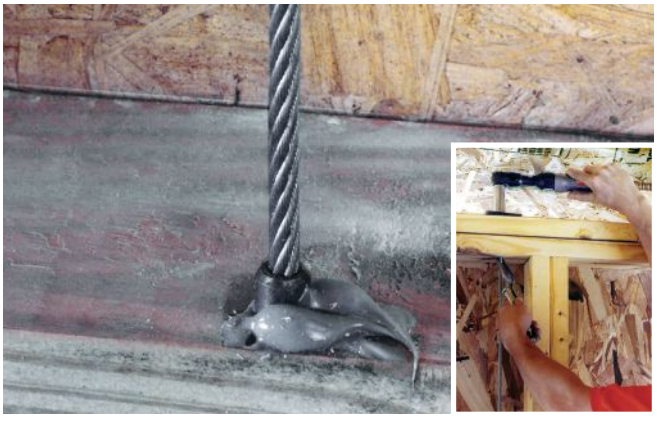
The laminated veneer lumber (LVL) cores in GlassCraft's plank-style doors should make them resistant to cracking and warping. They're available in 1¾-inch and 2¼-inch thicknesses and with mahogany or knotty alder cores and veneers. Premium options include straps, clavos, and speakeasy grilles. List price for the unfinished slab shown here (including options) is $1,880. GlassCraft Door Co., 800.766.2196, glasscraft.com

Big Microwave Drawer

Thermador's new MicroDrawer microwave has a 1.2-cubic-foot cavity. It's tall enough to hold a 20-ounce cup and large enough for a 9-inch by 13-inch oblong dish. It offers 10 cooking modes, flush installation, and a sensor that detects food moisture. The exterior dimensions match the company's refrigeration columns and warming drawers. MSRP: $1,650. Thermador, 800.735.4328, thermador.com

Screen Door Alternative

The Brisa "screen door" is actually a retractable screen housed in an aluminum frame. The frame attaches to a brick-mold door casing using just a power drill, with the bottom of the frame locking into the existing door's threshold. The frame is adjustable for doors from 30 to 36 inches wide without cutting; smaller doors require two simple cuts. The screen needs no trimming. Cost is around $180. ODL, 800.253.3900, odl.com



Pre-Tensioned Anchor

QuickTie is an anchor-and-cable system for use in seismic areas or where builders have to meet a 90-mph wind code. The cable is tensioned to 140% of the design load by the framer and, according to the manufacturer, ends up at 100% after the building settles and the lumber shrinks. Cables come in various sizes; a 10-foot-long 3/16-inch cable should cost $7 to $10. Quick Tie Products, 800.397.5542, quicktieproducts.com

Sliding Pot Rack

Glideware is a sliding maple rack with zinc hooks. It fits into a standard-depth base cabinet and extends fully into the workspace, making it easy to access pots and pans. Because the hooks slide back and forth and can be removed if not needed, the rack will accommodate different cookware types and sizes. It comes preassembled for easy installation. Price: $200. Glideware, 800.558.9947, glideware.com

Better Tankless

The TruTankless electric water heater squeezes 24 feet of heating element into a briefcase-size housing, so it operates at relatively low element temperatures. That, and the mineral-resistant alloy used for the element, helps prevent the scale buildup common with tankless. Wi-Fi functionality allows for remote monitoring. A 4 gpm unit (for a three-bath home) lists for $1,500. Bollente Cos., 855.862.8987, trutankless.com

Advanced Wall Oven

Useful features on Bosch's 30-inch Benchmark convection oven include optional side-opening doors, dampened hinges, a built-in meat thermometer, and an energy-saving mode that uses residual heat to finish up cooking. Style and sizing match the company's steam and microwave ovens. Prices range from $2,900 to $3,200 for single ovens and from $4,400 to $4,950 for double ovens. Bosch, 800.944.2904, bosch-home.com

Anywhere Epoxy

Designed for embedding rebar or threaded rod into masonry, USP's new line of two-part anchoring epoxies offers targeted formulas for nearly every jobsite condition. For example, there are epoxies for use on foundations in earthquake- and hurricane-prone regions, as well as fast-cure and cold-weather epoxies for use down to 34°F. Prices range from $14 to $24. USP Structural Connectors, 800.328.5934, uspconnectors.com

Classifieds

May Advertising Index

Weigh In!
Want to test a new tool or share a tool-related testimonial, gripe, or technique? Contact us at JLCTools@hanleywood.com or 707.951.9471

EDITED BY BRUCE GREENLAW

BULLET CENTERFIRE FOAM-CUTTING SAW BLADES

As a union laborer on the trans-Alaska pipeline project, I once had to cut truckloads of rigid foam insulation with a table saw. Clouds of noxious, statically charged dust billowed from the saw, some of which inevitably ended up in my lungs. I could have reversed the saw blade to reduce the dust, but that would have produced more fumes. Cutting with a utility knife would have been too slow and tedious.

I wish I'd had Bullet Tools' new carbon-steel Centerfire 7¼-inch and 10-inch circular-saw blades (bullettools.com). They have a knife edge instead of saw teeth and are designed to make swift, factory-smooth cuts in foam panels and insulating concrete forms while eliminating 95% of the dust.

I just made a series of test cuts with both blades through 1-inch-thick Owens Corning Foamular XPS foam and 2-inch foil-faced Rmax Thermasheath-3 polyiso foam. The blades worked exactly as advertised, creating virtually no XPS dust, and just a light sprinkling of polyiso dust. They seared *continued on page 78*

Milwaukee M18 Fuel Sawzall

BY STEPHEN KLUG

According to an ad in the October 2013 issue of *JLC,* the new cordless Milwaukee M18 Fuel Sawzall reciprocating saw is the first 18-volt model to deliver true corded performance. When *JLC* asked if I'd like to field-test one, I couldn't resist.

I've been a hands-on contractor since 1980, and my company is currently doing lots of residential remodels and additions. Our go-to recip has been the 10-pound, 15-amp corded Makita model JR3070CT, which pumps out up to 2,800 strokes per minute with a 1 ¼-inch stroke length. The Makita has an aggressive orbital cutting mode, electronic speed control for maintaining constant speed under load, a clutch that helps prevent gear damage if the blade jams, and a counterbalance to reduce vibration. My crew and I were anxious to see if the new M18 Fuel Sawzall could stand in for our tried-and-true corded Makita with no significant drawbacks.

FEATURES

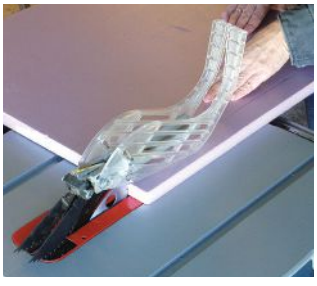
The M18 Fuel is the first cordless recip with a brushless motor. Brushless motors are more compact, efficient, and durable than standard motors with brushes. The tool has the same gear design, gear-protecting clutch, and vibration-damping counterbalance as Milwaukee's corded 12-amp model 6519-31. Advanced electronics maintain constant speed under load while protecting against overloading, overheating, and overdischarging.

The saw also has a lever-action blade clamp for speedy swap-outs, and a quick-release adjustable shoe that makes it easy to control the maximum cutting depth or to use a fresh series of teeth to extend the life of the blade. Much-appreciated finishing touches include a pivoting hang hook and a bright LED headlight with a 10-second afterglow when you release the trigger.

POWERING UP

According to Milwaukee, the M18 Fuel cuts up to 30% faster than competing cordless recips, and can even outpace its own corded model 6519-31 in some applications despite having a similar transmission and the same stroke specs. Unlike the M18 Fuel, the 6519-31 doesn't have electronic speed control.

As for battery runtime, Milwaukee says repetitive internal tests revealed that the M18 Fuel armed with a 6-inch Milwaukee AX demolition blade can consistently make up to 40 crosscuts per *continued on page 78*



continued from page 77

some of the foam edges slightly, but didn't overheat.

The 7¼-inch blade has a diamond knockout so it can fit wormdrive or sidewinder saws. I used a wormdrive because the manufacturer warns that sidewinders can bog down when cutting foam more than an inch thick. I installed the 10-inch blade in a portable table saw equipped with a riving knife, a blade guard, and anti-kickback pawls. I made most cuts freehand, as suggested by the manufacturer, but when I did use the fence, the foam would sometimes bind against it. To solve that, Bullet now includes with every 10-inch blade a "SpeedSpacer," an adhesive-backed plastic strip that sticks to the side of the fence to prevent binding.

The 7¼-inch Centerfire blade costs $60, the 10-inch costs $90. According to the manufacturer, the blades will cut about 25,000 linear feet of 2-inch foam before they need to be resharpened. For a modest fee (plus shipping), Bullet Tools will handle the tuneups. *—Bruce Greenlaw is a contributing editor to* JLC.

continued from page 77

charge in 2x12 pressure-treated pine when using the optimal feed pressure.

We're too busy to conduct our own speed and runtime tests, but we've pushed the M18 Fuel hard for five months—cutting everything from existing framing to ½-inch rebar—and it's in a league of its own. We thought we would miss the orbital cutting mode, but we don't. The saw speeds through our cuts like a corded tool and has yet to stall or to shut itself off to prevent overloading. The 4-amp-hour battery has had ample runtime to complete each of our cutting jobs, and its built-in fuel gauge tells us when it's time to recharge. This is helpful given that it's not a quick charge—in one timed trial, it took us one hour and 26 minutes to fully recharge the high-capacity battery.

The saw weighs about a pound less than our corded recip, is comfortable to grip, and does a good job of taming vibrations.

THE BOTTOM LINE

Since we started testing the M18 Fuel Sawzall, our corded recip hasn't left the truck. The new cordless is surprisingly fast and powerful, delivers impressive runtime, and has every recip feature available. The cordless convenience is fabulous.

The bare tool (model 2720-20) costs $200, or the same price as our deluxe corded recip. That's great if you've already bought into Milwaukee's M18 platform and are using the 4-amp-hour batteries. I haven't, so I'd opt for the full 2720-22 kit, which doubles the price. That's pretty steep, but I think the payback is worth it. A third option is the $300 2720-21 kit, which has one battery instead of two.

2720-22 SPECS

Motor type: brushless
Weight with battery: 8.9 pounds
Stroke length: 1⅛ inches
Strokes per minute: 0 to 3,000
Price: $400
Included in kit: two 4-Ah batteries, charger, blade, plastic case
Warranty: 5 years tool, 3 years battery

Milwaukee / 800.729.3878 / milwaukeetool.com

Stephen Klug owns Fine Building & Finish, in Yarmouthport, Mass.

(1) The 2720 Sawzall includes a pivoting hook so you can hang it from framing, ladders, and scaffolding. **(2)** Thanks to its abundant power, long runtime, and cordless convenience, the M18 Fuel quickly became the author's go-to recip saw.

Photo: bottom right, Rob Boland

Senco Autofeed Drywall Screw Gun

BY JOSH OVERLIN

Seven years ago, I replaced our standard corded drywall screw guns with Senco autofeed guns, which drove plastic-collated screws that come 50 to a strip. Collated screws cost almost twice as much as bulk screws, but I figured that the labor savings would more than compensate.

GROWING PAINS

First my crew and I tried Senco's 18-volt model DS275-18V. We appreciated the cordless freedom, but the tool generated only 3,000 rpm and started stair-stepping screws as its nickel-cadmium batteries drained. It could sink high screws and back out misplaced ones, but you had to remove the screw strip first. We normally used a separate screwdriver instead. Also, the tool lacked an inline grip, and it needed a firm push to drive each screw, which was tiring. The spring-loaded depth gauge would sometimes stick, requiring us to manually retract it.

We replaced the cordless model with Senco's corded autofeed model DS200-AC. It was slightly faster and eliminated the stair-stepping, but it had all the other drawbacks of the cordless version. Still, it was much faster than hand-feeding screws, so we stuck with it until late 2011.

That's when we started field-testing two 18-volt Hilti SD 4500-A18 drywall screw guns equipped with Hilti SMD 50 autofeed magazines for *JLC.* We reported on their stellar performance in the April 2012 and May 2013 *Toolbox* columns and continue to run both of them hard.

For the past year, though, we've been intermittently field-testing the new 18-volt Senco DS215-18V autofeed screw gun. It's powered by a 1.5-amp-hour lithium-ion battery, which has eliminated the stair-stepping of the older cordless Senco while increasing the runtime. By our count, it drives up to about 500 1¼-inch screws per charge. The new depth gauge is easy to adjust, locks securely at the desired setting, and has yet to stick after we drive a screw. We also like the new reversible belt hook.

THE VERDICT

If we were starting from scratch, would we buy the new cordless Senco? If we turned the calendar back three years, the answer would be yes. It's better than our old Sencos. But we're spoiled by the cordless autofeed Hilti, which almost always drives screws to the right depth even if we're holding it with one hand. We can also quickly pull off the magazine and use the tool as a conventional screw gun, which comes in handy. The new Senco still lacks a classic inline grip and now spins at a blazing top speed of 5,000 rpm, which might explain why we often have to hold it with two hands and push hard to fully sink a screw. That's especially troublesome when we're reaching to drive screws or holding up our material with one hand while fastening it with the other. As with our old Sencos, we use a separate screwdriver to sink high screws or remove errant ones. Even at $540 for the full kit, we'd buy the Hilti instead.

DS215-18V SPECS

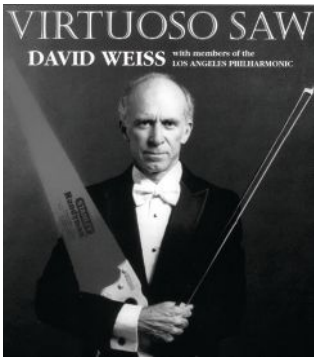
Weight with battery: 4.9 pounds
Rpm: 0 to 5,000
Collated screw length: 1 to 2 inches
Price: $260
Included in kit: two batteries, charger, drywall and wood nosepieces, two drive bits, nylon bag
Warranty: 1 year

Senco / 800.543.4596 / senco.com

Josh Overlin owns Chetco Drywall, in Brookings, Ore.

BY JON VARA

Saw players cut loose at an annual get-together in Felton, Calif. While often seen as a folk instrument, the musical saw has another dimension as well. Classical oboist David Weiss (far right) has performed on the Stanley Handyman at the Hollywood Bowl and other prestigious venues.



Song of the Saw

Full-size handsaws, once indispensable to the day-to-day business of cutting lumber to size, are seldom seen on modern jobsites. But they have another, equally traditional use that persists today: as musical instruments. A hundred years ago, saws were manufactured specifically for use in vaudeville musical acts. A few—such as the Bahco (formerly Sandvik) "Stradivarius" and the Mussehl & Westphal "Professional"—are still available.

But professional saw player David Weiss favors the familiar Stanley "Handyman," finding that its thin-gauge steel produces excellent tone. Weiss should know what he's talking about. A classically trained woodwind player who enjoyed a 20-year career as first oboe with the Los Angeles Philharmonic, he has played saw on *The Tonight Show*, recorded a well-received CD, and appeared on movie soundtracks, most notably the 2000 comedy *O Brother, Where Art Thou?*

Weiss describes the sound of the musical saw as "a combination of a soprano voice and a whistle." Perhaps the best way to experience the sound, though, is to start playing yourself. Apart from a saw, all you need to get started is a $20 violin or cello bow. If that's more than you want to spend, you can use a straight dowel rod as a bow, or simply strike the saw gently with a mallet. Thanks to YouTube, there's no shortage of instruction and performance videos available. After that, as with carpentry itself, it's just a matter of practice.

And should you someday find yourself on stage, you can use an old-as-the-hills warm-up gag that's still one of David Weiss' favorites: After flexing your saw, look around for a chair and, not seeing one, gesture toward the wings. A stagehand then brings out a stool with four legs, one of which is two inches longer than the others. After several frustrating attempts to sit on the tilted stool, pull a carpenter's tape from your pocket. Measure the legs, then trim the long one to length with your saw (this is easier if you've sawed halfway through the leg ahead of time). Take your seat to applause and cheers, tuck the handle of your saw between your knees, raise your bow, and begin to play.

Jon Vara is a writer in Cabot, Vt.

Photos: courtesy David Weiss

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