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# JLC

THE JOURNAL OF LIGHT CONSTRUCTION


Installing Batts

Practical Air-Sealing

Frost-Protected Foundation

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On the cover: An insulation technician from Cape Cod Insulation in South Yarmouth, Mass., slips the outside layer of a split insulation batt behind wires in a bay under a window for a remodeling project. Photo by Roe Osborn. See the story on page 7.

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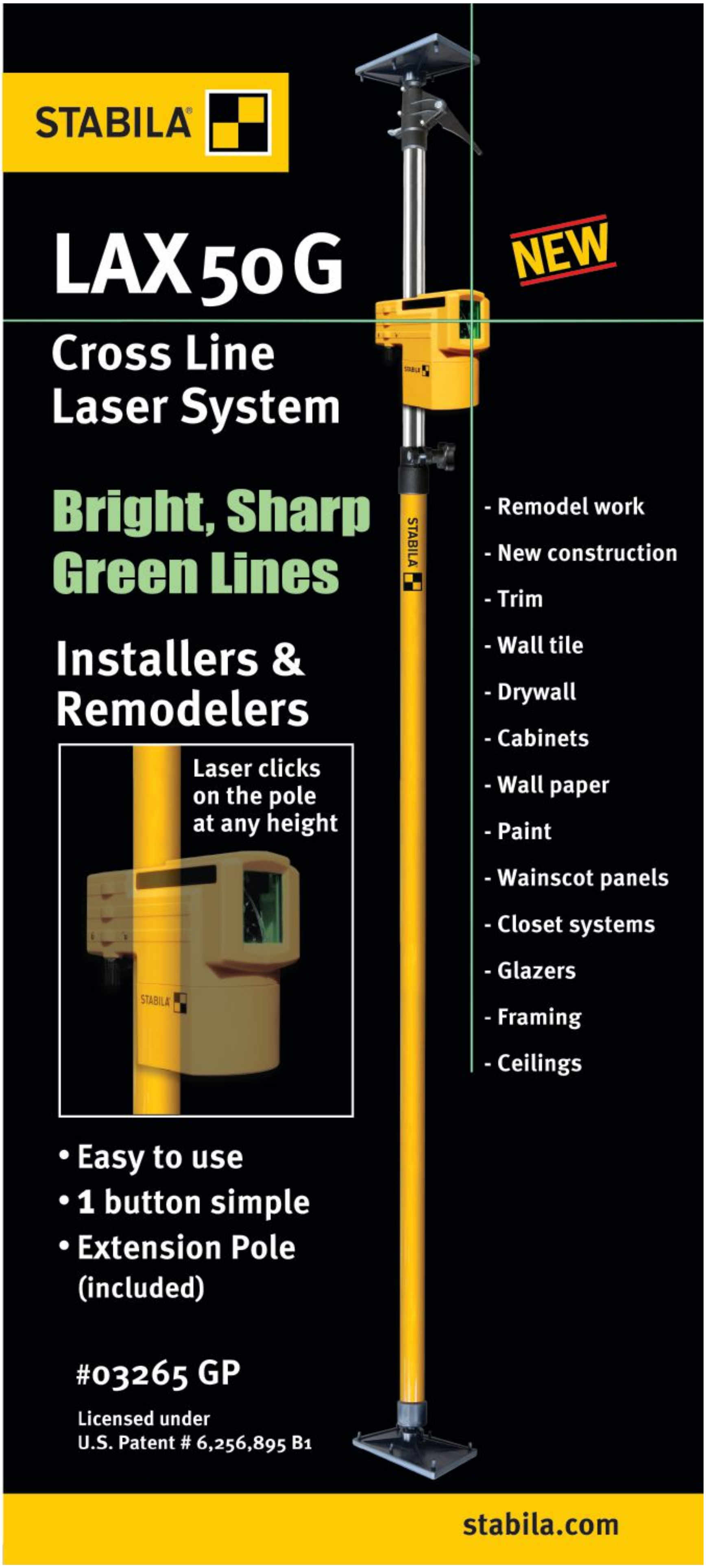


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## "INSULATION OVER A CONCRETE SLAB," BY JIM WOLFER AND STEVEN BACZEK, JUN/2018

**Howard Brickman, online 6/17/18:** Wood-floor industry best practices call for a vapor barrier of 6-mil polyethylene or better over the concrete. If there were ever any defect in the wood floor related to excessive moisture, the designer and builder of this subfloor would most likely take the hit for failing to follow WFI standards [NOFMA/WFI Technical Service via Wood Flooring Manufacturers Association]. And no, the 10-mil poly under the slab does nothing to deal with concrete mix water in excess of the amount that will be hydrated during curing or with rain on the building before it is weathertight.

**David Paal, online 6/17/18:** I too am a bit skeptical of using Type IX EPS on top of a 4-inch pour. I'm not so much concerned with the compressive strength of the EPS (25 psi) as I am with its ability to absorb the moisture from a 0.50 w/c ratio pour, which is going to be 1.6 lb. per square foot during the drying phase once the hydration phase (curing) has concluded (Harriman 1995).

I realize that framing must go on because of fast-tracking. However, the drying phase is best assured with HVAC in full operation once the building is totally enclosed. This reasonable expectation is not going to happen; it seldom does. Use MERV 8 filters on your handlers and everything is fine; just change them every few days. I would hold off on the wood flooring as long as possible. Get dehumidification going immediately after the building is totally enclosed.

If the double 3/4-inch AdvanTech option is going to be employed, at least cover the slab with a 10-mil polyethylene first. I would rather see the slab dry for 30 days per inch poured with strong dehumidification employed *first*. The slab free-water must go somewhere, and it's best to exercise patience and remove it before you [put] OSB over the top of it. The wood flooring is going to pay the price if the underside RH vapor is not taken out of play, let alone the ambient RH topside.

**Jim Wolfer responds:** Thanks for your excellent questions and concerns. As a project follow-up, we allowed the slab to dry (protected from precipitation) for a period of about four months, and during that period we ventilated the building as much as possible. We used heaters periodically during that time, but only in conjunction with having the building opened up to ventilate at the same time.

We too were concerned about moisture left in the concrete. After the four months, we taped a sheet of 6-mil poly over a large section of the slab to see if any moisture could be detected. I'm not sure if that was a scientific approach, but it seemed like a logical step to take to determine if any moisture was still escaping from the slab. After leaving the poly for several days, the underside was still completely dry. This test was done prior to installing the insulation layer, so after that, we were not concerned with the EPS absorbing moisture from the concrete. (The EPS foam doesn't have the capacity to absorb or store water. At 4 inches, the EPS is roughly 1 to 2 perms.)

Regarding the hardwood flooring installation: Our intent is to apply Bona R859 to the OSB as the flooring is being installed. This product is a sealer and adhesive. (It can also be used to glue flooring directly to concrete, which we would never even consider doing). In addition, this product is a Class I vapor retarder offering further protection [which meets or exceeds the NOFMA/WFI Installation Manual requirements] from any residual moisture for the wood flooring.

**Editor's note:** For a detailed description of how concrete dries, see *Q&A*, page 12.

## SEND US YOUR TRADE TIPS

*JLC* and our sister publication *Tools of the Trade* are partnering with Milwaukee Tool to give away a power tool to the reader who sends us the best tip, trick, or technique for publication. Please write a description of your trade tip and send it to jlc-editorial@hanleywood.com with "Trade Tip" in the subject line.

Don't worry too much over the writing part. That's what we do. We're interested in the quality of the tip for increasing efficiency, solving a problem, or advancing the quality of a project. Do include your name and an email address so we can reach out to you if we need clarification. (We won't publish anything you haven't had a chance to review.) Also please include photographs or send a sketch. When sending photographs, use the highest quality setting on your phone and note that sharing via phone sometimes compresses the photo. We'll need high-resolution photos for print.

*Tools of the Trade* editor Chris Ermides and the *JLC* editors will select the best tip for publication on the *JLC* website, on Instagram @jlconline, and in the October 2018 issue of *JLC*. The tip doesn't have to be a tool tip, per se. If you used tools to implement the tip on site, that is often evident without it having to be spelled out. But if you have a specific tool tip, that definitely qualifies, as well.


The prize for October's "Trade Tip" will be a Milwaukee M18-Fuel Super Sawzall (Model 2722-21HD). In the words of Chris Ermides, "This saw is a Beast. Seriously, unbelievably powerful."


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BY JLC STAFF

# Installing Fiberglass Batts

**No other building material** has changed more in the past few decades than insulation. From fibers made from stone and recycled slag to spray foam insulation, new materials (each with its own pros and cons) seem to arrive almost daily. But despite all the changes and advances, fiberglass-batt insulation is still one of the most common types of insulation being used today. Readily available and easy to install, fiberglass can provide effective insulation in walls and ceilings if installed correctly.

**General guidelines.** Before discussing installation, we need to understand some broad concepts about fiberglass insulation. First, it comes in either rolls or batts. With rolls, each individual length has to be cut. Batts (which we will be talking about here) are available in precut lengths that commonly fit stud bays for 8- and 9-foot walls.

Fiberglass insulation also comes in precut widths to fit typical stud wall spacing—either 16 or 24 inches on-center—and in thicknesses that fit typical wall framing, such as 3 1/2 inches thick for 2x4 walls and 5 1/2 inches for 2x6 walls.

The most important thing to realize about installing fiberglass-batt insulation is that its effectiveness depends on six-surface contact: top and bottom plates, studs on both sides, wall sheathing to the outside, and wallboard to the inside. The insulation should fit snugly in the stud bay without being compressed; compressing the batts reduces the insulation's overall R-value. Also, do not leave any empty air spaces in the stud cavity—voids around insulation allow air to move, which again undermines the R-value of the insulation.

Fiberglass batts are available faced or unfaced. The facing on the batts acts as a vapor barrier. There is some disagreement as to whether to staple the facing to the edges of the studs or along the sides of the studs. Face stapling does not compress the batt along the edges, allowing the insulation to loft fully into the entire space

1

To insulate effectively, fiberglass batts need to fill the entire stud bay without being compressed. To insulate a wall, start by filling the full-width bays. Insert the batt from the top down, pushing it up against the wall plates. If the sides snag on rough lumber, run a putty knife along the side of the stud.

Photos by Roe Osborn






To cut a batt to width, hold it up to the bay and pinch the top at the width needed. Holding the batt against a double stud, cut down from the pinched point as far as possible **(2)**, and then flip the batt to cut the rest **(3)**. Cut the batts to length along the bottom plate **(4)** and tuck into place **(5)**. For stud bays below windows, cut the batts to length all at the same time **(6)**.

between studs. Side stapling creates small pockets of air and compresses the edges of the batts, both of which can reduce the effectiveness of the insulation. However, if the drywall installer intends to glue the sheets to the studs, side stapling will leave the edge of the stud exposed for the adhesive.

**Protecting yourself.** Exposing bare skin to fiberglass can cause itching and irritation. When working with fiberglass insulation, protect your hands with disposable gloves. A long-sleeve shirt and long pants or a disposable paper suit can help protect arms and legs.

Fiberglass insulation also tends to produce fine dust that can be very irritating to the lungs and breathing passages, so always wear a good dust mask (3M 8210, N95 or equivalent) when working with fiberglass insulation. That dust can irritate eyes as well, so safety goggles are advisable.

**Cutting and installing batts.** When insulating a room, first fill the full-width, completely open stud bays (with no plumbing, electrical, or HVAC in the way). Working from the top of the stud bay down, gently insert the batt into the bay with the top edge snug against the top plate **(1)**. Then work your way down the bay, pressing the batt into place. If the sides of the studs are rough, they may snag the insulation as it slides into the stud bay, preventing it from expanding to fill the cavity. Run a putty knife along the edge of the stud to release any places where the insulation might be hung up.

Depending on the brand, precut batt lengths will be slightly long for the stud bay, but at this point, just let the excess stick out at the bottom of each bay. It's usually much easier to cut them off all at once rather than getting up and down for each batt.

Next, fill the full-height empty bays that are narrower than a full width. Hold a batt up against one side of the narrow bay and pinch the top of the batt at the desired width. While still pinching the width, hold the batt up against a double stud (such as the side of a window opening). Fiberglass batts cut easily with a sharp blade in a utility knife, so starting at the pinched point, cut down the length of the batt, keeping the cut as close to parallel with the edge as possible **(2)**. When you've cut as far down as you comfortably can, stop, flip the batt lengthwise, and finish the cut from the other end **(3)**. Now the narrow batt can slip into its bay.






To fit insulation around simple wires traveling across a bay, pinch the batt at the height of the wire **(7)**, and then slit the batt partway at that point **(8)**. For complex wire runs, separate the thickness of the batt **(9)** and then feed the outside layer behind the wires **(10)**. After pressing the inside layer into place, cut around the switch box for a snug fit **(11)**.

When you've completed a large wall section, go back and trim the bottoms of the batts. Simply cut the excess off each batt using the edge of the bottom plate as a cutting guide **(4)**. After cutting a batt to length, push the bottom edge into the bay to allow it to loft or expand properly in the space **(5)**. Keep track of all the cut-off scraps. They come in handy for small or odd-shaped wall cavities that need to be filled with partial pieces.

Finally, cut the pieces that fill in the bays under window openings. Hold a batt up to one of the bays, and this time, pinch the side of the batt at the proper height. Count the number of short pieces you'll need and cut them all at once **(6)**.

**Insulating around wires and pipes in walls.** Now we can turn our attention to the stud bays that have electrical or plumbing in them. Where wires run horizontally across the bay, there are two strategies. With the first approach, begin by holding the batt against the bay and pinching the location of the wires **(7)**. Then cut partway through the batt at that height **(8)**. The slit then wraps around the wires as the batt is pressed into the bay.

This method is fine if the wire is pretty close to horizontal and if there are no switches or feeds that have vertical runs. Otherwise, it makes more sense to split the thickness of the batt up as far as the wire **(9)**. Because of the way fiberglass insulation is manufactured, you can separate the batt naturally without cutting the fibers. Then when the two sides are pressed back together, their fibers marry naturally to create a complete and effective blanket.

After splitting the batt, feed the outside section behind the wires and switches, sliding it up to the wall plate **(10)**. Then push the inside part of the batt into the bay. If there is a switch box, run the utility knife around the box, cutting out just the inside layer of insulation. Make the cutout slightly smaller than the box so the insulation fits tightly around it **(11)**. When the cutting is done, go around the bay and make sure that both layers are in full contact with the top, bottom, and sides of the bay, and that the fibers of the two layers have joined back together.

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For a more detailed discussion, go to **jlconline.com/training-the-trades/installing-fiberglass-batts**.


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## Q On a basement remodel, the existing CMU foundation had a lot of efflorescence. We added foundation waterproofing and corrected the drainage to deal with the moisture issues. Do we need to remove the efflorescence before we finish the walls with rigid foam, 2x4 framing, and drywall?

A Foster Lyons, an engineer and building-science consultant, responds: One of the saving graces of concrete block (CMU) is that it is extremely porous. CMU is more like no-fines concrete than brick or normal-weight concrete. In fact, this material is so porous that it puts up almost no resistance to the movement of water. That's one of the reasons you typically see basement interior efflorescence on the CMU and not on the mortar between the blocks. Water is leaving the assembly through the CMU rather than through the mortar (see photo, right). Mother Nature always takes the path of least resistance, and when the water exits, it leaves behind dissolved salts (efflorescence) on the surface of the block.

Do those salt deposits pose a problem? Not really. CMU is so porous, internal osmotic pressures don't build up the same way they do in brick and normal-weight concrete. In brick and normal-weight concrete, the pore structure is so small that osmotic pressure caused by the salts on the exterior surface can break the material, causing structural damage. But the extremely porous structure of CMU means no internal pressure and therefore no structural damage.

With the new waterproofing and drainage measures for the foundation, the amount of available water has been greatly reduced. The salt in the CMU is not unlike mold—without water, the problem doesn't exist. And speaking of mold, the salt that leaches out of CMU in the efflorescence process does a pretty good job of dehydrating and killing mold spores. So in that regard, the salt deposited on the wall acts as a good anti-fungal agent.

However, that salt will attract water in both liquid and vapor form. Mother Nature doesn't like this type of salt concentration and will try to dilute it. The salt acts to pull water from whatever source it can—the CMU, the ground, the footing, the interior air—to self-dilute. For this reason, I suggest removing this salt. Don't worry about being too thorough. Just stiff-brush the salt from the wall, sweep it up, and throw it in the trash. That treatment won't remove every last speck of salt, but it will take care of the bulk of it. I don't recommend acid washing the wall or wet washing it in any way. Using water to remove the salt only adds water to an assembly that you would prefer to keep perfectly dry.

More critical than removing the salt crystals from the CMU is air-sealing the interior rigid insulation. Tape the rigid insulation at all joints, and seal along the top and bottom edges with caulk. This air-sealing will reduce the potential for condensation behind the new rigid insulation by preventing warm, moist interior air from coming in contact with the cool surface of the CMU.

Some moisture may still get through the CMU, and it needs a way to dry. About the only way for water vapor to exit is through the interior insulation, so don't prevent it. If the home is in climate zone 3 or below, any rigid insulation with a perm rating above 0.1 will work. If the home is in climate zone 4 or above, the insulation should be "vapor semi-impermeable" (greater than 0.1 perm but less than 1.0) or "vapor semi-permeable" (greater than 1.0 but less than 10). Do not rely on "vapor permeable" (greater than 10 perms) insulation—such as fiberglass only—in the 2x4 interior wall in climate zone 4 or above where there is a risk of condensation on the above-grade section of the foundation wall.

Photo by Foster Lyons

**Unsightly salt.** White deposits on concrete block are salts that leach from the block as moisture passes through. The deposits don't do any structural damage to the block, but should be dry-brushed off and thrown away.

## Q How long does it take a fresh concrete slab to dry out before flooring can be put down?

A Bill Palmer, editor at large for *Concrete Construction* magazine, responds: Contractors are correct to be concerned about moisture in a new concrete slab when installing wood flooring or moisture-sensitive impermeable flooring over one. Every year, hundreds of floors suffer damage—including delamination, blistering, warping, staining, and mold growth—from moisture that comes from the concrete underneath. Unfortunately, so many factors affect drying time for concrete, there is no chart to consult. Variables include ambient relative humidity, permeability of the concrete, amount of water in the concrete when placed (water-cement ratio), slab thickness, presence or absence of a vapor barrier in contact with the slab bottom, and the method used to finish the surface (hard troweling can create a barrier to drying). Each one can affect how much time drying might take.

For most impermeable flooring (like vinyl or linoleum), the goal is for the concrete to reach an internal relative humidity of about 85% or surface moisture-vapor emission rate (MVER) of 3 to 5 pounds of moisture per 1,000 square feet over 24 hours. For wood floors, the National Wood Flooring Association recommends 75% internal RH and an MVER of 3 pounds per 1,000 square feet over 24 hours. Under typical drying conditions, with the ambient RH around 50% most of the time, temperatures above 65°F, concrete w/c ratio of 0.5, and a 4-inch slab, drying to an 85% RH level should take three to four months. But remember that the clock starts when the surface is dry. If the slab gets wet (such as being rained on), the drying time can be extended.

The ambient RH can have a huge effect on drying. In Florida in the summer with an ambient RH of 90%, the slab can never dry down to 85%. In many parts of the U.S., getting the RH to 75% may be difficult without closing in the building and operating the HVAC system.

The easiest way to determine the internal RH of the slab is to test. A couple of fairly simple tests are available: the calcium-chloride test to measure surface moisture emission rate (ASTM F 1869), and the internal RH test (ASTM F 2170). I strongly recommend the latter. Don't be tempted to use electrical-resistance moisture meters (like you would use with lumber). These testers can indicate differences in moisture from one part of a slab to another, but they don't tell you anything about overall moisture.

One of the most important factors governing the moisture content in a slab is presence of a vapor barrier (or retarder) in the assembly. Years of testing have shown conclusively that the relative humidity of the ground beneath a concrete slab—whether in Arizona or New England or Florida—is 100%. If there's no vapor barrier, the slab will never dry out. So the best location for the vapor barrier is in direct contact with the bottom of the slab to take ground moisture out of play. Some years back, the consensus was to put the vapor barrier under a sand "blotter" layer, but the sand simply acted as a reservoir for moisture. The best-quality vapor barrier is a poly sheet with a thickness of at least 10 mils, preferably 15 mils. Lap and tape any seams, and seal around any openings.

If insulation is used over the concrete (as in "Insulating Over a Slab," Jun/18), a four-month drying time should be adequate before installing EPS. With the vapor barrier placed in the right location, the EPS insulation will absorb some moisture, but not a lot (about 0.5% by volume, according to the EPS Industry Alliance). On the project in the article, the double layer of OSB (with its perm rating of 1) will also serve to keep moisture from migrating from the slab to the flooring. Another strategy for projects such as that one is applying a moisture-mitigation coating directly on top of the concrete. A poly barrier could also be used on top of the concrete, but the chances of it being damaged during construction would be high.


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Photos by Tim Healey

The 32-foot-long beam is built safely on the ground **(1)**. The longer LVLs are chained to the telehandler's forks, ready to be moved **(2)**. The telehandler lifts the partially built beam into place **(3)**. The beam is guided into place via hand signals **(4)**.

# Lifting Big Beams—the Easy Way

BY JOSH GIRARD

**I've been building and remodeling** homes since 2000, first as an employee, then breaking out on my own in 2010. About two years ago, I bought a used telehandler from a local excavator for $30,000 and so far, it's been a wise investment. Having grown weary of moving stacks of heavy lumber and sheet goods around jobsites (and up and down ladders), I decided to take the plunge and buy this invaluable piece of equipment.

I currently run a two-man home-building company with my friend, Aaron Guinness, but I used to employ three- and four-man crews. I needed the extra manpower to help lift walls and lug material around. But now with the telehandler, we can build homes faster and more safely than we did with those larger crews. For example, while framing a new two-story home recently, we had to install a 32-foot-long built-up LVL beam. We were able to build the beam safely on the ground, rig it up with chains, and drop it in place without breaking our backs. This article offers some insight into how we efficiently use our telehandler on the jobsite.

## PLACING THE BEAM

As part of the purchase of a floor framing package, my lumberyard offers free engineering (I give the yard my plans and it sends me drawings in return, showing where to place the wood I-joists and any needed LVL beams). In this case, the engineering plans called for a built-up, four-piece LVL beam supported by a partition wall at one end and by a double-LVL support beam at the other. The floor system was flush-framed and built with 12-inch-deep wood I-joists and LVLs. To accommodate a stair opening, two of the LVLs needed to be 6 feet shorter than the two 32-foot-long ones. So we decided to nail together the two 32-footers on the ground and install the joined pair with the telehandler. Afterwards, we lifted the two 26-foot-long ones and nailed them in place.

We began by field-measuring to verify both the main-beam and the support-beam locations, then cut the two longer LVLs to length. We then applied a continuous bead of construction adhesive to one of the LVLs and sandwiched the two together. We nailed off the beam with 16d nails in a robust nailing pattern, keeping the pair aligned by toenailing as needed **(1)**. While still on the ground, we cut the main beam's two shorter members and the support-beam LVLs to length.

Prior to tele-lifting the partial main beam into place, we installed the first of the doubled-up 12-foot-long support beams by hand from ladders (marking where the main beam would butt into it). Then, we attached the 32-footer to the forks of the telehandler with a pair of heavy-duty chains (double wrapping the beam and forks) **(2)**. I slowly brought the beam over to the front of the house and lifted it up and over the first-floor wall **(3)**. Aaron hand-signaled me as we guided the beam roughly into place **(4)**.

To hold the main beam's butted end in place, we nailed a temporary 2x6 block to the bottom of the support beam to serve as a seat. I further tweaked the main beam's position with the telehandler's articulating fork setup (tilting it side to side) to line it up with the location mark. Back on deck, I helped muscle the partial beam into its final position **(5)**. Aaron end-nailed the butted end while I toenailed the beam to the top plate.

Next, I picked up the main beam's two remaining 26-foot-long LVLs with the telehandler and lifted them in close proximity to the installed 32-footers (laid across the forks like a work table). On the ground, we had cut these shorter LVLs a little long so we could precisely mark and cut them in place. After we applied construction adhesive on the side of the installed beam, we flipped the third LVL into place and nailed it off **(6)**. The fourth LVL was installed the same way **(7)**. Aaron applied construction adhesive to the first support beam, then we lifted the second support LVL into place and nailed it off **(8)**. Finally, I installed the beefy beam hanger **(9)**, while Aaron started marking off the I-joist spacing for the floor system.

### THE THIRD 'MAN'

What once would have taken a three-man crew to complete in four hours (build and install a large beam), Aaron and I were able to do safely in just under two hours with the telehandler.

In addition to moving material to work-staging areas with it, we use this 23-year-old work horse to lay out joists and stand up walls. Though there are some maintenance costs associated with running it—changing the oil every 200 hours and regularly greasing its fittings—they haven't broken the bank (luckily, I haven't needed to replace any of the hydraulic lines or any of the tires). In purchasing the telehandler, I chose to invest in my business to make our lives easier and keep the job fun.

*Josh Girard owns and operates North Country Construction, in Jericho, Vt.*


The author positions the first doubled LVL **(5)**. Once these first pieces are nailed off, the telehandler becomes a work platform for laminating the third **(6)** and fourth layers **(7)**. The telehandler supports the beam while end support is installed **(8)** and the structural assembly is secured with a beam hanger **(9)**.

# Curved Head Flashing

BY RYAN LABRENZ

**A few years ago,** the company I work for, New Dimension Construction, was asked to repair a leaky cupola on a carriage-house garage (see "Fixing a Poorly Flashed Cupola," Apr/16). The restoration of the cupola went well, and the clients called us back last fall to repair more of the home's exterior problems. Though only 13 years old, this nicely trimmed-out house showed signs of premature trim and siding failure on both the main house and the attached garage—something we had pointed out to the clients while we were working on the cupola.

The cause of most of the problems was inappropriately installed drip-cap flashing. Some of the window and door heads were "flashed" with housewrap tape (the tape was adhered to the face of the WRB and run onto the exterior head trim). Over time, the tape lost its adhesion and failed, leading to repeated water intrusion into the home. Nowhere was this more apparent than with the garage doors on the carriage house **(1)**.

### ARCH-TOP GARAGE DOORS

The home's two segmented-arch-top garage doors were shop-built and made out of mahogany (the rest of the building had been trimmed out in pine). As I started in on the repairs, I noticed that the arch top's wide cap molding was custom milled with an outward slope for drainage. Standard metal head flashing had not been installed, and loose tape was all that remained to bridge the gap between the existing WRB and curved cap molding (the original builders probably thought the sloped cap molding would be sufficient to shed water away from this critical juncture).

Though it appeared some water had been wicking behind the clapboards and the subpar tape "flashing" for some time (the siding was cut tight to the cap molding), the main problem was at the lower ends of the cap molding. Water had managed to collect at the bottom of the sloped mahogany cap and find its way in behind the siding and WRB.

**Removing the rot.** I opened up the garage wall to discover rotted sheathing and framing that looked charred from the effects of whatever type of mold or other fungus was present. The wall's open-cell foam acted like a sponge, holding a reservoir of moisture from years of repeated wetting **(2)**. I demolished the sheathing and removed about 1 1/2 to 2 inches of the wall's 2x8 SPF framing (the carriage-house garage and living space above were heated and well insulated). I then cut slices in the exterior face of the framing and chiseled out the


At top are the repaired carriage-house wall and arch-top garage doors **(1)**. Water damage was due to a poorly flashed drip cap **(2)**. The sloped drip cap made a tricky flashing job even trickier **(3)**. The copper overhung the cap in the center when laid in place; the flat stock needed to be crescent-shaped to fit properly **(4)**.

Photos by Ed Brady

little blocks of rot down to good wood. The door's header had some surface rot, which I cut out. I let the insulation dry out for a few days, then spliced new wood onto the front of the existing wood and skinned over the repaired framing with new plywood sheathing.

The door's mahogany frame had some minor rot and its wide cap molding had just started to deteriorate at the lower ends **(3)**. I restored these areas with small applications of Abatron Wood Epoxy.

**A LEARNING CURVE**

I've made numerous site-fabricated curved head flashings for windows and doors (usually no more than 4 feet wide, covering 5/4-thick head trim stock). At more than 8 feet wide and with 5-inch curved cap trim, these doors were on the large side for me (I had to make the flashing in two pieces, lapping them at the center high point).

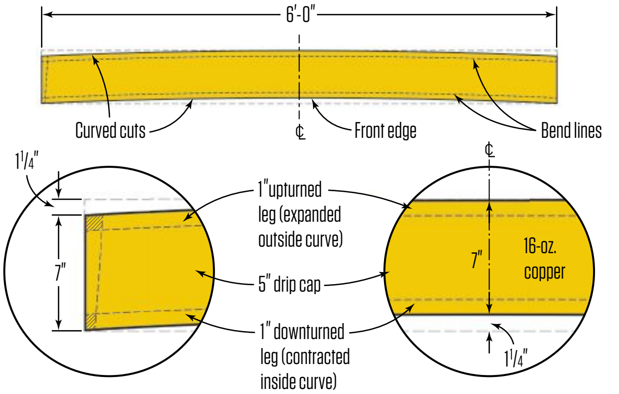
Starting out, I laid down a 6-foot-long strip of flat stock over half the arch. That's when I noticed that making the flashing wasn't going to be as easy as I thought—I hadn't factored in how the outward slope of the curved cap would affect making the new flashing. The flat stock overhung the wood cap's front edge by about 1 1/4 inches in the middle of the curve. A corresponding gap between the flat stock and the wall sheathing roughly mimicked the crescent-shaped overhang in the front **(4)**. Not only would I have to make an arch-shaped flashing, but I'd also have to bend it along a slight crescent-shaped curve, upping the degree of difficulty.

After a few minutes of head scratching, I laid the flat stock back down and marked a scribe line from underneath from the front edge of the cap. I set the scribed piece on my work table and cut out the crescent shape; this became my pattern (see illustration, right). I laid the pattern on some wider 16-gauge copper stock and traced out this crescent shape **(5)**, then cut out the curve with a pair of tin snips **(6)**. Next, I used a block as a scribe and marked a 1-inch fold line for what would be the downward vertical leg of the front of the head flashing **(7)**, then bent the copper stock with a hand brake **(8)**. I measured out 5 inches to match the width of the sloped cap, plus another inch for the vertical leg, which would run up the sheathing. I repeated the previous marking, cutting, and bending steps for the upturned leg of the head flashing.

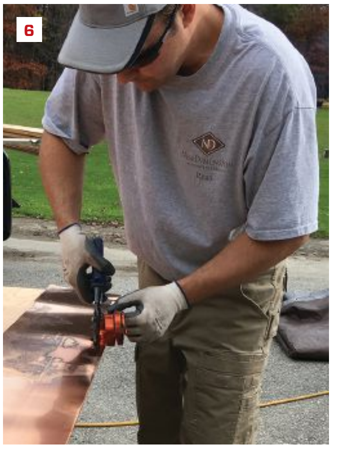
**SHAPING THE CURVE**

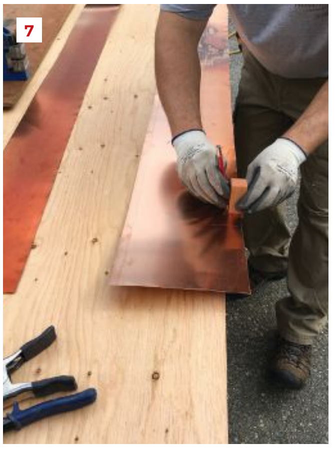
On repair jobs where we've encountered metal flashing at arch tops, we've typically found butchered aluminum flashing with vertical legs repeatedly cut in order curve the flashing to its needed shape (they might as well have not installed anything). To avoid such practices, we use a couple of tools that allow us to make curved flashing on site fairly quickly and easily.

**Crescent-Shaped Flat Stock**



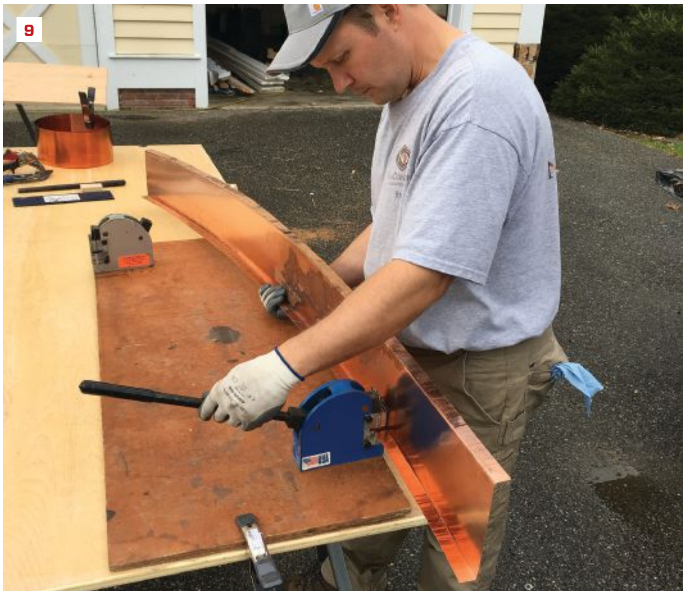






The author laid a crescent-shaped template on wider copper stock **(5)**, traced the slight curve, and cut it out with snips **(6)**. He used a scribe block to mark the 1-inch fold line for the flashing's downward vertical leg **(7)** and then used a hand brake to bend the leg **(8)**. He repeated the process for the upward leg.



Flashing was shaped with Eastwood shrinker (blue) and stretcher (gray) tools **(9)**. Flashing in the corners helps direct water away from the wall **(10)**. Flashing was installed with minimal nailing; ends were folded down **(11)**. The center seam was soldered **(12)**.

Years ago, our company purchased a set of Eastwood sheet-metal shrinker and stretcher tools (largely used in autobody repair work; eastwood.com) after seeing a roofer using them on a jobsite. They operate on the same principle; both have little jaws that grab the metal and either contract it to form inside curves or expand it to form outside curves. When making curved flashing with both upturned (an expanded outside curve) and downturned (a contracted inside curve) vertical legs, you have to gradually form it into its final shape—you can't shrink or expand one side all in one shot.

**The first piece.** With the vertical legs bent, I began to shape the curve. First, I transferred half of the arch's profile onto a piece of plywood, then laid it on the table as a reference guide. Then, I started to curve the copper, alternating between the shrinker (blue) and the stretcher (gray) as needed **(9)**. I lightly pulled the handle up to release the jaws, slid the flashing's vertical leg forward into the jaws, and lightly pressed the handle down. I was careful to advance the metal about an inch at a time (the tools shrink or expand the copper over a small area). After repeatedly checking the flashing against the reference and going up and down the ladder a few times to lay it in place, I finished one side of one arch top's flashing. Now that I knew what I was doing, I was able to form the second, third, and fourth pieces faster.

## INSTALLING THE HEAD FLASHING

Before I installed my finished head-flashing pieces, I first slipped small pieces of copper flashing under the ends of the mahogany drip cap (the bottom of the flashing lapped onto the clapboard siding below) **(10)**. These small corner flashings help prevent water draining off the head flashing from finding its way behind the siding and housewrap.

With the small flashing in place, I installed the two head-flashing pieces **(11)**, lapping them 2 inches at the center high point **(12)**. The finished flashing fit snugly to the existing drip cap and I needed only a few fasteners to hold it in place—the fewer nails, the better. I nailed the flashing to the sheathing with three copper nails, one at each end and one at the center seam. Then I top-nailed the flashing's sloped leg with three more copper nails (similarly located), setting the nails in sealant. Finishing up, I soldered the center seam where the two pieces lapped. Then, I patched in some new drainable housewrap, placed peel-and-stick over the new housewrap and copper, and re-sided. The flashing fabrication process (learning curve and all) took about two days to complete.

*Ryan Labrenz is a lead carpenter for New Dimension Construction, in Millbrook, N.Y.*

Chief Architect




EAST (REAR) ELEVATION
¼" = 1'
A1
EXTERIOR ELEVATION
Chief Architect


# Curved Window-Wall Makeover

## A single step protects the wall during and after construction

BY TED CUSHMAN

Walls facing the ocean take a year-round beating. Continual maintenance and periodic replacements are routine—and often, those everyday jobs also offer the opportunity for a timely upgrade. It's bread-and-butter work for Mark Pollard and his crew from Thompson Johnson Woodworks, on Peaks Island, Maine. This spring, Pollard and his TJW team stripped out and replaced some aging and outdated windows on a curved house wall, then took the opportunity to upgrade the existing clapboard siding with an advanced rainscreen system, complete with a new, vapor-open Henry Blueskin weather-resistive barrier, bulletproof window-opening prep, and custom-bent zinc flashing. *JLC* visited the island to follow the action.

To protect the wall from the weather as they stripped and replaced the existing materials, Pollard and carpenter Tyler Strout made wise use of the Blueskin's attributes by applying the Blueskin immediately after stripping off the old siding, and then lapping the new membrane temporarily over the existing window flanges. Later in the week, they were able to slit the Blueskin around the old window edges and pull the units out one by one for replacement, without leaving the whole wall open to the weather, even briefly. (One lesson learned, Pollard noted: Existing Ice and Water Shield on the walls comes off more easily if you use an oscillating multi-tool.)

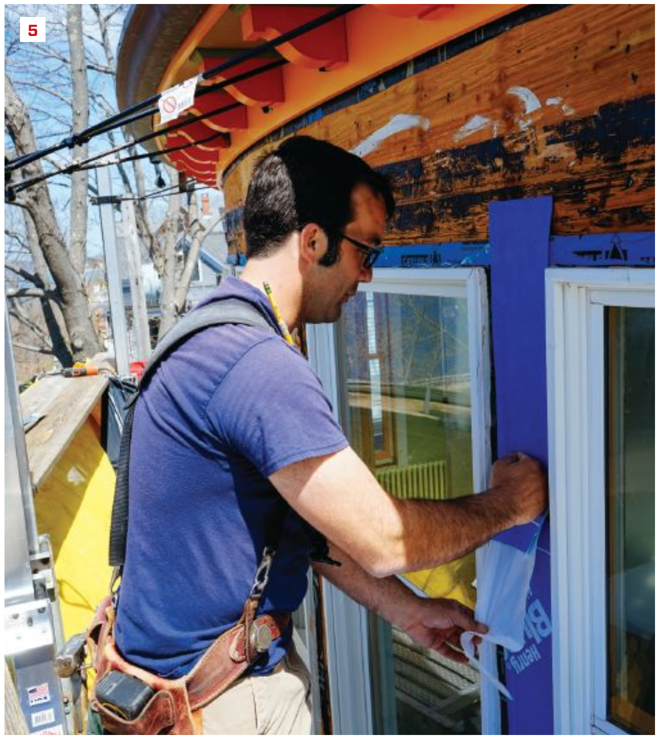
The final phase was to flash the new window head casings with custom-bent zinc flashing (easy to shape to the curve), apply MortairVent rainscreen material, and nail up new cedar clapboards and pine trim. With a $^3/_8$-inch air space behind it, the brand-new preprimed and prepainted cladding system should serve for many trouble-free years before it needs its next paint job.

*Ted Cushman is a senior editor at* JLC.

Photos by Ted Cushman



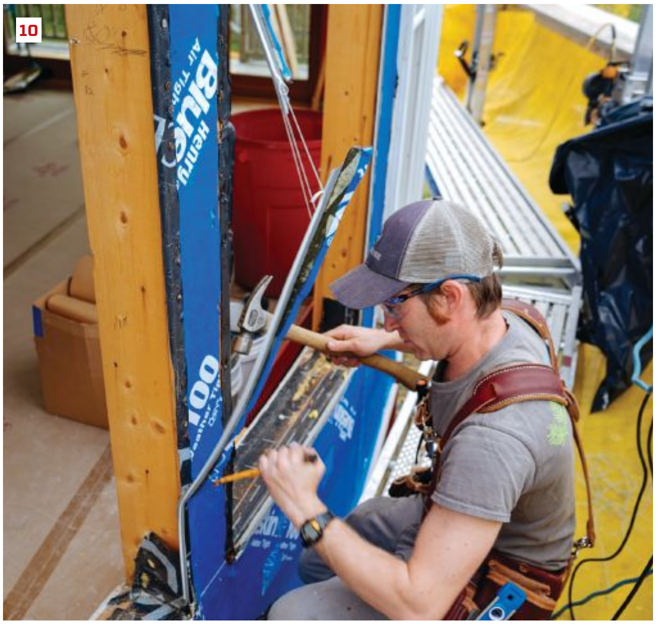

Thompson Johnson Woodworks had repaired the trim above the windows a few years before and had rebuilt the curved soffit at the top of the wall as well. But to replace the dated windows, the existing window casings unfortunately had to go. Pollard pried off the existing zinc flashing **(1)**, then the pine trim **(2)**. Next came the labor of removing existing peel-and-stick waterproof membrane **(3)**, which turned out to go much faster with the help of an oscillating multi-tool. Replacing the old membrane with a new, breathable membrane (Henry Blueskin) would make the wall vapor-open as well as watertight. A new rainscreen, with an air space behind the new siding, would help the walls drain and dry when hit by wind-driven island rainstorms.

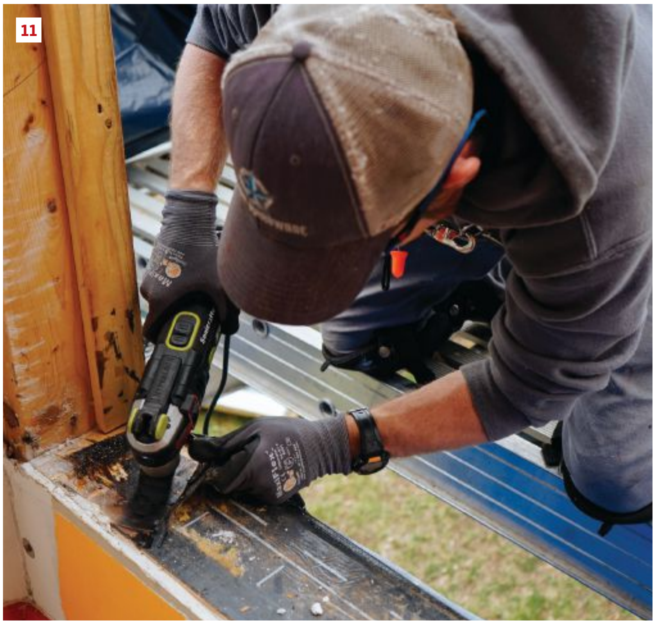






Blueskin VP 100 is easy to handle and apply. Pollard cut the material to size by slitting it with a utility knife **(4)**, then pieced it onto the wall shingle-fashion, peeling away the backing as he went and smoothing the pieces into position by hand **(5, 6)**. At the top of the wall, he left the existing curved soffit trim and bitumen–polyethylene membrane in place. After covering the wall with Blueskin, he went over the whole area with a roller **(7)**, a recommended practice that activates the material's pressure-sensitive adhesive. He lapped the new Blueskin over the existing window flanges and frames, planning to cut the windows free one by one as he replaced them in a later step.






When the entire ocean-facing wall had been weather-protected, the crew could start tearing out the existing Andersen windows and replacing them with new Marvin windows, one or two openings at a time. After slitting along the edge of each aluminum window flange, Strout pulled nails from the flanges with a cat's paw **(8)** and removed the windows and flanges from the openings **(9, 10)**. Bitumen membrane on the windowsills also had to come off—again, with the help of an oscillating multi-tool **(11)**. Because the newly applied Blueskin remained in place on the walls, the house could be left watertight at the end of each day as long as any newly installed windows had been buttoned up.






After pulling out three windows, Pollard and Strout set about replacing them. The rough openings needed a little tweaking: Strout packed down the window rough head using a 2x6 and some structural screws **(12)**, and Pollard furred the face of the header out with plywood to match the plane of the existing sheathing **(13)**. Next, Pollard prepped the window rough sills, applying a bead of adhesive caulk **(14)**, a piece of clapboard to slope the sill **(15)**, and a piece of waterproof peel-and-stick Henry membrane **(16)**. The clapboard sill packing had to be trimmed to match the wall curve using a multi-tool (not shown); the sill membrane had no trouble conforming to that curve.

17

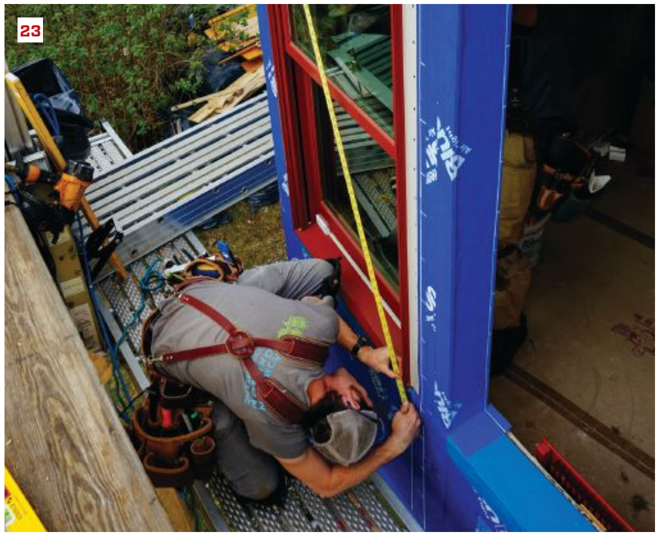

18


19

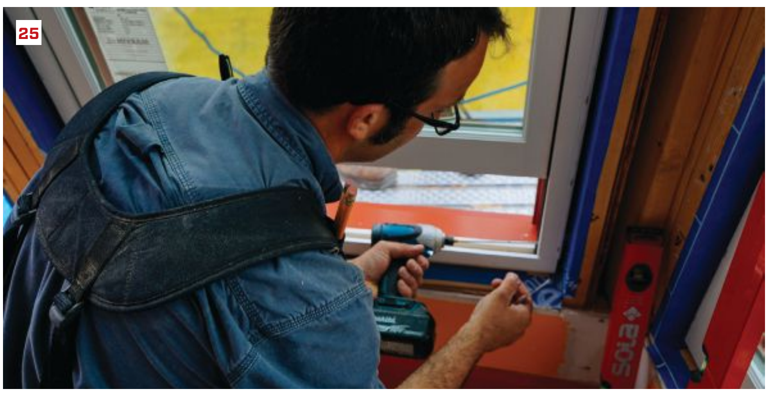

20


21


Each rough opening received a watertight wrap. After cutting and folding the membrane at the bottom of the curved windowsill, Pollard applied a custom-cut “bow tie” to the corner **(17)**. Next, he applied a strip of VP 100 to the side of the window **(18, 19)**, peeling the backing paper from the adhesive backing as he went, and cutting and wrapping the material to fit. He applied another piece of membrane at the window head **(20)**, then applied pressure to all the membranes with the roller to activate the material’s adhesive and improve the bond **(21)**. The reverse lap at the window head is allowed by the manufacturer’s spec, but a bead of silicone caulk is recommended at the joint.

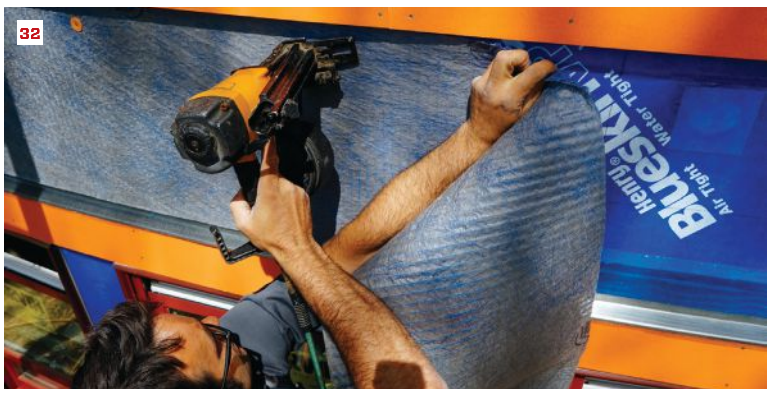


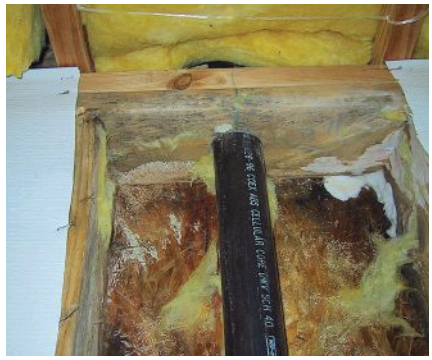

Pollard and Strout installed the new Marvin windows into the prepared openings. They muscled the new units out onto the scaffolding **(22)**, tacked them in place, then checked each unit for square **(23)** and plumb **(24)**, making adjustments as needed until the windows were correctly in position. Pollard used long structural screws to pin the windows in place on the inside **(25)**, splitting the difference to match the curved sill opening. The screws through the side jambs would also help resist wind suction on the window units. Finally, Strout nailed off the flanges with aluminum nails **(26)**. (Although these flanges were vinyl, Pollard said the crew always uses aluminum nails to keep nail selection simple on site.)






To prepare for siding, the crew installed trim and rainscreen fabric. After applying spacers and screen to the back of the preprimed 3/4-inch pine trim **(27)**, the carpenters nailed the trim pieces above and below the windows **(28)**. Hand pressure was enough to fit the pine trim to the wall radius. Pollard custom-bent lengths of zinc flashing **(29)**, then nailed the pieces up above the window head trim **(30)**, bending the zinc around the curve of the wall. He applied another strip of Blueskin over the top of the flashing **(31)**, then used a cap-nail gun to fasten MortairVent drainage fabric to the wall **(32)**. The MortairVent would create a 3/8-inch air gap behind the wall's preprimed cedar clapboard siding, helping to prolong the building's paint job.




# Practical Air-Sealing

## Getting to 3 ACH50 isn't hard if you focus on these locations

BY STEVE EASLEY

In my work as a building-science consultant, I meet with builders around the country. Many of these are production builders, and I often work with their crews to teach them about quality assurance—issues that can lead to either inspection red tags or costly callbacks. In the past few years, as more states and municipalities have adopted the 2012 and 2015 International Energy Conservation Code (IECC) into local building codes, I have spent an increasing amount of time educating crews about cost-effective approaches to air-sealing. The new energy code mandates blower-door verification for homes, with a maximum 3 ACH50 in climate zones 3 to 8. That's a tough mark for some builders to get to from the previous requirement of 7 ACH. The new requirement means that builders now have to be very deliberate in their air-sealing efforts.

With diligent effort, we can do a lot better than 3 ACH50. A good example is Jake Bruton's work featured in "Air-Sealing That Works" (Apr/18). But in this article, I'm not going to look at how close to the cutting edge of airtightness we can bring conventional practice. Rather, I'm going to target some of the low-hanging fruit, so to speak—the places a building crew can focus on to hit the 3 ACH50 that's required by code. That low bar begins with a discussion of what doesn't work.

Fiberglass insulation (by far the most commonly used insulation in U.S. homes) does not stop air leakage. Two of the photos above show this clearly: The black areas are caused by dust and dirt getting pulled through the insulation. Insulation works as a filter but not as an air barrier. I'm constantly surprised how builders loosely think that if we are dealing with insulation, we must be dealing with the energy code. Maybe the limitation here is a lack of understanding that there's much more to the energy code than just saving money on air-conditioning bills.

Many of the builders I work with initially see air-sealing only as an energy issue. A few also appreciate the comfort and indoor-health issues. But one of the most important, and often underappreciated, reasons for air-sealing is durability: By controlling air leakage, we help control moisture.

The photo above of fungus growing on the sheathing and wall

Photo 10 by Arn Mcintyre; all others by Steve Easley framing is of an exterior wall; it's inside a wall cavity where a plumbing stack is running. Leaks at the plumbing stack and the sheathing allowed moisture laden air from the interior to leak into the stud bay. The moisture condensed as the air made its way out through sheathing joints, leading to water soaking the wood and providing the right conditions for mold and rot. The lesson here is that air-sealing is about so much more than just about reducing energy bills.

## WHY ACCURATE MEASUREMENTS?

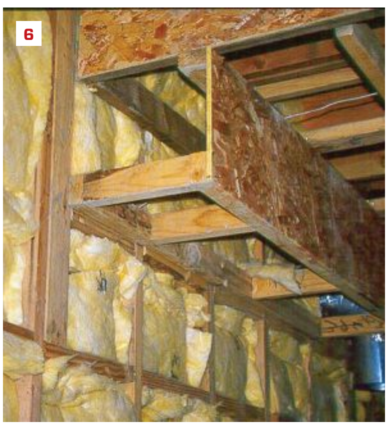
Air-sealing, or rather providing a "continuous air barrier," has been a code requirement for a long time. The big change with the 2012 version, in addition to lowering the maximum air leakage rate, was the new requirement to verify the air leakage rate for a home using a blower door. While the testing requirement is new to many builders, it may be a blessing in disguise. If you don't measure, you don't know how leaky or tight your building is. Many of the air leaks in a building cannot be visually identified. With a blower-door test, you have an accurate approximation of the total air leakage in the building.

Researcher David Wolf, working with Owens-Corning in 2013, performed a study that dove deeply into quantifying home air leaks. Using typical blower-door depressurization conditions, Wolf designed a battery of tests to measure, and rank, the impact of air leaks in different locations of a home to determine which air leaks make the biggest difference in the total air leakage (see "An Air-Sealing Priority List," Aug/13).

Wolf's work has been especially useful in quantifying all those seemingly small, inconsequential leaks to show how big an-impact these can have on total house air leakage. His work mirrors my field experience and is a good guide for builders and their crews on where to focus their air-sealing efforts. But there are other factors besides just the amount of leakage. How much effort is involved plays a big role, and that effort often varies by how a builder works, how many trades are involved, and how the scheduling of different trades unfolds during a project.


**Recessed lights** are a common source of air leakage, as clearly shown by the light shining around this conventional can light viewed from the attic **(1)**. This fixture **(2)** reportedly meets the code requirement for "airtight, IC rated," but in fact you can see light through one gasket. **Duct boots** are best sealed with foam sealant **(3)**.







**Huge hidden leaks** above this garage ceiling **(4)** will be inaccessible once the ceiling is hung. These areas should have been sheathed before the shed trusses were installed. Similarly, attic trusses used for this bonus room create enormous leaks **(5)**. **Cabinet soffits** are huge leaks to the attic **(6)**. Drywall on the lid is the best way to shut these down **(7)**.

## ATTIC FIRST

For an air leak to occur you have to have a hole and a pressure difference. Pressure differences are caused by wind, stack pressure and mechanical equipment. Fewer holes mean less leakage. Attics are particularly prone to losses from stack effect, which effectively turns a house into a drafting chimney (hence "chimney effect" is a synonym for "stack effect"). Air leaks at the top tend to be the most numerous and the easiest to remedy, making the attic the single most important place to focus on.

I recently air-sealed a house built in 1978. Because the house had a family of bats in the attic, all the attic insulation had to be removed. This was a perfect opportunity to air-seal. By sealing only the attic leaks, we cut the air leakage rate from 4,460 cfm to 2,180 cfm—more than half the total air leakage. If builders would conscientiously air-seal the attic ceiling after the drywall is hung—before insulation—getting to 3 ACH50 would be much easier. It wouldn't have to interrupt the sequence of the job, and it could be done with minimal cost. More production builders need to take this step.

**Can lights.** Of all the openings in a house, one of the biggest from an air-leakage perspective is around recessed light fixtures. In Wolf's study, can lights accounted for an average of 9.1 CFM50, or about 0.15 to 0.31 ACH50, per fixture. One way to think about this amount of air leakage is that for every four to five can lights you seal, you can gain about 1 ACH50.

Conventional recessed cans are extremely leaky. You can see right through them **(1)**. Surprisingly, many so-called "airtight, IC-rated" fixtures (which is what the energy code requires) are not much better **(2)**.

Better from an air-sealing perspective (and arguably from a lighting perspective, as well) are a range of new LED "can-less" fixtures that either have a low-profile housing or are surface mounted. Both types have simple plug-and-play-type wire connections that not only simplify the installation but result in almost no penetrations. With LEDs, you also don't have to worry about any thermal overload so you can spray foam or otherwise bury them in insulation without fire concerns.

**Duct boots** at the end of HVAC supply runs through the attic are another big ceiling penetration from an air-sealing perspective **(3)**. Wolf measured the average leakage at 7.7 CFM50, or 0.13 to 0.26 ACH50, per boot. Foam sealant carefully applied to the perimeter of the boot and the drywall tends to be the easiest way to seal these leaks.

**Knee-wall areas** and the floor and roof sections outside attic trusses are protected from weather, but otherwise "open" to outside **(4)**. The best way to deal with these enormous leaks is with rigid foam or heavy cardboard sheathing. It is picky work to piece-in these sheet goods and foam or tape the edges. But if not done, the impact on performance can lead to costly warranty issues. (For more on this, see "Fixing the Bonus Room," Mar/17.)

Attics often have other huge openings that many builders don't see as air leaks. A common one occurs in the ceilings of single-story attached garages where they bump up and connect to a larger attic space over the main house **(5)**, or to a two-story wall. The best way to shut these huge leaks off is to sheathe over them at the framing stage. Otherwise, you will need to go in later and cut pieces of rigid foam to block off the areas between the truss chords, and then seal the edges with foam sealant.

**Dropped ceilings above cabinets** are often left open to the attic floor **(6)**. The exterior wall gets insulated, and often the insulation contractor will lay a batt over the opening in the attic floor, but underneath that insulation is just one big hole to the unconditioned attic, which is effectively outside.

The most effective way to seal these is by installing the ceiling drywall before framing out the soffits. A continuous drywall lid over the area effectively shuts down the airflow, whereas the drywall that gets pieced on the sides and bottom of the soffits doesn't. There are too many cracks at the soffit corners that corner bead and drywall mud don't seal.

Not every builder can get the drywall contractor on board to hang the whole ceiling early in the schedule, but you may be able to get the pick-up framing crew to install a few selective sheets of drywall over the soffit area **(7)**. It's not much drywall compared with the entire ceiling. Having the pick-up




**Top plates** of partition walls in attics are huge sources of air leaks, made worse by all the electrical penetrations **(8)**. They can be sealed effectively with canned or boxed foam sealant **(9)**, but with foam sealant, installers have to be extra careful to not miss spots along each side of the plates. Having an insulation contractor hit the entire top plate with closed-cell foam **(10)** often works better.

11

12

13

**All exterior wall plates** can leak, and the garage separation wall **(11)** should be considered an exterior wall. **Band joists** are among the leakiest areas in a house. Insulation stuffed between joists is not an air-seal **(12)**. Closed-cell foam applied here provides a good air-seal **(13)**. Even if you don't insulate the walls with it (as shown here), hitting the rim-joist area only with foam can be a cost-effective way to air-seal this difficult area.

crew install these few sheets may not be as disruptive as you expect.

**Wall plates in attics.** Partition walls are typically framed with truss chords fastened to the top plates. Once the ceilings are hung with drywall, you generally end up with hundreds of feet of cracks on either side of the top plates open to the attic. Each stud bay in the partition effectively becomes a little chimney. Stack effect draws in air at the bottom of the wall plates and pushes it out the cracks into attics. Holes for electrical wiring and plumbing vents compound the leakage **(8)**.

While leakage around can lights and duct boots are the biggest "openings" identified in Wolf's study, drywall-to-top-plates are one the biggest "joints," accounting for around 0.5 CFM50, or 1.3 to 1.6 ACH50, *per linear foot* of joint. This can add up fast in attics.

As with soffit leaks, one way to shut down top-plate leakage on partition walls is to drywall the lid before standing partition walls. Jake Bruton employed this method on the build he covered in the April 2018 issue. It does require a full-scale sequencing change, which I have not been able to sell to many big builders, especially in this labor market. Even if you don't like this approach, its still easier to air seal the attic before insulation is installed. I can't stress enough that if builders take this step of addressing air-sealing in the attic, they will be able to achieve 3 ACH50 relatively easily.

Foam sealant sprayed along all the plate joints certainly can work **(9)**, but it's easy for installers to skip spaces along the joint, creating an incomplete air-seal. Some builderss find it's easier to send in a spray-foam-insulation installer. One reduced-cost method is to foam-over plate areas of the attic floor, including the perimeter wall plates **(10)**. Or, you can foam over the entire attic floor, though this can get expensive.

## BOTTOM PLATES AND BAND JOISTS

Beyond the attic, there remains a host of wall air leaks on which builders can focus attention to produce a significant reduction in total leakage area.

One of the most significant is the bottom plate connection to the foundation, and especially at the garage separation wall, where plate leaks measured in at 0.6 CFM50 or an average of 0.2 ACH50, per foot of joint.

At the bottom of the house, stack effect is a strong driver of air leakage, concentrating high pressure at the top and bottom of the building. This makes all sill plates prime leakage areas **(11)**.

Band joists for second floors fall closer to the neutral pressure plane—the middle section of a building's height—and therefore, they do not tend to be as affected by stack pressures. Nevertheless, they are still extremely leaky owing to the number of cracks formed by all the pieces joining in this area. In fact, Wolf measured these as the leakiest joints in a house at 0.86 CFM50, or about 0.4 ACH50, per foot.

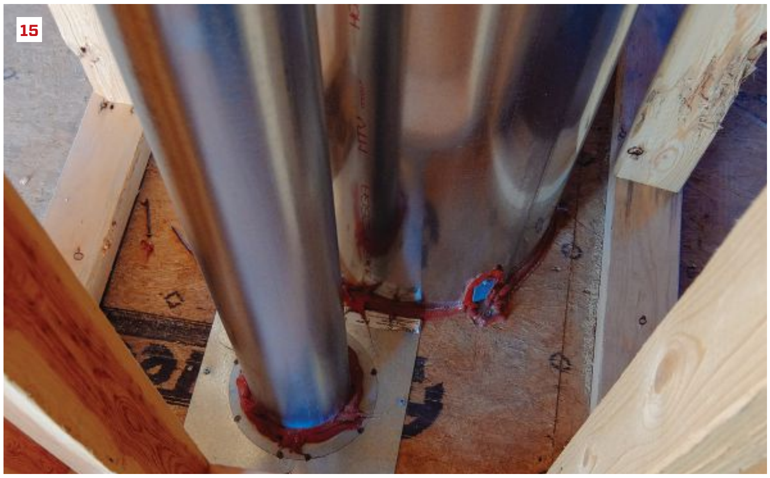
Some builders continue to believe that stuffing the rim with fiberglass is sufficient **(12)**. Batts may work to insulate this area, but you first need to air-seal with caulk in the corners at the top and the bottom of the rim joists (the corner between the sill or wall plate and the top-side decking), as well as along the joists or floor trusses crossing the sill plate. This is awkward work, to say the least. Getting between the floor joists and the decking is difficult. Some framing crews have gotten skilled at handling a caulk gun as they frame, sealing the plates before installing floor decking, and then coming back to apply one bead to seal the top of the rim to the deck. This is not the way every framing crew likes to work, however.

A much easier and still very effective way to address the rim joist is to seal the entire area with closed-cell spray foam **(13)**. It can be cost-effectively foamed to a 1-inch thickness (or in colder areas to 2 inches), and insulated with batts (flash-and-batt), or insulated to a great depth to satisfy the entire code-required wall R-value. Even if you're not insulating the wall cavities with foam, insulating the rim joist entirely with closed-cell spray foam is turning out to be a go-to solution for an increasing number of builders.

## HVAC PENETRATIONS

Vents and ducts passing through framing can lead to some large, significant leaks through the building shell. (That is, leaks that impact the blower-door test—not to be


14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16


17

**Vents** for combustion appliances **(14, 15)** must not touch combustible materials; sheet metal and fire-rated caulk will work for air-sealing the gap. **Ducts** need to be sealed at the locations where they run from an attic or crawlspace into conditioned space **(16)**. But just going through the motions is not enough **(17)**; attention with spray foam is required.



**Fireplace inserts** are typically boxed into framed recesses that leave open framing areas connecting the conditioned space with the exterior **(18)**. A good solution is to build a sealed chamber for the insert **(19)**. The chamber will be hidden once drywall is hung on the walls.

confused with a duct-tightness test. Duct testing is a separate concern between the builder and the HVAC installers.) Many HVAC ducts and vents run through boxed-out framing chases and connect an equipment room at slab level, or a basement or crawlspace, with the attic **(16, 17)**. Once again, with many of these leaks, stack pressure is the principal driver. Plumbing vents, which run either in boxed out chases or through a stud bay, also fall into this category of leaks that connect the bottom of walls to the attic. (And we'll get to plumbing drains in a moment, which deserve their own kind of special attention at the floor level).

What makes HVAC vents, including chimney vents, special is that the air-sealing solution often includes an all-important accommodation for avoiding the risk of fire. Boxed-out vent chases should be capped with OSB or plywood **(14)**, and this combustible material needs to be cut back from the vent and the gap bridged with sheet metal and fire-rated caulk **(15)**.

Fireplaces are an important subset of this. Too often, these are installed in boxed-out framing areas. The fireplace insert itself is often housed in an area that has walls that are open to the exterior walls and a lid that opens, with a vent running out through the roof **(18)**. It's critical that builders follow the vent, which sometimes passes from the conditioned space into the attic through a very large framing opening.

The best way to handle the insert is to house it in its own chamber **(19)**, seal it off with drywall and sheathing, and use the appropriate vent, sealed with fire-rated caulk. When the walls of this home are drywalled, only the face of the fireplace will be visible (in other words, it will look like a fireplace, not a woodstove).

## COMBUSTION SAFETY

Here is an important addendum related to combustion appliances and fireplaces: If you are working with a home-performance contractor for your blower-door testing, you are likely in good hands and will be guided on accommodating any natural-draft combustion appliances. For those, best practice by far is to install direct-vent, sealed combustion appliances. However, if you're making a budget choice not to use these and you're not working with a home-performance contractor, beware: A combustion appliance that is starved for air can backdraft, drawing carbon monoxide down the chimney. This is one of those no-joke matters; it can end in the death of an occupant, and no builder wants to face that.

Until recently, energy codes have not done a good job addressing the life-safety issue of combustion-appliance backdrafting. The IECC rectifies this in the 2015 version with an entirely new section addressing fuel-burning appliances. It requires the combustion appliance, such as a furnace or a water heater, to be isolated from the building envelope by locating the equipment room either outside the envelope—in the garage or crawlspace, for example—or in a separate room supplied by open air ducts. This room must be insulated and sealed off from the rest of the conditioned space, so that like a garage or the crawlspace, it exists effectively outside the building envelope. Again, the safest, simplest and most cost-effective solution is to use sealed combustion equipment.

## PLUMBING

There are two serious leaks that get missed time and time again: One is the bathtub drain over crawlspaces. It's not uncommon for plumbers to overcut the floor sheathing to make ample room to glue up the drain trap. This happens not only in wood-framed floors **(20)** but also in slabs where the slab is often formed to fit the trap and this gets left as a wide-open hole under the tub **(21)**.

The other place that gets missed is the wall behind the tub **(22)**. Unlike the wall around the tub, which is air-sealed with drywall or backerboard, the area behind the tub is often left open. The solution is simple: Before the tub surround is framed in **(23)** or the tub installed hard to the framing, the wall needs to be covered with a panel stock. This is required by code.

*Steve Easley is principal of Steve Easley Associates, a company based in Danville, Calif., that provides building-science training and quality assurance for builders nationwide.*





**Tub area.** Plumbers often cut out a section of the subfloor to install traps, leaving a massive hole under the tub. Rigid foam and sealant can remedy this **(20)**. Slabs also need to be sealed **(21)**. Behind tubs, framing is often left open (**22**). This should be sealed with drywall or sheathing **(23)**.


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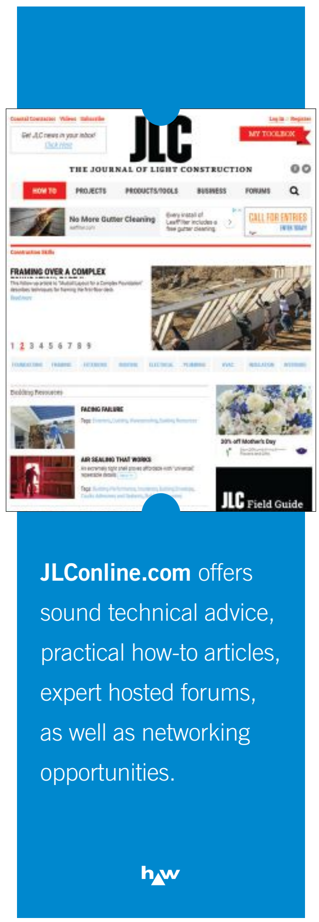
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Photo: Tim Healey

# Frost-Protected Shallow Foundations

## Cold-climate alternative uses specialized insulated forms

BY ROE OSBORN

When Mitch Frankenberg decided to build five small cottages to expand his B&B in central Vermont, he looked for a strategy that would fit within his budget. Pouring five separate conventional foundations with 4-foot-deep frost walls was out of the question. Instead, he decided to put each cottage on a frost-protected shallow foundation (FPSF).

### CAPTURING WARMTH FROM THE EARTH

An FPSF works by holding in the ambient warmth of the earth to prevent the soil below a shallow monolithic slab from freezing and heaving (see EPS Forms for a Shallow Foundation, page 42). The FPSF requires minimal excavation and much less concrete, resulting in savings that more than offset the additional cost of the insulation.

For these foundations, Frankenberg's contractor contacted J.E. McLaughlin, a local company, which fabricated L-shaped forms out of 6-inch EPS foam. The EPS has a 2-pound density for greater compressive strength to withstand backfilling and concrete placement.

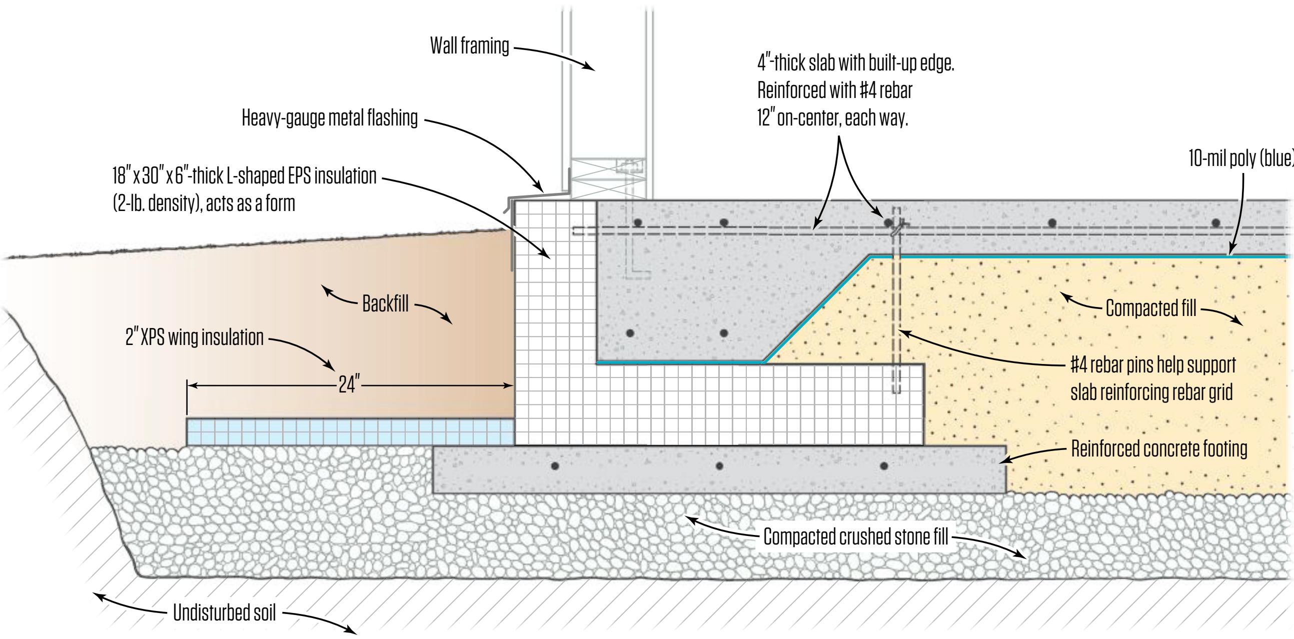
### SIMPLE MATERIALS

The beauty of this FPSF is that all the materials were simple and were easy to work with. After the initial excavation, the crew formed the footings with 2x4s. The EPS forms cut easily with a handsaw and fit together like giant Legos.

The built-up edges of the slab were formed by adding and compacting soil inside the EPS forms. Extra attention was paid to constructing the rebar grid, and the pour itself was straightforward. When finished, each slab was ready for the framing crew to come in and start building the little cottages.

*Roe Osborn is a senior editor at* JLC*.*

## EPS Forms for a Shallow Foundation




**Capturing warmth.** The insulation around a frost-protected shallow foundation captures ambient warmth of the earth to keep the soil beneath the foundation from freezing and heaving. L-shaped EPS forms create a built-up edge for the reinforced monolithic slab and hold in warmth from the ground. XPS wing insulation raises the frostline around the building's perimeter.

1

2

**Excavation and footing.** The first step is excavating for the foundation assembly. With the excavation open, the crew can put down a layer of crushed stone. The crew sets up 2x4 forms for the footing, using a laser to make sure that they are perfectly level **(1)**. After the crew stakes the forms in place, a concrete truck carefully fills them **(2)**.

Illustration by Tim Healey; Photos: 1, Roe Osborn; 2, Mitch Frankenberg



**Insulated forms.** After the footings set, the crew cuts and fits insulated forms made from EPS foam for the slab **(3)**. The forms cut easily with a handsaw, and the crew miters the corners. Next, they even out the ground inside the forms with a fresh layer of crushed stone, compacting the layers as they go **(4)**.



Photos this page by Mitch Frankenberg

**Prepping for the slab.** After putting down horizontal wings of insulation around the base of the forms, the excavator backfills around the forms to lock them in place. Soil added inside the forms is compacted **(5)**, and then the crew spreads a layer of poly as a vapor barrier below the concrete slab **(6)**. Vertical sections of rebar will tie into the rebar grid for the slab.

7


8


**Rebar grid.** A grid made from 1/2-inch rebar forms the reinforcement layer for the monolithic slab **(7)**. The ends of the bar insert into the foam, and pieces of CMU act as chairs for the grid to sit on. Each intersection is wire-tied together and anchored to the vertical rebar sections. An additional layer of rebar below the main layer reinforces the built-up edge of the slab **(8)**.

9


10


**Slab placement.** The concrete crew places the slab, screeding the mix flush with the top of the forms **(9)**. The treated sills for the walls attach to the slab with concrete screws for positioning **(10)**. Embedded J-bolts around the perimeter of the slab provide permanent anchoring for the framing.

Photos: 7, 8 & 10, Tim Healey; 9, Mitch Frankenberg

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## KEYNOTE

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BY DAVID GERSTEL

# Taking the Slop Out of Estimating

*This article is the second in a four-part series. The first emphasized that estimating and bidding require different mindsets and should be clearly separated from one another. The third and fourth articles will get into the specifics of accurately estimating labor costs and of obtaining reliable subcontractor bids.*

**Like archery or any other target sport**, estimating can be practiced with a high degree of proficiency. Even so, when you take a shot at the cost of an item or assembly and miss the bullseye, you want to avoid getting discouraged. You want to avoid letting perfection be the enemy of the good.

Unfortunately, that's often not what happens in our world of light-frame construction. Because perfection is not achievable, guys settle for a lot less than good, and excuse inept work with all manner of clichés. Just the other day I bumped into a friend I will call "Frank." He is an outstanding builder. When the subject of estimating and bidding comes up, however, Frank shape-shifts. He transforms from an exacting craftsman who does not tolerate excuses for sloppy construction into the opposite. "It's just a crap shoot," he says of estimating.

Yes, estimating is approximating. Plumb, level, and square are approximations, too. But there are frames that are very close to dead-on plumb, level, and square—that are "true." Estimates and bids can be very close approximations rather than sloppy ones, as well. They can be true, too.

But the truth is that Frank is just one of many talented builders I have met who produce sloppy estimates because, even as they steadily strive to refine their on-site production skills, they put little effort into creating good estimating and bidding systems. And because they treat estimating like a "crap shoot," they get exactly that: erratic results that have only an accidental relationship to the actual costs of a project.

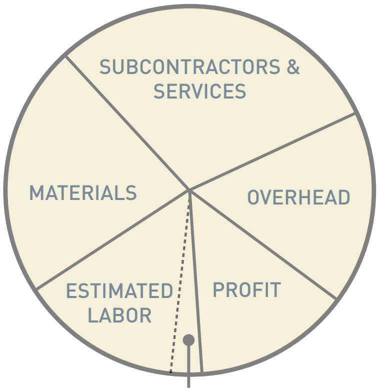
The rationalizations for inept and inaccurate estimating and bidding are offered up not only by builders but even by construction industry consultants and educators. Among their favorites: "To estimate" means "to approximate"; therefore, an estimate is just an approximation and by definition can't be, should not be expected to be, anything more than a rough stab at a number. Well, yes, estimating is approximating. Plumb, level, and square are approximations, too. But there are frames that are very close to dead-on plumb, level, and square—that are "true." Estimates and bids can be very close approximations rather than sloppy ones, as well. They can be true, too.

Another excuse: "A construction project is like a lawsuit. You cannot know what it will cost till it's over." Rubbish! The cost of a lawsuit can be driven upward by the anger of litigants thirsting for vengeance or self-justification. But for a well-run construction company, the costs of a project as designed are highly predictable by owners or staff who have done the hard work of learning to estimate systematically. Even the less known costs—change order charges for hidden conditions or upgrades—can be provided for reasonably well with allowances or contingencies derived from experience.

A final rationalization holds that estimating is as much an art as it is anything else. One builder advocating for the estimating-as-art idea sought to support it by describing a series of projects with difficult job site access. His examples were helpful. They illustrate how important it is to account for access, especially difficult access, when building an estimate. But to call that process "art" does not seem to me to be helpful; for it implies that an estimator can rely on some sort of loose intuitive process when what is really called for is controlled number crunching. Adjusting for access in an estimate serves to illustrate that point nicely.

Difficult access will slow productivity. But it is equally important to note that while access might be difficult for some items in a project, that does not mean it will be difficult for all items. For example, tight interior space may slow productivity for the tear-out, some reframing, and all finish work in the replacement of a worn-out bathroom that is up a stairway and at the end of a narrow hallway. But it won't adversely affect floor reframing or repiping or rewiring if that work can be installed from an uncluttered garage under the bathroom. In other words, for some items of work in a project, difficult access will slow productivity, and the costs in an estimate for that work must be appropriately adjusted. For other items, access may be normal and productivity and costs won't need to be adjusted at all.

In short, adjustments to productivity for difficult access should be made not with some broad brushstroke applied across an entire




**Which Charges to Include?**

This chart, which summarizes the charges in an estimate and bid, does not include a slice for equipment. Here's why: Relatively small items of equipment, such as table saws, are most efficiently charged for as part of general company overhead. Heavy equipment (think front-end loader or excavator) is another matter; its use should be charged only to the projects for which it is used. If it is not to be used for a project, you don't want to bump up your bid by including costs for the equipment in your estimate for that project. And that is what would happen if its cost were included in your general overhead markup. Bear in mind, a bid that is low is a bad bid. But a bid that is unnecessarily high is also a bad bid. If you win it, it might be a lucky bid. But it still is bad work, for it means you do not have control of your numbers. And over the long haul, that's going to do your company more harm than good.

estimate, but selectively and precisely. If you want to describe the work via metaphor, call it a target sport, not "art"—which, like other rationalizations for loose or even sloppy estimating, can too easily become just a cover-up for the lack of well-honed estimating procedures.

Costs in an estimate can be targeted with precision if you have a quiver of well-crafted arrows—including especially labor productivity records for a broad range of items and assemblies, a subject I will explore in an upcoming article. With those in hand, you can hit even your numbers for labor by your own crew—the most difficult costs to pin down in an estimate. And with a variety of records for items of work—for example, with one record for framing a pony wall on a steep hillside (tough access) and another for framing a pony wall on a flat lot (standard access)—you can accurately factor access, as well as other conditions, into your estimates.

It is quite possible to nail down all costs included in an estimate, and even those charges to clients that are more usefully captured during the bidding process—namely overhead and profit.

**Subcontractor costs** can be estimated tightly by 1) requiring that subs cover all work normally produced by their trade unless that work is explicitly excluded in writing and 2) making sure any excluded work is covered elsewhere in the estimate. (As with labor productivity, we will take a look at just how those steps are accomplished in an upcoming article.)

**Material costs** can be accurately nailed down with thorough quantity takeoffs and written—always written—quotes from reliable suppliers and contract protections against inflation.

**Overhead costs** can be reliably allocated to projects one job at a time. In my view, that is best accomplished by allocating overhead for a project on the basis of the length of time that project will take and the portion of company capacity it will absorb—that is, by using the "time/capacity method" I detail in *Nail Your Numbers.* I am not a fan of the much more commonly used fixed percentage or gross profit margin (GPM) methods. The first is simplistic. The second is unnecessarily complicated and muddies the distinction between overhead and profit by marking up for them with a single calculation.

**Profit** for a job can likewise be projected reliably. True, figuring the amount of profit to include in a bid is a judgment call that takes into account a range of factors including market conditions. But the amount of profit that will remain in a builder's bank account when a project is completed will be as anticipated if the other costs in a job are figured accurately, and if the job has been properly qualified for a bid, is built under a thorough and fair contract, is well run—and is not hit by one of those strokes of bad luck that do plague the construction business.

**Labor** is the toughest of all project costs to figure reliably. But that, too, can be done. Building a file of labor productivity records is the critical thing.

The final good news about the items in the pie chart above is this: Even a fairly large miss in estimating labor costs results in only a minor miss in your overall bid. You might be low on your labor estimate by 15%. But if labor is, say, one fifth of the total price for a job, then your miss on the labor will cause your total price for the job to run off by only some three percent (.2 x 15% = 3%). Further good news: Over time the small misses in labor cost estimates, some low and some high, will tend to balance one another out.

If you are willing to do the work necessary to build a strong estimating system, errors in your estimates and bids as a whole will also tend to balance out. As the estimating manual of the Associated General Contractors points out, the law of averages is on your side. You may never quite hit the bullseye dead center with any given estimate and bid. Perfection in estimating is no more attainable than in any other target sport. You will miss a bit one way on one job, somewhat in another direction the next. But over time the misses will average out to close to zero, and your overall results will get closer to the center of the bullseye.

*David Gerstel has been a builder for over four decades and is the author of* Running a Successful Construction Company, *long regarded as an industry standard. David's new book,* Nail Your Numbers: A Path to Skilled Construction Estimating and Bidding *is available from Amazon or at the bookseller of your choice. You can contact David via his website, davidgerstel.com.*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BY TED CUSHMAN

# Dumping Heat to the Pool

**In summer, the big power hog** in most homes is probably the air conditioner. But for homes with pools, heating pool water is often a significant factor too.

This raises the obvious question: When you're using lots of power to cool the house at the same time as you're spending money to heat the pool, shouldn't there be a way to capture the heat you're taking out of the home's indoor air, and put that heat into the pool water?

Lindsay Scott, currently an energy auditor in Austin, Texas, had that same thought back when he was a builder in the Cayman Islands. Electricity is expensive in the Caymans, and Scott's customers wanted high-performance homes with low energy bills. But they also wanted swimming pools. Scott's answer was to heat the pools with waste heat from the houses, using a heat transfer system called the HotSpot FPH (for "free pool heater"), from HotSpot Energy (hotspotenergy.com).

The system is simple in concept: You just install a secondary condenser in the air-conditioner or heat-pump refrigerant line. When the air conditioner is running, if the pool needs heat,

This Cayman Islands custom home, constructed with insulating concrete forms (ICFs), used waste heat from the air conditioning to heat the pool for free (see next page).

Photos courtesy of Lindsay Scott


This custom-home swimming pool **(1)** gets its heat from waste heat recovered using a condenser spliced into the air conditioning system's refrigerant line **(2)**. The heated water is directed into the small spa pool in the center, which then overflows into the main pool. The HotSpot FPH unit **(3, 4)** is rated for 78,000 Btu and is wired to kick in and draw heat whenever the pool needs heating.

the secondary system cuts in and pulls heat from the air conditioning's coolant loop.

John Williams, the CEO of HotSpot Energy, said his product sells nicely by word of mouth. "We've never advertised," said Williams. "We're engineering types, not marketing types." But Williams was happy to explain the concept to *JLC* in a phone call. "It's basically just a conventional commercial heat-recovery system, adapted for use with a swimming pool," he said. "The only differences are some minor differences in controls, and of course we upgraded to a titanium heat exchanger to deal with salts or corrosive chemicals that could be in the pool water."

"In a regular air conditioner," said Williams, "you have a fan, and you blow outdoor air across a coil, and the heat gets thrown away into the backyard. When our system is active, the refrigerant uses the alternative water-cooled condenser, and instead of a fan, we use the existing pool pump to push water across the titanium coil, which puts the heat into the pool instead of throwing it away."

The system takes a week or 10 days to warm the pool up at the start of the cooling season (which, conveniently, is also the outdoor swimming season, Williams noted). But once the pool is warm, the HotSpot keeps it warm continuously. Said Williams, "You could never afford to keep a pool heated continuously like that with a paid-energy pool heater. Your bills would be $5,000 for the season."

And, Williams explained, the HotSpot recovers the mechanical energy of the air-conditioner compressor as well as the waste heat from the house. "It makes your air conditioner more efficient," he said, "and it heats the pool for free."

*Ted Cushman is a senior editor at* JLC.

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**1. Heavy-Duty Vanity Bracket**
Federal Brace's recently launched Atlas Floating Vanity Bracket is designed for contemporary floating vanities, supporting a load of 1,500 pounds with an additional 300-pound point-load capacity per pair. The bracket ties directly to the floor by sinking into a 4-inch concrete slab with $\frac{3}{8}$-inch anchors. The 2x2 tubular steel arm, made of 11-gauge metal, extends from the column to provide support for the cabinet. It is available in unfinished steel for $111; Federal Brace offers custom quoting for powder-coated pieces. federalbrace.com

**2. Fiber-Cement Shower Niche**
Ledge Products has introduced a line of shower niches made from recycled engineered fiber cement and designed to sit flush with cement board or plaster wall. The niche's tapered edges allow for easy water drainage, and Ledge says the interior surfaces bond well to adhesive sealants. Once installed with thinset or mortar, the niche may be waterproofed and finished with the same surfacing as the rest of the shower space. Ledge's single shower niches are available in four sizes and range from $40 to $80 in price. ledgeproducts.com

**3. Faster-Install Roof Shingles**
IKO's Dynasty shingles portfolio has expanded to include three new color blends: earthy driftshake, brownstone, and two-tone frostone gray. The shingles' "ArmorZone technology" includes an enlarged nailing area with nail lines that are $1\frac{1}{4}$ inches apart instead of $\frac{7}{8}$ inch to make installation faster and easier. IKO says a reinforced woven band improves the shingles' resistance to high winds and increases its fastening strength. Coordinating IKO Hip and Ridge Cap shingles are also available. Contact a local distributor for pricing. iko.com

**4. Hands-Free Kitchen Faucets**
The Avery pull-down kitchen faucet collection from American Standard gives homeowners hands-free flexibility in the kitchen with wave-on and wave-off functionality. Users also may switch to manual operation by closing the sliding door on the faucet spout to cover the built-in sensor. The faucet has a two-function spray with stream or spray options. It comes in polished chrome and stainless steel finishes ranging from $350 to $700. americanstandard.com




BY SYMONE GARVETT

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**5. Seamless Closet Storage**
Hafele has unveiled an Italian-style organizational system that doesn't sacrifice aesthetics for function. Coloma sports a sleek and stylish design that hides mounting hardware and brackets either behind shelves and drawers or in narrow, vertical mounting channels. The system adjusts three ways (up and down, in and out, or side to side) and is compatible with the company's signature suspended wardrobe rods. Coloma hardware is available in four depths (12, 14, 16, and 18 inches) in silver or oil-rubbed-bronze finishes. Prices range from $22 to $186. hafele.com/us/

**6. Smart Garage Door Opener**
LiftMaster's 8500W Elite Series Wi-Fi–enabled garage door opener lets owners open, close, or check their garage door remotely. A deadbolt locks the garage door for added security, and a timer-to-close function can be programmed to close the door after a set amount of time. The opener also features a motion detector that lights the way automatically and an invisible light beam that auto-reverses the door if there is an obstruction. Price of the opener ranges from $650 to $800. liftmaster.com

**7. Easy-to-Install Load Center**
Leviton's new load center and plug-in circuit breakers allow contractors to terminate the conduit at the panel at rough-in and insert circuit breakers later to complete installation. Its design enables users to switch out branch circuit breakers with no rewiring required. Reset lockout technology to both GFCI and AFCI/GFCI circuit breakers exceeds UL standards. Circuit breakers are located behind an optional clear door that houses LEDs that communicate trip condition and type of fault. Contact a local distributor for pricing. leviton.com

**8. Siding Accessories**
Grayne siding from Boral now offers accessories that coordinate with its composite siding shingles. The line includes mounting blocks and utility vents; 3/4-inch J-channel for inside corners and gables; and cellular PVC trim—4-inch and 6-inch outside corners and flat casing—with an integrated nailing flange that forms a J-channel to facilitate shingle installation. The accessories range from $50 to $100 and the J-channel is $15. grayne.com

**9. Low-GWP Spray Insulation**
Demilec's new Heatlok HFO High Lift is a closed-cell spray polyurethane foam insulation that can be applied 6 1/2 inches thick in a single pass with high yield and low VOC emission. Heatlok HFO is formulated with Honeywell's Solstice Liquid Blowing Agent, which has a Global Warming Potential (GWP) rating of 1—significantly lower than traditional blowing agents, according to Demilec. The company claims that Heatlok HFO High Lift offers better sprayability and adhesion, reduces gun clogging, and meets ICC-ES code requirements. Contact a local representative for price. demilec.com

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**10. In-line Ventilation Fan**
Panasonic Eco Solutions' newest ventilation fan, the WhisperFresh Select, is designed to help builders meet the ventilation requirements for tightly built homes. The fan integrates with both central HVAC and ductless systems, and it may be used as a standalone whole-home solution or paired with Panasonic's multispeed central fans. The unit's ECM motor with SmartFlow Technology is designed to ensure optimal output, and the Pick-A-Flow Air Selector allows contractors to manually adjust the unit's airflow settings between 50 cfm and 150 cfm. The vent fan costs $860. panasonic.com

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**11. Roll-On Rainscreen**
The Roll-On Stick-On Rainscreen is a nonstructural corrugated aluminum furring strip designed to achieve maximum open wall area to dry moisture and condensation. A 3/8-inch air gap allows for air flow and drainage, and to simplify installation, a self-adhering membrane helps to reduce the number of fasteners needed to attach the product. The price ranges from about 89 cents to 99 cents per foot. rollonrainscreen.com

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**12. Solar Defense Siding**
Ply Gem has enhanced its "SolarDefense Reflective Technology" on select vinyl siding in its Mastic collection. The new technology uses three protective layers to shield from the sun's UV rays. The base layer has been reformulated to withstand higher temperatures to help prevent thermal distortion; the middle layer aids in reflecting light rays to keep the siding cool; and the top layer is designed to resist color fading and oxidation, says Ply Gem. Five new colors have been added to the existing line for a total of 10. Contact a local distributor for price. plygem.com

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# 'Dual-Mode' Random Orbit Sander

BY NATHAN RINNE

**Ask anyone** who works with wood what their least favorite part of the job is and you're bound to hear "sanding" more often than not. Whether because of the dust, the time-consuming monotony, or the physical pain in your hand from using a random orbital sander for hours on end, it is by no means a fun job. As such, I am always looking for ways to expedite the process while minimizing the dust that I have to deal with. Enter the Makita dual-mode sander. With its 6-inch pad, 6.6-amp motor, and dust-extraction port, this sander is built to cleanly remove material fast. It impressed me with its power, its tight, swirl-free orbit, and its strong dust collection.

### NOT YOUR AVERAGE ROS

The first time I used this sander, one thing that stood out almost immediately was its power. Most of my previous experience has been in using 5-inch random-orbit sanders that have motors less than half its size; it was immediately clear that this was a whole different animal. Its tight orbit diameter (7/32) leaves a swirl-free finish, in my experience, and the variable speed (1,600 to 6,800 opm and 3,200 to 13,600 sanding strokes per minute) allows you to tone it down for more delicate work or go full blast when you need material removed fast. The machine's weight and side handle allow for extra leverage when needed, but for the most part, the tool does all the work. While stripping an existing finish or smoothing out an uneven surface, you can switch over to a random-orbit mode with forced rotation and see it really shine.

### STRONG DUST COLLECTION

When I use Mirka Abranet sanding discs, the dust extraction performs almost flawlessly, leaving very little dust behind. I've used the sander hooked to my Fein turbo for everything from sanding face frames to stripping furniture and have been thoroughly impressed with its ability to mitigate dust. On a recent bunk-bed project that involved sanding a good amount of Bondo, this feature was indispensable. We spent a solid six hours sanding and there was no lingering smell or airborne particles to contend with. The design of the extraction port is also convenient: The hose connection is on the rear of the handle so it is out of your way and less likely to get accidentally knocked off.

The only issue I have with this sander isn't related to performance, but rather the price of consumables from the manufacturer. Makita has made a proprietary hole pattern on this sander and charges about $2 per sanding disc for it. The simple solution is to buy mesh-backed paper, such as Abranet, that doesn't use a hole pattern but pulls dust through the backing. Overall, I would definitely recommend this sander to anyone who, like myself, feels time is money. Cost: $320. Includes: Abrasive disc, pad, pad protector, removable side handle, removable dust nozzle, and interlocking case.

*Nathan Rinne is a finish carpenter in central Missouri specializing in ornamental built-ins. Follow him on Instagram @rinne_trimcraft.*

# The Most Compact Cordless Router

BY CHRIS ERMIDES



**The Bosch GKF12V-25N** is a compact cordless palm router that runs on Bosch's 12V Max platform. It has an EC Brushless motor and a unique design that positions your hand directly over the spindle. An elongated baseplate provides additional support on the surface being routed. The motor runs at a max 13,000 rpm and is reported to have a runtime of about 23 feet of round-over per Ah of battery. It has an easy-change spindle lock, fast macro depth adjustment, and a fine depth-adjustment knob that changes 0.04 inch per revolution of the dial. An internal sensor stops the motor if the router is dropped while running. Cost: $150 (tool only).

*Chris Ermides is the editor of toolsofthetrade.net. Follow him on Instagram @toolmagazine.*

# Remote Start for Festool CT Extractors


**Auto-start functionality** has been a staple in dust extractors for years but has always relied on a power cord being plugged into the tool for it to work. If you own a Festool CT extractor, you now have the option of turning it on via remote or a tool equipped with a new Bluetooth-enabled battery. The remote control CT-F I/M set is an affordable plug-and-play conversion kit that allows you to turn on the extractor remotely without having a tool plugged into it. In addition to the remote-control functionality, Festool has two Bluetooth-enabled 18V battery packs that will start the extractor automatically when the respective tool is turned on. Officially, Festool says that module installation should be "carried out by a qualified electrician." But I can report from personal experience that it's as simple as unscrewing two screws, pulling out the blank face plate, plugging in the new module, and then reinstalling the two screws (be sure the extractor is unplugged before you begin). The kit, which can be retrofitted onto the CT 26, 36, or 48, costs $80 and includes a Bluetooth reception module, one remote control, and two straps (for mounting the remote to a hose). Additional remotes (CT-FI) can be purchased for $45 each. Bluetooth-enabled 18V batteries are available in 5.2 Ah ($110) and 6.2 Ah ($125) sizes. *—C.E.*

## 3-in-1 Concrete Levels

**Expanding on the Redstick** box level line, Milwaukee has added a new set of concrete levels. The levels are designed to be three tools in one: hand darby, screed, and spirit level. For lasting rigidity and to eliminate potential deformations, the levels are constructed of a magnesium core that is said to create a durable, protected setting for the vials. A plastic and rubber overmold provide added grip and make the levels easy to clean—just spray with water and wipe down with a cloth. Magnified bubbles are reportedly highly visible and are marked with four black band lines to delineate 1/8-inch and 1/4-inch pitch or 1% and 2% grade—useful for necessary water run-off applications. To help with grip and usability, the levels feature a keyhole shape, a precision-milled bottom, and a 2-inch-wide working surface with a rounded edge for smoothing and an angled edge for screeding or striking. Milwaukee is backing the levels with a limited lifetime warranty and limited accuracy warranty. The levels are available in three sizes: 24 inches ($100), 48 inches ($150), and 72 inches ($220)—sold separately, not in a kit. Carry bags will be available in 2019. *—C.E.*

## A Small Cordless Radio and Speaker


**The Ridgid R84086B** compact FM radio and speaker works with the Ridgid Radio App. It pairs your smartphone to stream music, set jobsite alarms and alerts, and control the radio remotely. Charge your devices via the onboard USB port and connect via the Aux port for non-compatible Bluetooth devices. It has a fold-down, rotating antenna, and it is water resistant and compact. AAA batteries back up the clock memory and any other settings when an 18V battery is not installed. It is backed by the Ridgid lifetime service agreement. Cost: $70 (tool only). *—C.E.*

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BY MARK LUZIO

# Ahab and the Carpenter

**This winter,** a carpenter I have worked with on many projects suggested I reread *Moby Dick*, the iconic American novel written in 1851 by Herman Melville. My last reading was 45 years ago in my freshman year of college. At the time, I didn't appreciate the role carpentry played in the book—nor did I anticipate the role house carpentry, boat millwork, and furniture building would come to play in my own life for more than 40 years.

After diving anew into the 400-page novel, I had to smile when early in chapter 3, Ishmael arrives late on a nasty December night at The Spouter Inn (in New Bedford) and finds no beds. The innkeeper, though, has a plan: "'I've got a carpenter's plane there in the bar - wait, I say, and I'll make ye snug enough.' … he vigorously set to planing away at my bed, the while grinning like an ape. The shavings flew right and left; till at last the plane iron came bump against an indestructible knot. The landlord was near spraining his wrist, and I told him for heaven's sake to quit - the bed was soft enough to suit me, and I did not know how all the planing in the world could make eider down of a pine plank." Ishmael then decides that sharing a bed would be a better choice, and this is how he meets Queequeg, a Fijian harpooner.

The ship's carpenter is described near the end of the book in chapter 107: "He was pure manipulator; his brain, if he ever had one, must have early oozed along into the muscles of his fingers."

In chapter 108, Ahab's whale bone peg leg has split and the carpenter has to make a new one: "Drat the file, and drat the bone! That is hard which should be soft, and that soft which should be hard. So we go, who file old jaws and shinbones. Let's try another. Aye, now, this works better (sneezes). Halloa, this bone dust is (sneezes) - why it's (sneezes) - yes it's (sneezes) - bless my soul, it won't let me speak! This is what an old fellow gets now for working in dead lumber. Saw a live tree, and you don't get this dust; amputate a live bone, and you don't get it (sneezes)."

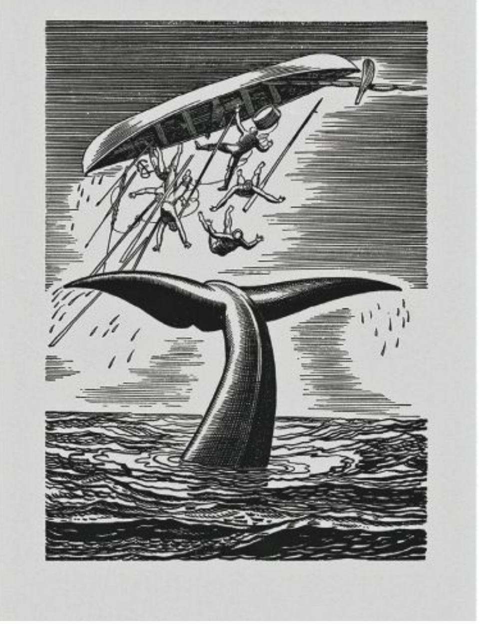
In chapter 110, Queequeg falls ill with fever and asks the carpenter to make his coffin. After testing the fit, he declares he is not ready to die, having an unfinished job on land. He spends his recovery carving the top. "With a wild whimsiness, he now used his coffin for a sea chest; and emptying into it his canvas bag of clothes, set them in order there. Many spare hours he spent, in carving the lid with all manner of grotesque figures and drawings; and it seemed that hereby he was striving, in his rude way, to copy parts of the twisted tattooing on his body."

In chapter 126, a sailor falls from the rigging and the ship's life-buoy is thrown, but it sinks and the man drowns. It is decided that if Queequeg's coffin is nailed shut and caulked, it can be hung off the ship's stern as the new life-buoy. The carpenter speaks: "We workers in woods make bridal-bedsteads and card-tables, as well as coffins and hearses. We work by the month, or by the job, or by the profit; not for us to ask the why and wherefore of our work … Any way I'll have me thirty separate, Turk's-headed life-lines, each three feet long hanging all round to the coffin. Then if the hull go down, there'll be thirty lively fellows all fighting for one coffin, a sight not seen very often beneath the sun! Come hammer, caulking-iron, pitch-pot, and marling-spike! Let's to it."

We all know that the great book ends with the White Whale ramming The Pequod until she sinks. In the Epilogue, Ishmael is the lone surviver, able to tell his story because: "Owing to its great buoyancy, rising with great force, the coffin life-buoy shot lengthwise from the sea, fell over, and floated by my side. Buoyed up by that coffin, for almost one whole day and night, I floated on a soft and dirge-like main."

Ishmael has told his story, beginning on a bench planed almost smooth enough for sleeping, and ending with being saved by a carpenter's well-crafted, well-caulked coffin. In my 45 years as a carpenter, I have never made a coffin, but who knows—I may yet. I still have a few years for which the lessons we carpenters can draw from Ishmael's tale will serve me well: Keep your block plane sharp and your joints tight and caulked!

*Mark Luzio owns Post Pattern Woodworking, based in Brooklyn, Conn.*



Rockwell Kent illustration of Herman Melville's *Moby Dick*.

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