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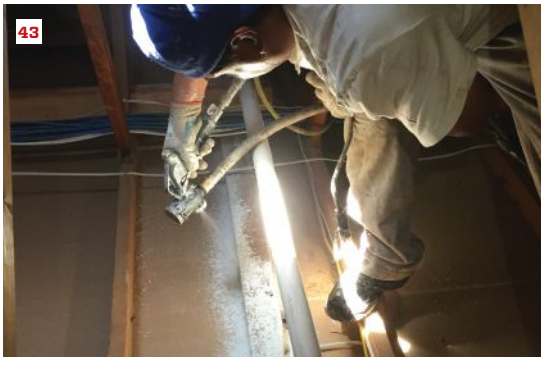
Contents



On the cover: Tim Donbeck, a carpenter in Saratoga Springs, N.Y., temporarily sets and levels a base cabinet as part of the scribing process. See the story on page 17. Photo by Chris Ermides.

FEATURES

DEPARTMENTS

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PORTAL FRAME DETAILS

Correction: *JLC*'s article "The Portal Frame Option" (Aug/17) contained an error concerning the allowability of the Continuously Sheathed Portal Frame (CS-PF) method in the International Residential Code (IRC). In a caption, we wrote, "The Continuously Sheathed Portal Frame is allowed only if the builder has sheathed the entire exterior wall system with plywood or OSB." In the main text, we wrote, "If the building isn't continuously sheathed with wood structural panels, then you can't use method CS-PF." This was incorrect; in fact, as several APA engineers pointed out, the CS-PF method is allowed by code as long as the entire braced wall line that includes the portal frame is continuously sheathed with wood structural panels. The rest of the building may be braced using any code-compliant method and need not necessarily be sheathed with plywood or OSB, provided the building is not in a high seismic area or in a >130-mph wind-speed zone.

ENCAPSULATED ATTIC ALTERNATIVE

Edward J. Cazayoux, EnvironMental Design, Breaux Bridge, La.: Would you agree that if the attic is not insulated under the roof deck, has a radiant barrier, and is naturally ventilated, and if the HVAC unit and all the ductwork is in the conditioned space below the attic, that this is more acceptable than to encapsulate the attic?

Curt Kinder, a Jacksonville, Fla., air-conditioning contractor, responds: Generally speaking, yes—if the ceiling plane is air-sealed, well insulated, and shielded by a radiant barrier, and all the ductwork is in conditioned space, that is a good solution. Unfortunately, in my market, that is an exceedingly rare condition; few builders or owners want the hassle of bulkheads, and fewer yet "get" the importance of a truly airtight ceiling plane.

There are other benefits to encapsulating the attic, particularly with closed-cell foam: civilized storage, reduction of vermin entry, and vastly increased assembly strength (see "Buried Ductwork in the Energy Code," Aug/17). My favorite is combining insulated concrete forms with closed-cell foam. With that stack and decent windows, we've gone as high as 1,600 to 1,800 square feet of conditioned space per ton of cooling capacity.

OVERSIZED SCAFFOLD PLANKS

John C. Warlikowski, Vandermeer Forest Products, Lynnwood, Wash.: The article published in *JLC* in August about scaffolding is excellent. Thanks for keeping scaffolding safety in front of the industry. However, there is one concern that will raise a lot of questions. You mentioned that users should adopt a 75-psf, instead of the current 50-psf, design load. I know I will soon be receiving calls about your loading suggestion.

Stucco and plaster are considered light duty and fall into the 50-psf range, or one-person loading. In order to meet the 75-psf design load you recommend, scaffold companies would need to change to 1.75-inch-thick planks from the current 1.50-inch planks at a 10-foot span. Or, if they want to stick with 1.50-inch-thick planks, they would need to shorten the spans to 7 feet. Both are very expensive proposals.

Stucco work requires scaffold planks that meet a 50-psf design load; you can safely use 8-foot-long, structural-rated Doug fir or southern pine 2x10s.

Photo: Isaiah Cushman

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BY GREG AND SUE BURNET

Casing Windows

The trim around a window, known as casing, makes the physical and visual transition between the window frame or jamb, and the surrounding wall area. Stylistically, casing may take any one of dozens of forms, ranging from Colonial to Craftsman to Greek Revival to Modern and everywhere between, with variations limited only by the imagination. But regardless of the style, the approach to casing the window is similar.

There are two basic ways of casing windows: the "picture-frame" method, where the casing detail is the same on all four sides of the window, and the more traditional style with a stool (that is, a window sill) and apron. In this article, we'll focus on the traditional approach. However, because the top of the casing gets mitered, we'll touch on the important aspects of the picture-framing method, as well .

As a finish trim, window casing is meant to be seen, so it's important to select good millwork stock from a reputable supplier. Using top-quality stock will help ensure that the contours of the profile line up properly at miters, that the casing lies flat against the wall, and that all the casing joints stay tight. Warped, twisted, or inaccurately milled material makes it difficult to create clean, tight-fitting joints.

Casing windows is very involved, and the photos that follow show just the key steps. For veteran carpenters, the photos—which show how I handle measurements and assembly—will be a quick refresher. If you are new to the trade, you can find additional photos and a more detailed description online by following the link at the bottom of page 10.

Greg and Sue Burnet are co-owners of Toolbelt Productions (toolbeltproductions.com), an education and training firm for the building industry.

Photos by Sue Burnet

Measure for the depth of the extension jambs that bring the window jambs flush with the wall **(1)**. After milling the extension-jamb stock and cutting it to length, glue and tack the assembly together **(2)**. Screws then fasten the joints more securely. Mark the reveal for the casing on the extension jambs using a sliding square set to the reveal measurement **(3)**.

Cut sill stock to the proper length and set it against the wall using marked centerlines to align it with the window **(4)**. Set compass scribes to the distance needed for the sill to meet the window, and scribe the ends of the sill **(5)**. After removing the scribed areas, fasten the sill to the extension jambs and secure the assembly in place **(6)**.

After marking the reveal on the extension jambs, measure and cut the casing pieces to length **(7)**. Biscuit joinery and glue add strength to the miters that are held together with corner clamps while the glue sets **(8)**. Cut bevels and returns for the apron **(9)**. The returns are glued and pinned in place. Fasten the casing first to the extension jambs and then to the wall framing **(10)**. The apron is the last piece to be installed below the sill **(11)**.

For a more detailed discussion on casing windows, go to **www.jlconline.com/training-the-trades/casing-windows**

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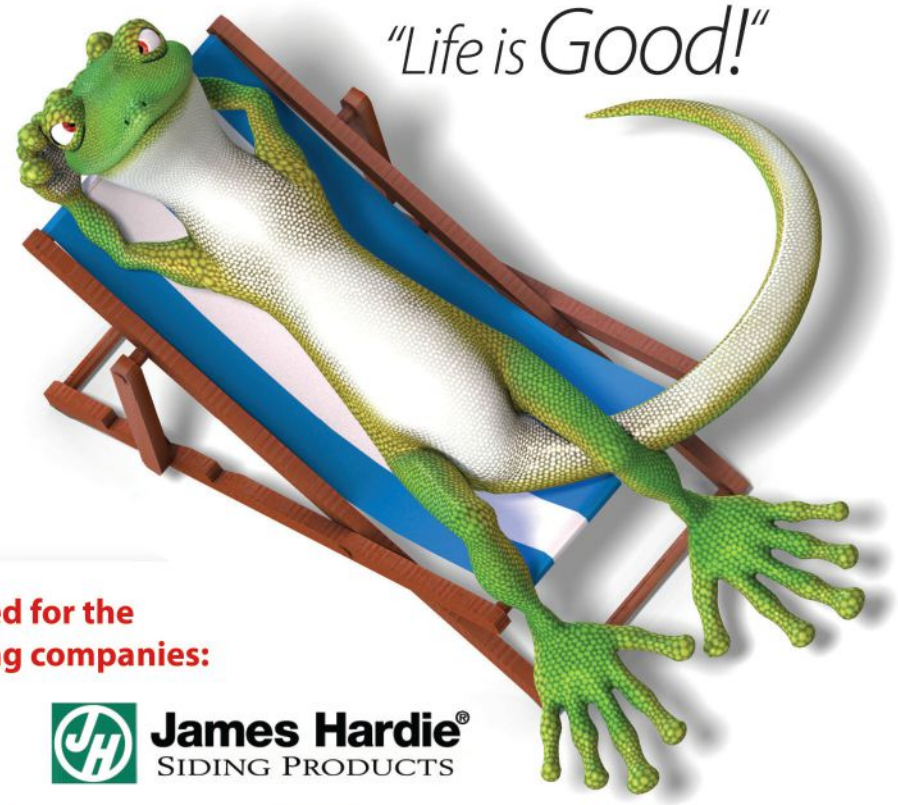

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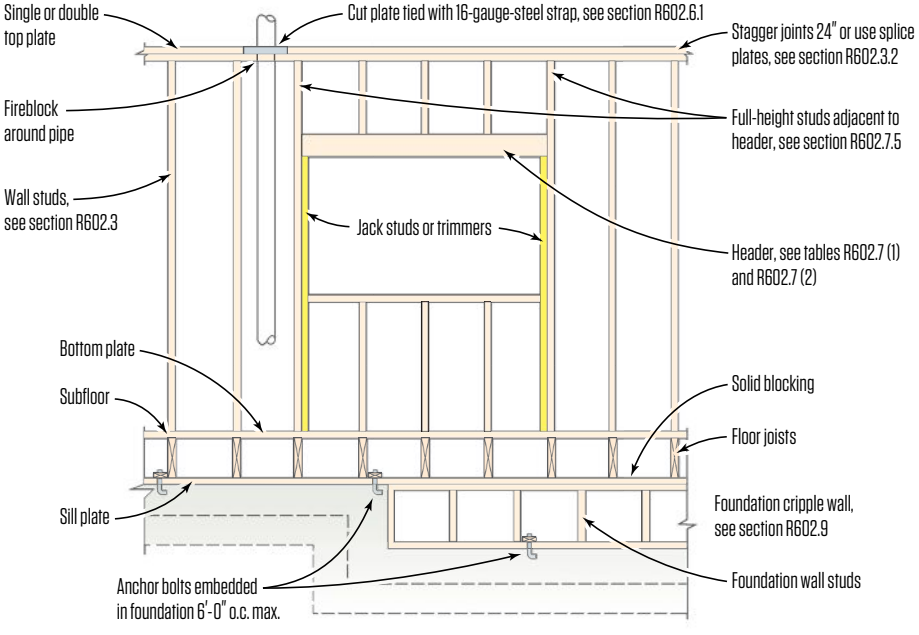
Q Is there a structural difference between full-height jacks at window openings and split jacks that fit around the rough sill?

A John Bologna, a structural engineer and president of Coastal Engineering Co., in Orleans, Mass., responds: When the jacks on a window opening are interrupted at the sill, that framing strategy is known as the "split-jack" or "split-jamb" method, and the short answer to your question is that split jacks are structurally weaker than solid jacks.

While the code does not address the issue of split jacks directly, section R602.3 Design and Construction does allude to how rough openings for windows should be framed: "Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2), or in accordance with AWC NDS." Figure R602.3(2) (re-created below) clearly shows solid jacks on either side of a framed window opening, with the sill butting into the jacks.

Most people think only in terms of the gravity load transfer—that is, floor and roof loads transmitted through the header and into the king-and-jack-stud assembly. If you've framed the walls with good kiln-dried lumber, transferring those vertical loads with split jacks should not be a problem structurally. Anecdotally, I have heard of framers who used the split-jamb method with green wood, however. When the wood shrank across its thickness, the loads from above caused the opening to rack and the windows to bind.

But a window that operates poorly is just a small part of why split jacks aren't a good idea.



Code wall framing. This illustration is how the IRC presents wall framing. While not calling out solid jacks specifically, it clearly shows the jacks running in an uninterrupted line from the header to the bottom plate, with the sill butting into the jacks on both sides.

Illustration by Tim Healey

Keep in mind that the stud wall assembly is also important for resisting lateral (wind or seismic) loads. This loading is transferred into the structural frame in two directions: longitudinally, or parallel to the wall (when acting as a shear wall), and transversely, or perpendicular to the wall, when lateral loads are applied against the wall area (as with a sail).

When you're analyzing jack requirements, this second type of loading is most relevant. In a framed wall, the studs act in concert with the cladding system, transferring horizontal wind forces into the horizontal floor and roof diaphragms. This transfer occurs in bending along the strong axis of the studs and into the deck above and below. At window and door openings, the common stud spacing is interrupted, and the wind pressure on the window is transmitted to the structural elements around all four sides of the rough opening.

On smaller openings, a single king stud and continuous jack stud are usually OK, but for larger openings, more than one king stud may be required. Think of it this way: When the common studs are removed to create an opening, king studs and jacks are asked to assume the loads that would normally be resisted by the common studs. Those loads become concentrated at the king-and-jack-stud assembly. The studs at the sides of the opening are doing the work of three or four studs missing from the opening. When jacks are split, they cannot help to resist those transverse loads, which then become concentrated mainly on the king studs.

In high-wind areas like the coast where I work, we often beef up the jack-stud assembly by installing additional king studs to form a stronger jamb assembly. In some cases, we call for engineered-lumber posts with proper connection hardware to help transfer the forces. A good rule of thumb is to add an extra stud to each jamb stud assembly for every two studs that are removed for the window. If the opening is 5 feet wide and you've taken out four studs, add two studs to the assembly on each side.

Q I recently read that wide shingles get two nails in the center as well as nails on the edges. Others say one nail in the center. Who's right?

A Chris Yerkes, a cedar-shingle installer certified by the Cedar Shake and Shingle Bureau (CSSB), and owner of Cedarworks, in Brewster, Mass., responds: The answer depends on whose guidelines you follow. If you go to the websites of both the CSSB (which has jurisdiction over red-cedar installation) and Maibec (which has white-cedar jurisdiction), you'll find

they offer slightly different guidelines for installing wide shingles.

The official guidelines from the CSSB regarding red-cedar shingles are as follows: Cedar shingles up to 10 inches (254mm) wide require two corrosion-resistant nails driven 3/4 inch (19mm) from each edge and 1 inch (25mm) above the exposure line. For shingles wider than 10 inches (254mm), drive two additional nails approximately 1 inch (25mm) apart near the center. To decrease the chance of splitting the shake or shingle, fasteners should be blunted. Siding nails should be ring- or twist-shank to improve holding. A ring-shank nail will have adequate holding power if it penetrates 3/4 inch (19mm) into the wood. Corrosion-resistant nails are needed to avoid iron stains caused by extractives in the wood and corrosion by acid rain, salt air, and the like.

On the other hand, Maibec's installation guidelines for white-cedar shingles require that two fasteners per shingle, regardless of its width, be located 3/4 inch from each edge and 1 inch above the butt line of the overlapping shingle. Fasteners must penetrate solid nailable substrate (for example, plywood) a minimum of 1/2 inch.

As you can see, the nailing strategy for wide shingles differs depending on who you ask and what material you're using. Both strategies above are ways of dealing with the same simple fact about cedar shingles, regardless of the species: Wide cedar shingles are likely to bow and crack over time. As shingles absorb moisture and give it up during normal seasonal cycles, the wood tends to expand. The wider the shingle, the greater the expansion. If a wide shingle has been nailed just along the edges, the center will bow out, creating unsightly ripples in the siding.

With repeated seasonal movement, a wide shingle will eventually crack, which can compromise the integrity of the siding. If a wide shingle is attached in the middle, the bowing might seem less pronounced, but the chances of cracking or splitting over time are the same. As contractors, we can't afford to have a dissatisfied client demanding that we rip out and replace shingles that have bowed or cracked. In addition, blending in a repair might be next to impossible, especially if the shingles are prestained.

Our strategy is simple: We avoid using any shingle that is wider than about 8 inches on the wall, period. Instead, we cull any shingles wider than that as we come across them, and set them aside to be cut for the angled shingles on dormer cheeks or along gable edges. I've had some folks suggest that I just rip wide shingles into narrower widths. But ripping wide shingles is not worth the time and effort, especially with color-stained shingles because of having to go back and paint the cut edge to meet the warranty requirement. In the last few years, Maibec has started including a separate box of "wides" with each color-stain shingle order, specifically for installation along cheeks and gables. This relatively new idea seems to work and saves us the time of having to cull wide shingles from the regular stock.

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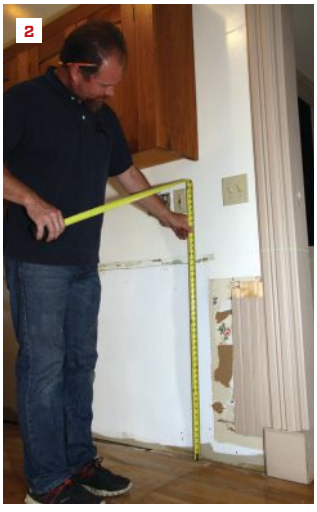

Lay of the land. Carpenter Tim Donbeck starts by marking a plumb line on the wall where he'll have a cabinet face frame or, in this case, an end panel **(1).** Next, he sets a laser level at final countertop height, accounting for appliances like dishwashers or stoves **(2)**. He checks the floor for high and low spots, as well as humps or dips along the cabinet run **(3)**. He also checks for the same issues along the front plane of the cabinet run to get a sense of how much he'll need to shim and what will happen to the toekick height once it's scribed to the floor **(4)**.

Photos by Chris Ermides

Scribing Cabinets

BY ROBERT COURTNEY

My brother, a master craftsman on my custom-home building crew, started out as a boat builder. He learned a scribing technique that involves something called a "joggle stick." It looks similar to an old-school handsaw blade—though when you lay eyes on one for the first time, you might think it's something Sasquatch would use as a back scratcher. You it use to plot a series of points on the material you're scribing. It's the perfect tool for fitting complicated shapes and round curves, like countertops into the hull of a boat. It's not that practical, however, for scribing the kick or side panel on a base cabinet in a house. For that, we employ a number of strategies, depending on whether we're retrofitting cabinets in an existing house with a finished floor or building in new construction before the floors go in.

This particular job was part of a large renovation we've been working on for months in an immaculately maintained historic Victorian in upstate New York. The cabinets were in good shape but weren't installed well (the maple countertop was 1/2 inch out of level in 8 feet).

The owner wanted us to relocate a single large base cabinet in what will become a utility room, making this is a good place to illustrate some of our basic scribing techniques. Some may think them a little crude—but I can assure you that they are both efficient and effective for a skilled craftsman; doing good work doesn't have to be elaborate or sexy. Most of the time, only a small block of wood (the fat part of a shim works well) and either a circular saw or a belt sander are all that we need. I'm sure some hipster "maker" could produce a titanium alternative, but it's not needed. For long, straight tapers on end panels or face-frame stiles where the finished edge won't be seen (wainscot will cover it on this job), we use a circular saw.

When the base will sit on a finished floor, especially if the floor is in an older home, we've found that a belt sander can't be beat for wasting away material on the cabinet bottom. We like that it provides a good amount of control and can follow even slight variations (like subtle waves) in the floor. The sander also removes a significant amount of material quickly, so it's fast. The

circular saw and belt sander were the perfect tools for this job; we could maintain high quality and accuracy but still work quickly without a lot of fuss.

Most of the time, we install custom-built cabinets in new custom homes in which our framers leave us level and plumb planes to work from and to. Scribing is fairly minimal on those jobs (we pay our framers well). When setting cabinets before the flooring will go in, we simply shim level and plumb, and then spend the most time carefully scribing where a finished edge will be visible.

Scribing face frames and end panels. To mark the scribe line, we like to use a set of dividers because they scratch the surface with a distinct line, making for an accurate scribe. General Tools (generaltools.com) and Starrett (starrett.com) make good ones. We don't often use a traditional compass and pencil if we need a very fine, precise scribe line.

We also do a fair amount of renovation and remodels on homes built in the late 1800s and early 1900s—a prevalent house type in our area. The new kitchens that we install in these older homes are often substantial in scope and call for custom-built cabinets. On those jobs, I check the floors and walls for level and plumb before I start building the cabinets (or order them, if they are coming from elsewhere), so that I can add enough "scribe" material to the toekick height and the panel and face-frame stiles. I don't get carried away here—I just give myself a fair amount of extra material (usually about 1/2 inch, sometimes 3/4 inch) to ensure, for instance, that the kick isn't too small once we level the base cabinets. I do the same on face-frame and panel stiles so that the smallest amount left will match the width of the matching stile.

Robert Courtney is a custom home builder living in Saratoga Springs, New York.

Scribing. Donbeck sets the cabinet temporarily, checking front and back for level and looking for bows in the floor **(5)**. Then he shims everything in place until it's level across the floor **(6)** and plumb down the face. Next, he scribes to fit the contour of the floor and the wall, using a pencil and a scrap of wood that matches in thickness the widest gap he shimmed (he didn't have dividers on hand for this job) **(7)**. He does the same thing along the end panel's stile and rails as well **(8)**. He likes to put tape on the surface of darker woods to better see his mark and also to help prevent tear-out.

Removing material. Once everything is marked, Donbeck removes material from the base, using a belt sander. Here, to ensure a crisp line at the floor and wall, he maneuvers the sander so he bevels slightly away from the front plane **(9)**. On finished panels like this bottom rail **(10)**, he cuts the tape and the scribe line to prevent tear-out.

For longer straight runs where the line won't be shown (this one will be covered by wainscot), he uses a circular saw outfitted with a finish blade **(11)**. When this line will be visible, he uses a power plane.

On high-end cabinets, he almost exclusively uses hand tools, and even scrapers. Reading the grain of the wood is important. When grain changes direction along the length of one board, as it can in many hardwoods, power planers and even hand planes can blow out the grain in an instant, so a scraper is often necessary. The process is more time consuming, but the result is what's most important. The author typically knows the level of cabinet when he bids the job, so he's sure to account for the extra time these types of details will take.

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Sealing a Chimney Chase

BY TED CUSHMAN

Air-sealing a flat attic and upgrading the insulation with a blanket of blown cellulose is bread-and-butter work for weatherization contractor Matt Damon and his company, Penobscot Home Performance, based in Bucksport, Maine. Among the many air leakage points Damon and his crews commonly encounter in an older Maine house is the open chase around the brick chimney. Earlier this year, *JLC* visited one of the company's jobs to see lead weatherization technician Chris Jerome seal up a chimney chase.

"Sealing penetrations in an attic is one of the most cost-effective weatherization measures," Damon told *JLC*. "These holes can cause both comfort issues and high fuel use. It's like leaving a window open year-round."

Code requires any material in contact with a masonry chimney to be noncombustible. Older codes and traditional practice also respected this rule, which is the reason that the open gaps between the attic framing and the chimney exist in the first place. To block the air pathway, the technician cut 26-gauge metal flashing to fit over the gaps and sealed the joints between the metal and the masonry chimney and the wood framing using high-temperature caulk (in this example, 3M Fire Barrier Sealant).

For large gaps that were more than 2 inches from the chimney, Jerome cut pieces of foil-faced polyiso foam and sealed them to the structure using one-part expanding adhesive foam sealant.

After the air-sealing work was complete, including wiring, vent, and plumbing penetrations throughout the attic, the attic received an R-60 blanket of blown cellulose insulation. That material is not allowed to contact the masonry chimney, so after blocking the bypass, Jerome fit pieces of 2-inch Roxul mineral-wool insulation around the chimney to isolate the masonry from the cellulose.

This attic also received a rebuilt access hatch with rigid foam insulation and weather stripping (see "A Site-Built Insulated Attic Hatch," June/17). After $1,400 worth of state and local rebates, the total cost to the homeowner was $5,300. Before the work, Damon tested the house at 4,270 CFM50 with a blower door; after sealing up the attic, that number had dropped to 2,800 CFM50. "A 35% reduction is pretty good for an attic-only weatherization project," said Damon.

Ted Cushman is a senior editor at JLC.


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4


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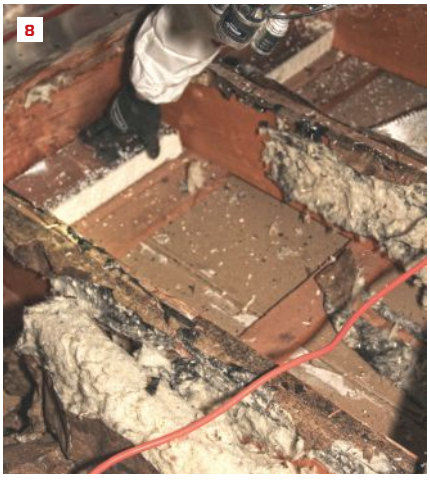

The chimney chase in this older attic communicated directly with the home's living space and basement below **(1)**. Craftsman Chris Jerome first laid a bead of high-temperature sealant on the masonry **(2)**, then used 26-gauge metal to bridge the gap between the masonry and the surrounding wood framing **(3)**. Jerome sealed the edges of the metal to the brick with sealant **(4)**. Fitting the metal to the irregular masonry and framing required some ingenuity and care **(5, 6)**.

Larger gaps that weren't in direct contact with the masonry were blocked up using foil-faced rigid foam insulation **(7, 8)**, sealed to the framing at the edges with one-component gun foam **(9)**. Once the air seal was accomplished, Jerome installed a Roxul mineral-wool-insulation barrier around the chimney **(10, 11)** to isolate the masonry from an R-60 blanket of cellulose insulation that was blown in place after all the air-sealing measures were implemented.

Photos by Ted Cushman

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BY MELANIE HODGDON

How to Identify and Analyze Profit

When building professionals talk about how their businesses are doing, they often quote sales figures. "We're already ahead of last year's sales and it's only October," they'll say. What is rarely mentioned is profit.

We can look at profit in two ways: in dollars (gross profit and net profit) or as a percentage of sales (gross margin and net margin). Let's examine both.

PROFIT IN DOLLARS

Profit can be described as whatever is left over from sales after you deduct your project costs and your overhead. Profit exists in two forms:

Gross profit is what's left over after you deduct your production costs from your income.

Net profit is what's left over after you deduct your overhead costs from your gross profit.

MARGIN

Margin refers to the percentage of sales due to profit. For a simple example, if sales are $100 and your job costs to earn the $100 are $68, that leaves you with $32 of gross profit (what's left over after your project costs are deducted from sales). The $32 of gross profit is 32% of your sales ($32 / $100), which is your gross margin.

Then you have to also deduct the costs of maintaining the company (overhead). If that's $25, the $7 left is net profit. That's equal to 7% of your sales ($7 / $100), which is your net margin.

While it's tempting to look at profit in dollars, it's more important to look at margin. Since margin is shown as a percentage, you're not likely to be confused by figures that differ each year. If the margin is going up, you're squeezing more profit out of every sales dollar. That's a good thing!

Profit in dollars, both gross profit and net profit, increased each year in the example at right. But when you look at gross margin and net margin (below right), you can see that this company's profitability declined

Profit in Dollars

	Year 1	Year 2	Year 3
Sales	$680,000	$750,000	$893,000
Job costs	$472,600	$541,985	$672,405
Gross profit	$207,400	$208,015	$220,595
Overhead	$156,897	$156,205	$168,702
Net profit	$50,503	$51,810	$51,893

Profit Margin

	Year 1	Year 2	Year 3
Sales	$680,000	$750,000	$893,000
Job costs	$472,600	$541,985	$672,405
Gross profit	$207,400	$208,015	$220,595
Gross margin	30.50%	27.74%	24.70%
Overhead	$156,897	$156,205	$168,702
Net profit	$50,503	$51,810	$51,893
Net margin	7.43%	6.91%	5.81%

For example, look at the financials in "Profit in Dollars" on the previous page. The numbers look great! After all, each year the company is showing increases in sales, gross profit, and net profit. That's what's important, right?

But what happens if we add margin figures to the same table (see "Profit Margin," previous page)? All of a sudden, it's easy to see that both gross and net margins are steadily falling. That means it's actually costing the company more, proportionately, to produce work. If this company continues the trend, it may fall into the trap of believing that it needs to sell more work (less profitably) to try to make up for dwindling profits. We call this the "Death Spiral."

Added to this downward spiral is the likelihood that as the number of projects grows, staff will need to be added in order to manage the additional jobs. This will cause overhead to spike, lowering net figures even further.

CORRECT PRICING IS THE SOLUTION

Instead of focusing on more sales, focus on selling jobs at the right price, and producing each job as efficiently as possible. You may find that if you do this, you will be able to sell fewer jobs (requiring lower management costs) at a higher profit and make a better bottom-line figure than you did when you were selling more jobs with lower pricing.

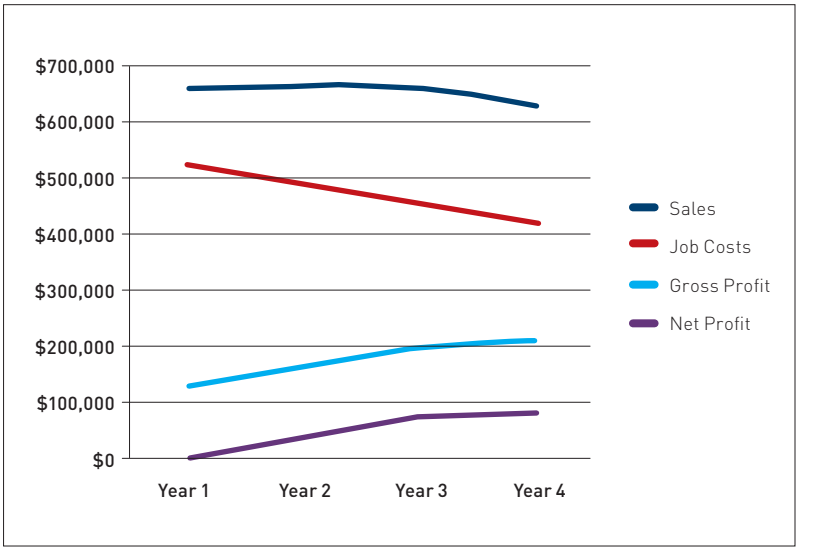
The table and graph at right show a four-year cycle during which a company's average job cost and overhead costs are consistent. Note that by increasing the markup, this company actually produced fewer jobs and lowered its total sales volume while increasing its bottom line.

Do not be enticed to try to increase your sales dollars unless you're simultaneously increasing your achieved margins. There's no point in making yourself crazy (and possibly damaging your reputation) by focusing on sales dollars. Wouldn't you rather concentrate on selling a manageable number of jobs to well-qualified prospects and sending more to your bottom line?

Melanie Hodgdon is president of Business Systems Management based in Bristol, Maine.

Effect of Increasing Markup

	Year 1	Year 2	Year 3	Year 4
Average cost per job	$35,000	$35,000	$35,000	$35,000
Markup	25%	35%	45%	50%
Target margin per job	20%	23%	31%	33%
Average sale price per job	$43,750	$47,250	$50,750	$52,500
Number of jobs sold	15	14	13	12
Total sales	$656,250	$661,500	$659,750	$630,000
Job costs	$525,000	$490,000	$455,000	$420,000
Gross profit	$131,250	$171,500	$204,750	$210,000
Gross margin (achieved)	20%	26%	31%	33%
Overhead	$125,000	$125,000	$125,000	$125,000
Net profit	$6,250	$46,500	$79,250	$85,000
Net margin (achieved)	0.95%	7.03%	12.09%	13.49%



The key is selling jobs at the right price, and this may mean increasing your markup so you are realistically covering your costs. Over a four-year cycle during which its average job cost and overhead remained consistent, this company increased profits by increasing markup. The company produced fewer jobs and lowered total sales volume, but the jobs it did produce were higher-value ones.

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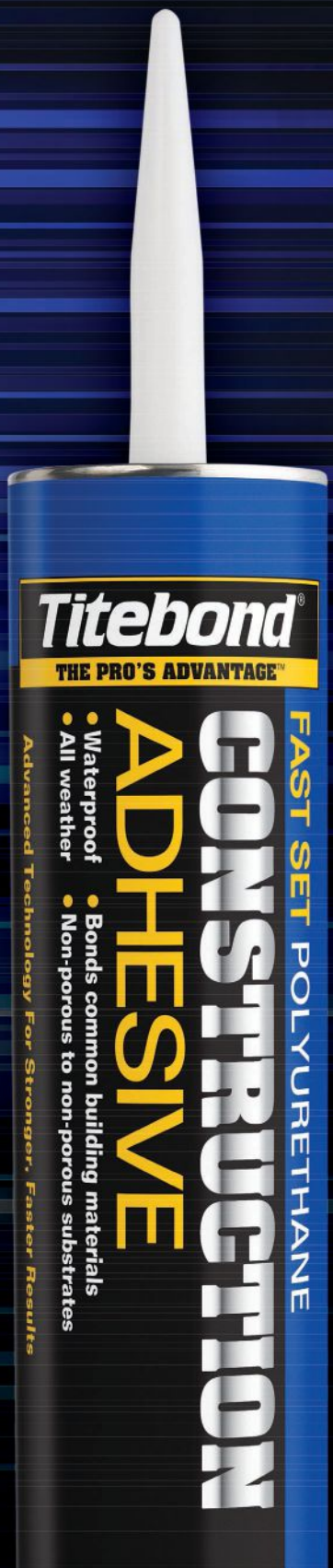

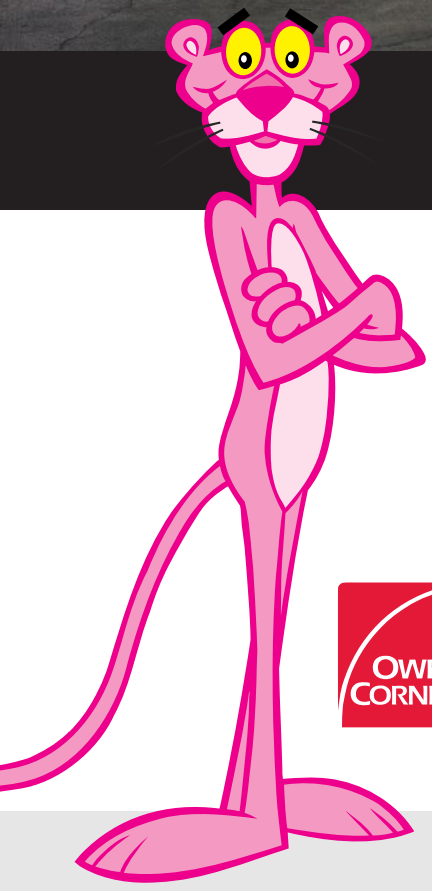

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BY CHRIS LAUMER-GIDDENS

Simple Fresh Air for Tight Houses

Airtight superinsulated homes require a reliable supply of fresh air. These days, the usual solution for providing that air is to install a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV). HRV systems, of course, transfer heat between the outgoing and incoming air streams, while ERVs have an "enthalpy core" that transfers water vapor as well as heat between the air streams. Both devices warm up the intake air during cold weather and cool it down during warm weather, to reduce the load on the HVAC system.

But a state-of-the-art HRV or ERV comes with a hefty price tag. And depending on the climate and the heating and cooling needs of the house, the savings on space conditioning energy may not justify the cost of installing an ERV—or perhaps even the cost of operating it.

My company has installed many ERV systems, and we've recommended an ERV for dozens of homes. But ERVs are not the only way to bring fresh air into a house, and recently we've had very good success with a simpler (and less expensive) strategy. We use a semi-conditioned space such

An encapsulated, semi-conditioned attic houses the mechanicals for one of the author's high-performance homes. A fan-powered fresh-air intake draws in a continuous 20 to 30 cfm. Below that, a five-zone air handler distributes conditioned air to occupied rooms below. Behind the sloping kitchen exhaust duct is a makeup air intake, which opens whenever the kitchen exhaust vent downstairs creates a negative pressure.

Photos by Chris Laumer-Giddens

Here's a closer look at the home's air intake ports: a fan-powered inlet that supplies continuous fresh air **(2)** and a makeup-air inlet with a weighted passive damper that opens only if exhaust vent fans depressurize the house **(3)**.

as an encapsulated attic or a basement mechanical room to act as a large "buffer zone" for a small, controlled amount of continuously supplied incoming fresh air. Makeup air for kitchen and bath exhaust fans also is brought into this buffer space as needed. The fresh air mixes with the semi-conditioned air already in the space, then is drawn into the HVAC equipment for conditioning and distributed to the home's living space through the HVAC system's supply ducts. This solution has proven to work quite well, and its initial cost as well as its power requirements are lower than for an ERV.

INTAKE AND DISTRIBUTION

The photos in this article show the equipment we installed several years ago in our extremely tight (0.47 Ach50), PV-equipped, net-zero "High Performance Bungalow" near Atlanta, where the setup we devised has been performing beautifully for several years.

The home's very low heating and cooling requirements are easily handled by a 2.5-ton ducted Daikin SkyAir minisplit heat pump with a heating capacity of 34,000 Btu per hour and a cooling capacity of 30,000 Btu per hour. We paired the heat pump with Daikin's five-zone DZK zoning kit, which allows independent thermostatic control of five zones (Daikin also makes a four-zone and a six-zone version of this same device).

The minisplit's air handler circulates air through the home 24 hours a day. The variable refrigerant flow (VRF) heat-pump system has an inverter compressor in the outdoor unit that varies the power consumption and output, and the indoor air handler has a linear expansion valve that also varies the amount of refrigerant entering the coil, to satisfy the instantaneous demand. The system efficiently supplies just a trickle of heating and cooling as needed by any of the five zones. The continuously operating, quiet, and efficient fan is well suited for the distribution of fresh air.

We bring that fresh air into the house with two independently operating intakes located in the buffer space. A Fantech FR-125 inline fan with a 4-inch duct serves one intake vent, controlled by a Fantech switch in the laundry room on the main level. The fan can move as much as 200 cubic feet per minute (cfm), but we initially set it to 20 or 30 cfm and advise the homeowner to keep it there.

The continuous stream of fresh air drawn in by this fan is dumped directly into the attic, where it is tempered and preconditioned by mixing with air in the space. Then the air is drawn into the open return side of the air handler (located just a few feet away from the inlet) and distributed via the air handler to the occupied rooms in the house below.

The other intake vent provides makeup air as needed for the 400-cfm kitchen range exhaust vent. This intake is connected to a 10-inch Broan barometric damper, which opens whenever there's negative pressure in the house. A lever with a counterweight allows the damper to open only as far as needed to provide the volume of air that the range hood needs. Again, the outdoor air moves first into the semi-conditioned buffer space, where it mixes with return air that is coming from conditioned rooms in the house through a series of large jumper ducts in the ceiling of each bedroom (see photo 4, facing page) and through louvered doors that separate the attic and the conditioned space. Should there happen to be another source of makeup air (such as an open window), the range hood might not depressurize the house; in that case, the damper stays closed.

When the kitchen exhaust is running for typical short durations, most of the air entering the kitchen will be tempered air that has already mixed with other attic air, rather than hot or cold air drawn directly from outside, so the kitchen doesn't get a direct, harsh blast of outdoor air. Most of the air drawn into the attic through the dampered vent will end up being conditioned by the minisplit and distributed into the rooms of the house via the air handler and its five supply ducts.

KEEPING CONTROLS SIMPLE

Our solution is mechanically simple. Another advantage to this approach is that it's "dumb" for the user—homeowners have no

difficulty understanding it or operating it. We don't give the owners control over bath exhaust vents—the Panasonic bath fans are set to run continuously at a low level and to boost for a few minutes whenever the occupancy sensor indicates that the bathroom is in use. That way, they don't have to think about it.

The owners are in charge of the kitchen range hood's exhaust vent; we emphasize to all our clients the importance of using their range hood fan every time they cook, and they seem to do that religiously. But they don't have to think about the makeup air when they're cooking; the intake vent opens and closes on its own and has no power requirement.

The owners also can adjust the air volume supplied by the continuous intake vent fan to satisfy their own comfort needs. If a house is full of guests and their pets, for instance, it's easy for the owners to boost that fresh air supply. We didn't want to automate that; in our view, the owners best know how much fresh air they need and want from one day to the next.

At full power, the intake fan by itself would supply two or three times as much air as specified by ASHRAE 62.2, the industry standard for ventilation. But realistically, the building's operable windows and doors let in a lot of fresh air during the occupants' normal daily activities. So far, the homeowners have been happy to keep the intake fan at its initial 20-cfm setting.

For an off-the-grid project (currently under construction) that we designed in the North Carolina mountains, we needed to provide a greater degree of flexibility. The owners of that house expect to often have gatherings of 20 or more guests, and they want to be able to boost their fresh air supply fan accordingly. To simplify the controls for that house, we're having a custom plate made for the twist dial that controls the intake air fan, indicating not the cfm of the fan, but the number of people in the house. That way, the owners can simply set the fan according to the number of guests: two people, five people, 10 people, and so on.

MONITORING PERFORMANCE

When we first started to use this method for fresh air supply, we recognized that it was an original approach, and we wanted to be careful about measuring and documenting the results. So in our "High Performance Bungalow," we installed sensors in the attic and throughout the house to record the levels of volatile organic compounds (VOCs), the concentrations of fine particulates (PM2.5), the relative and absolute humidity, the dew point, and the temperature. We monitor carbon monoxide levels with a device called the "Defender," which would notify us if CO levels were to spike even a tiny amount, and we track the system's energy consumption. After three years of occupancy, we've established that air quality in the home has been right on target, and that the system uses very little energy and adds very little to the home's heating and cooling loads. We also keep an eye on the H2 ("Happy Homeowner") sensor, and those readings have been maxed out at "Extremely."

Architect and builder Chris Laumer-Giddens is a principal in LG Squared, in Atlanta.

A large jump duct in the attic floor allows free airflow between each bedroom and the buffer space for pressure relief **(4)**. A heat-pump water heater **(5)** recovers latent heat from the indrawn air, helping to dehumidify the space as it heats water.

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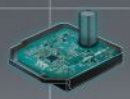

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- 0°- 53° bevel capacity with positive stops at 22.5°, 45°, and 53°

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- Two batteries deliver maximum power, speed and run time
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XCV04Z*
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XCV06Z*
18V X2 LXT® (36V) BRUSHLESS
2.1 GALLON WET/DRY VACUUM

HEPA filter

XCV07ZX*
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HEPA FILTER DRY DUST EXTRACTOR

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A SERIES OF PROTECTIVE SEALS INSIDE THE TOOL THAT CHANNEL WATER, DUST AND DEBRIS AWAY FROM INTERNAL COMPONENTS

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XBU02PT / XBU02Z*

18V X2 (36V) LXT®
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- Sound pressure rating of 60.2 dB(A); measured per ANSI B 175.2 standard
- 6-stage air velocity/volume selection dial with variable speed control trigger
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DELIVERS UP TO 28 MINUTES OF RUN TIME AT MID-SPEED (15,800 RPM)
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UP TO **60 MIN**
OF RUN TIME
UNDER LOAD ON LOW SPEED
with two 5.0Ah batteries

BRUSHLESS X2 18V + 18V 36V

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XRU09PT / XRU09Z*

18V X2 (36V) LXT®
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XRU09PT/Z

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2-PC. COMBO KIT AND GRINDER

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NEW

XUC01PTX1 / XUC01X1*
18V X2 LXT® BRUSHLESS
POWER-ASSISTED WHEELBARROW KIT

NEW

XUC01PTX2 / XUC01X2*
18V X2 LXT® BRUSHLESS
POWER-ASSISTED FLAT DOLLY KIT

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IMPACT DRIVER KIT

NEW
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1/2" HAMMER DRIVER-DRILL KIT

COMING SOON!

NEW
XWT12RB / XWT12ZB*
18V LXT® SUB-COMPACT BRUSHLESS
3/8" IMPACT WRENCH KIT

NEW
XRM08B
18V LXT® / 12V max CXT™
BLUETOOTH® JOB SITE SPEAKER

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ONLY 10-3/4" LONG & WEIGHS 4.6 LBS.

(w/ 2.0Ah battery)

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OPTION 1 — SPECIFIED EXPOSURE CONTROL METHODS

Employer is required to implement the engineering controls and respiratory protection specified for the tasks on "Table 1" of the OSHA Silica Rule.

LXT X2 18V + 18V 36V

XCV04Z

Xtract Vac Auto-Filter Cleaning System

VC4710

XCV04Z and VC4710 Dust Extractors / Vacuums meet Option 1 Specified Exposure Control Methods when the specified equipment is properly used in accordance with the manufacturer's instruction.

OPTION 2 — PERFORMANCE (OBJECTIVE DATA) OPTION

Employer may rely on objective data from Makita® providing evidence that the exposure level is below the permissible exposure limit when task is performed under the conditions tested by Makita®.

HEPA filter

XRH011X shown with DX01

LXT BRUSHLESS

XRH011TX

HEPA filter

HR2661 shown with 135905-6

HR2661
HR2651

HEPA filter

LXT BRUSHLESS

XCV05Z

XRH011X / XRH01ZVX / XRH011TX and XCV05Z / ZX / PT Dust Extractors/Vacuums meet Option 2 (Objective Data) when used under the conditions tested by Makita®. To see the test details and results, go to **makitatools.com/dustmanagement**.

PURSUANT TO OPTION 2, MAKITA HAS PERFORMED TESTING AND PRODUCED OBJECTIVE DATA OF THE APPLICATIONS DETAILED BELOW:

APPLICATION	DUST EXTRACTOR	TESTED TOOL	AIR VOLUME	APPLICATION DIMENSION	FILTER EFFICIENCY
SDS-Plus Drilling	DX01	XRH01Z	12.3 CFM	5/8" diameter x 2" depth	Greater than 99%
	XCV05Z	XRH03Z, XRH04Z, XRH05Z, XRH06Z, RH01Z, HR2475, HR2641, HR2811F	53 CFM	5/8" diameter x 2" depth	Greater than 99%
	135905-6	HR2661, HR2651	–	5/8" diameter x 2" depth	Greater than 99%
7" Grinding/ Surfacing	VC4710	GA7011C, GA7040S, GA9040S	135 CFM	7" Diamond Cup Wheel	Greater than 99%

A SOLUTION FOR ALL YOUR APPLICATIONS

KEY MAKITA DUST ATTACHMENTS LISTED IN OPTION 1 SPECIFIED CONTROL METHODS

DRILLING

193472-7 shown

CHIPPING/DEMOLITION

196571-4 shown

SURFACING

195386-6 shown 195236-5 shown

CUTTING/TUCK POINTING

196846-1 shown

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Speedymason Experience the Thin Brick Revolution
surefire local Marketing Cloud
Tamlyn
Velux Skylights
Windsor Windows & Doors A Woodgrain Millwork Company

hanley wood

Kitchen Lighting Design

Strategies for creating a functional and beautiful space

BY CAROLYN ANDERSON

When you ask architects and builders to design lighting for a kitchen, many will simply pencil in rows of downlights around the perimeter of the room. While this approach may cost less and be easier to install, it probably won't serve the client's needs well. Today's kitchens serve multiple functions, everything from preparing meals to entertaining friends around the island. Meeting those diverse needs requires a layered lighting plan. In addition, well-planned kitchen lighting is safer and can save electricity. And good kitchen lighting doesn't have to break the budget.

There are three basic levels of lighting to consider in a kitchen—ambient, task, and accent—and each serves a different purpose. There are many options for each level; for the most pleasing and effective light, the choices should reflect the architecture of the house and the style of your client.

The brightness and color for all kitchen lighting is as important as placement of the fixtures. I recommend using dimmable, energy-efficient LED bulbs that are 2,700K to 3,000K in color temperature everywhere in a kitchen. These bulbs emanate warmth. I never use bulbs above 3,000K and always try to steer clear of fluorescent bulbs—even CFLs. They don't provide good-quality light and they're toxic when broken. Check the lumens on the bulb packaging for the equivalence to incandescent bulbs.

AMBIENT LIGHT

Ambient light is the general lighting for the entire kitchen space, and it should closely mimic the natural daytime light in the room. When choosing ambient light sources for a kitchen, consider the kitchen size and ceiling height. The bigger the kitchen and the higher the ceiling, the more ambient light output is required,

Photos 1, 4, 6, 8, 9 by Carolyn Anderson; all others by Roe Osborn

which usually means that more fixtures will be needed.

Fixtures for providing ambient light can vary, and different sources can be combined to create a pleasing balance. The important thing is to avoid creating dead zones—areas that are dim, with little or no light. At the same time, be conscious of creating hot spots where light from multiple sources overlaps and creates an overly bright area. Here are some typical sources for ambient lighting.

Recessed downlights are the most common choice for ambient kitchen lighting. They're the most effective type of lighting, although in small kitchens, they should be used judiciously. Recessed downlights are typically spaced 4 to 5 feet apart, either on a grid or in a line depending on the kitchen layout and ceiling height **(1)**.

Be aware that recessed downlights often serve double-duty as task lighting. So positioning of these lights above counters and cabinets is critical (more on this later, in the discussion of task lighting). If downlights are the only ambient light sources, 6-inch-diameter fixtures that have a wider spread of light are the best choice.

Ceiling-mount fixtures come in either flush-mount models that attach directly to the ceiling or semi-flush-mount models that drop a short distance below the ceiling. Either type is a good choice for an older, smaller kitchen with a low ceiling. In such a kitchen, a single flush-mount fixture can be placed centrally; or two fixtures can divide a larger kitchen into thirds.

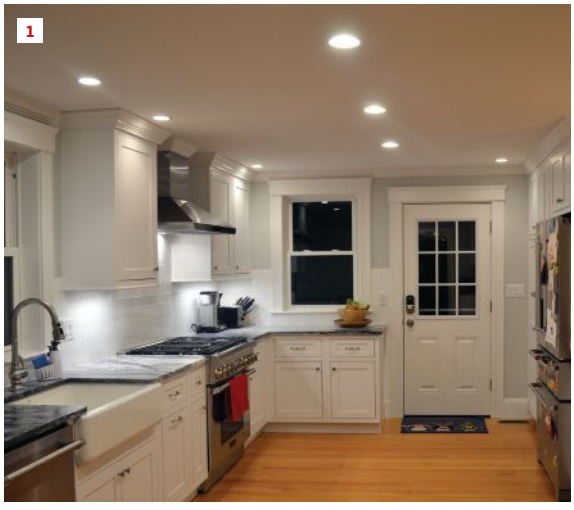
These fixtures can also work well when supplemented by other light sources, such as pendants over an island or peninsula. In a home with low ceilings (7 to 7½ feet), ceiling-mount fixtures can provide more comfortable light than downlights. These fixtures typically have translucent lenses or glass shades that diffuse the light throughout a room. Downlights, on the other hand, direct a more concentrated cone of light downward and tend to create uneven light in kitchens with low ceilings.

The lower positioning of semi-flush-mount fixtures lets more light reflect from the ceiling, but they work better with slightly higher ceilings because they hang down lower than flush mounts.

Chandeliers and pendants. For two-story, tray, cathedral, or pitched ceilings that are 10 or more feet high, chandeliers and pendants can provide effective ambient light. These fixtures bring light down to a more human scale in rooms with high ceilings and are often used to supplement other light sources **(2)**. In addition to providing light, pendants and chandeliers can be a focal point in an otherwise simple design.

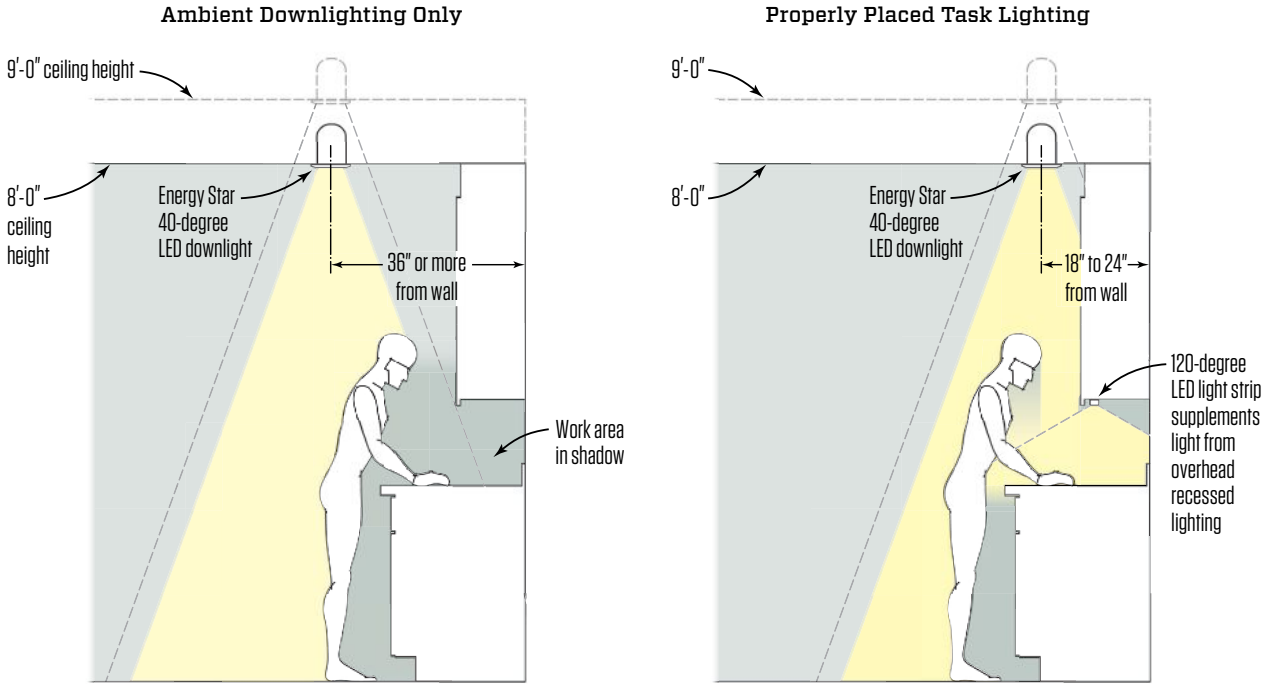
For small kitchens, a single fixture may be enough, especially if supplementing downlights. If the kitchen is very large, two or more fixtures work well in areas such as over a large island **(3)**. When multiple pendants are used for ambient lighting, they should be no less than 6 feet apart and no less than 6 feet from any structure such as a wall or upper cabinet. The bottom of pendants and chandeliers should be at least 7 feet above the floor so they don't block views, and they should be controlled with a dimmer to be effective for ambient lighting. The output of these lights should be between 100W to 250W equivalent, bright enough to light the kitchen when it's entered.

Wall sconces. When kitchens have free wall space, wall sconces can provide visual relief from overhead lighting and provide



Recessed downlights are a common option for ambient kitchen lighting **(1)**. A flush-mount light in the center of the kitchen can work in concert with pendants over a peninsula **(2)**, or pendants above an island can provide ambient light on their own **(3)**.

Fixture Placement for Task Lighting



The illustration on the left shows the all-too-frequent poor placement of stand-alone ambient downlighting in a kitchen. In this scenario, the person working at the counter casts a shadow over the work area. On the right, downlights placed much closer to the wall light up the work area and are supplemented with under-cabinet lights to provide effective task lighting.

pleasant ambient light in the kitchen. Place sconces that are oriented downward at a height of 6½ feet (assuming a ceiling that is 8 feet or higher). Upward-oriented sconces can be placed at a 6-foot height. Sconces don't need a lot of light output to be effective, so use a 60W equivalent bulb.

TASK LIGHTING

As the name suggests, task lighting ensures ample, focused light where it is needed for working. Most of my clients love to cook. When you're working with older clients with older eyes, adequate lighting for kitchen workspaces is also a safety factor, because of the range of sharp implements used for many kitchen tasks.

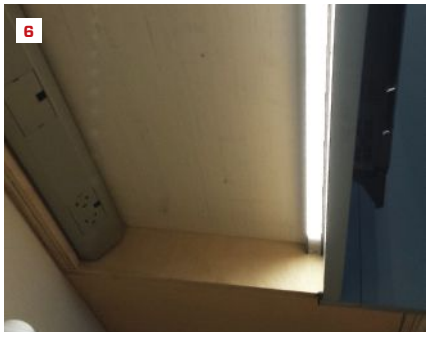
Recessed downlights. Earlier, I said that attention should be paid to the placement of recessed downlights that are used for task lighting. These fixtures should be placed 18 to 24 inches out from the wall to minimize shadows on countertops created by an overhead light behind the person working there (see Fixture Placement for Task Lighting, above). This placement means that with 12-inch-deep wall cabinets, the downlight fixtures should be just 6 to 12 inches from the face of the cabinet **(4)**.

If they are more than 7 feet high and project out far enough, soffits above cabinets are a good place for recessed downlighting **(5)**. And if the cabinets are white or light-colored, the reflected light from the cabinet faces will enhance the task lighting. I typically use 4-inch downlights for task lighting because they produce a more focused beam of light than the 6-inch fixtures I use for ambient light.

Fixture spacing should be a function of the ceiling height. The higher the ceiling or soffit, the farther apart the fixtures can be, but higher output is needed with the light source farther from the work surface. That said, I usually center lights on upper cabinets so the fixtures light the interior when the doors are open. Just make sure that the cones of illumination light the work surface evenly.

Under-cabinet lighting. Though recessed downlights can offer adequate task lighting by themselves, they work best in concert with under-cabinet lighting, which puts a light source below the upper cabinets, where small appliances and cooking implements are often stored and where food is placed as meals are prepared.

The under-cabinet fluorescent fixtures of 20 years ago have been replaced by low-profile dimmable LED strip lights that create pleasing, warm-colored lighting. Whenever possible, I specify upper cabinets with a light rail (a 2-inch addition to the lower face frame), with the light strips directly behind the rail **(6)**. The fixtures I prefer are 1 inch wide and only ½ inch deep so they aren't visible to someone sitting in the kitchen. Be sure that they provide a minimum



Downlights are placed in front of the cabinets in the ceiling **(4)** or in soffits **(5)** for task lighting. Under-cabinet lights hide behind a light rail **(6)**. Sconces are a good over-sink option **(7)**. Magnetic switches can activate lights in dedicated-use cabinets **(8)**.

of 60W equivalent light per cabinet. For corner cabinets, I often use a single puck light instead of a strip, also with 60W equivalent.

Pendant task lighting. Peninsulas and islands often offer the largest work surfaces in a kitchen, and many islands have prep sinks. Pendant lights in these areas can be a single fixture or multiple ones, or multiple lights suspended from a single bar. Pendants for task lighting should be 30 to 36 inches above the countertop height (66 to 72 inches off the floor) to avoid blocking the view. They should be placed 24 to 30 inches apart, with each light providing a minimum output of 75W equivalent.

Pendants come in a variety of styles and prices. These fixtures are often a distinct design feature, so be careful that they blend with the style of the kitchen. If you're using chandeliers or pendants for ambient light in the kitchen, avoid replicating this type of lighting over an island or peninsula, to prevent visual competition in your design. If the kitchen opens into the dining area, make sure the fixtures in both rooms relate to each other in shape, finish, or style.

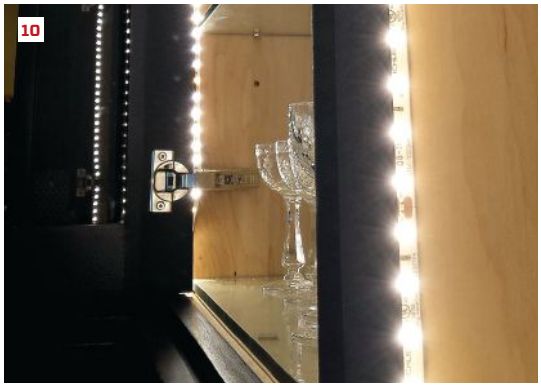
Over-sink lighting. For safety reasons, task lighting over the sink is essential and should never be overlooked or skimped on. A 4-inch downlight, a pendant (12 inches out from the wall), or a sconce over a window can serve this purpose equally well **(7)**. 60W equivalent is fine here.

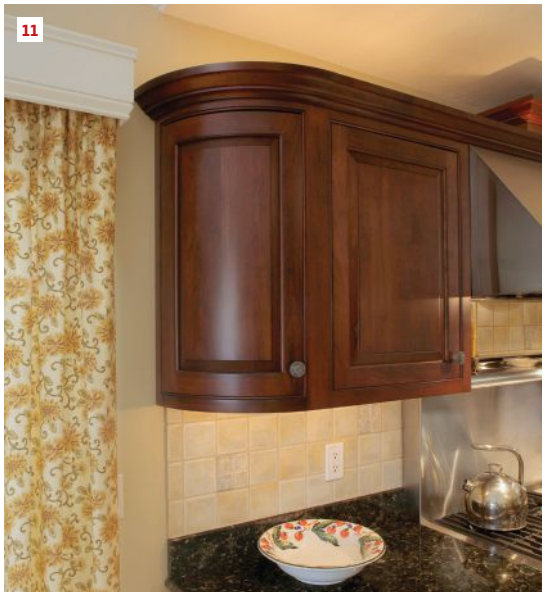
Walk-in pantry. If there's a walk-in pantry in your kitchen project, place a downlight or flush-mount light in the pantry, controlled with a jamb switch or motion sensor. When a homeowner dashes into the pantry in the middle of preparing a meal, good lighting makes it much easier to find things. The cost for the fixture and switch is minimal, and a 60W equivalent should do the trick.

Motion-sensor drawer and cabinet lighting. For high-end kitchens or for clients with limited vision, motion sensors or magnetic switches for certain drawers and cabinets can provide extra light in places that are not usually well lit, or where extra light might be helpful for finding a small item (a typical junk drawer comes to mind). This type of lighting is also helpful for a dedicated charging station for mobile devices in a drawer or cabinet **(8)**. A sensor switch automatically turns the light on when the drawer or cabinet door is pulled open. These applications don't require bright light; because of its low profile, an LED light strip usually works well.

ACCENT LIGHTING

The third level of kitchen lighting, accent lighting, provides depth to your design and can highlight architectural details or the homeowner's special objects. It can also provide low-lighting for a kitchen after the work is done.





Lighted glass-front cabinets show off glassware **(9)**. Light tape mounts behind a cabinet face frame **(10)** and glass shelves let light shine through to more than one level. Uplighting above cabinets creates a different accent light in the kitchen **(11)**.

Glass-cabinet lighting. Homeowners often ask for glass panels in upper cabinets to display their finer glassware and china or their favorite ceramic objects while keeping them in a safe, clean environment **(9)**. Interior cabinet lighting lends depth and dimension to cabinetry, while what is shown inside adds texture and interest to the kitchen design.

For this application, dimmable LED light tape or puck lights provide light inside and at the front of a glass-paneled cabinet. If the cabinets have face frames, light tape can be mounted behind the frame to direct the light back into the cabinet **(10)**. For box-style cabinets without face frames, puck lights are the best option. For cabinets 36 or more inches wide, use two pucks to cast light onto, and not behind, the objects inside. Installed one-third of the depth into the cabinet, these fixtures cast light on the items inside.

Use glass shelving so the lights shine through to more than one level. Light levels for glass cabinets should be standard output for light tape and no more than 60W equivalent on the puck light.

Open shelves and uplighting. Lighting on open shelves is a nice feature and makes it easier to find things on them. As with under-cabinet lighting, adding a stiffener that is at least 1 1/2 inches wide to the shelf face lets you hide the light tape behind it. Another nice accent in kitchens with high ceilings is uplighting over cabinets **(11)**; light strips can be placed against the wall to wash it with light and accent the height of the ceiling. Standard-output light tape can be used for open shelving, but high-output light strips work better above cabinets and light more of the ceiling.

CIRCUITS AND SWITCHES

Deciding which group or groups of lights will be governed by which switches and strategically locating those switches can make or break a lighting design. As you determine the circuits in the kitchen, always work with a licensed electrician to be sure that the circuit can handle everything you want to put on it, and that it's physically possible to wire the circuits the way you envision, especially in a remodel.

When establishing circuits for a kitchen, I try to err on the side of too many circuits rather than not enough. I start by putting the ambient light on its own circuit. When you walk into a kitchen from any direction, it should be the first switch you reach for. Pendants over a peninsula or an island should also be on their own circuit. These lights can serve multiple functions, so you may want them at a low level while task lighting over the counters is much brighter.

Whenever possible, I put recessed task lighting over counters on its own circuit. For large kitchens with workspaces in separate parts of the kitchen, I often put each area on a separate circuit. If the kitchen has recessed lighting above an island or a peninsula that will be used primarily as task lighting, I may combine it with the countertop lights if the circuiting allows.

I put under-cabinet lights on their own circuit and try to locate the switches for these lights near their point of use so they can be turned on easily as work begins. The light over the sink should also be on its own circuit so it can be as bright as it needs to be for washing food or cleaning up.

Accent lighting can be on a dedicated single circuit so all of the accent lights turn on together. This provides balanced light when used alone. Lights controlled by motion sensors or magnetic switches, such as in pantry areas or a dedicated-use cabinet, can be on the same circuit, as they are activated individually.

Switch locations. The one circuit that should be switched at every entry is the ambient lighting circuit **(12)**. When you walk into a kitchen from any location, you need to turn on lighting to safely enter the room. Work with your clients to determine the entry or entries they are apt to use most commonly. Place switches for the overhead task lighting at these locations. Gang the switches for the sink light and the under-cabinet lights in the same box within easy reach of the sink **(13)**. I like to put a switch for the pendants close to the island or peninsula, although a three-way switch at the most common entry is often an appreciated addition.

I find that multiple switch locations for controlling the accent lighting circuits aren't necessary. Single switches for those circuits can be at the most commonly used entry.

Don't skimp on dimmers. When the kitchen budget is tight, one of the first things clients scratch off the list is dimmer switches. Dimmer switches—especially those designed to control LED bulbs—can cost four or five times what regular switches cost, so it seems like a logical target for reducing costs. But dimmer switches are something that I insist be included in every project.

Dimmers allow you to tune in the amount of light in one area or for a particular situation. For example, the amount of ambient light desired might be different for entertaining guests in the kitchen than for doing homework at the island. If people in the household have vision problems, the dimmer switch will allow them to dial up the task lighting to compensate, or lower it if their eyes are sensitive to light. Lowering light levels when not needed also saves energy and money. At these times, a dimmer switch will be worth every cent.

When possible, have the electrician put all the dimmers in one group of switches **(14)**. This keeps things simple for the homeowner, especially when multiple switches are placed around the kitchen to control the circuits. I also have the electrician line up switches in terms of most common use: Ambient lighting always on the first switch, then task lighting, and then accent or specialty lighting.

High-tech controls. No discussion of kitchen lighting in this day and age would be complete without mentioning the specialty switches and controls on the market. The topic is worthy of an article all by itself. Whether or not your clients are tech-savvy, kitchen lighting systems should be designed for conversion to specialty controls at some point in the future. These control options include wireless ones where a single hand-held device can control all the lighting, window and skylight shades, as well as HVAC and individual appliances in the kitchen. It's a good idea to stay on top of these innovations and to use an electrician who knows how to incorporate them into the wiring plan.

Carolyn Anderson, an interior designer in Asheville, N.C., who specializes in kitchens and baths, has been specifying lighting for kitchens for more than 25 years (carolynandersondesign.com).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In a bank of switches at the entry to a kitchen, the first switch should always control the ambient lighting **(12)**. Switches near the sink control over-sink lights, while adjacent switches are for under-cabinet lights **(13)**. Keep dimmers together, if possible **(14)**.

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Whole-House Liquid Air-Sealing

A new method for air-sealing the shell

BY TERRY NORDBYE

I am an air-sealing specialist, and I work with architects and contractors to help them make their buildings tighter. Air-sealing is a relatively new skill in the building world.

Currently, the most common go-to air-sealing material is canned, or gunned, foam. It's fast and fun to use and it looks like it's doing something. But it's not the best product for air-sealing. The goal is not just visual evidence of air-sealing; the goal is comprehensive air-sealing that will last a long time.

Adhesion, flexibility, and durability are what we need in a good sealant material. Through years of testing and dissecting old foam seal work, I have found canned foam scores only "good" to "poor." In terms of adhesion and elongation, canned foam and gunned foam do not perform as well as tapes or elastomeric compounds, caulk, and various sealants. The cellular structure of foam is full of potential holes. Probably worst of all, foam gives installers a false sense of "well done," when in fact it is subject to poor installation.

As some readers may remember from my previous article ("Air-Sealing Without Foam," May/13), I've been looking for an alternative to canned foam for a while. When I wrote that article, some tapes and caulks were the only available materials for creating an effective air seal—materials that would adhere well, stay flexible, and remain durable. But while tapes and caulks might perform better than canned foam, they can be labor intensive, costly, and slow.

Three years ago, I set out to find, or invent, an air sealant to match the speed of canned foam but with the reliable performance of other air sealants. My goal was to make a first-class air sealant suitable and affordable for any house in the U.S.

After years of messing around with different formulas and applicators, I came up with one system that will air-seal most leaks

Working from the inside, the author probed with a strap tie to reveal the worst leaks in the house at the bottom plates **(1)**. At one place, where an exterior door was being replaced, the complete path of the air leaking into the wall cavity is revealed **(2)**. During an early blower-door test, the air flowing through this outlet and from the crack at the base of the wall gushed air **(3)**.

that come up in new or retrofit work. It is fast and nontoxic, works for all leak types, and emits no VOCs. It is a rubberized latex (elastomeric) mixed with fibered granules and sprayed onto surfaces with a texture gun.

In this article, I'll demonstrate how this new sealant works. On the particular job shown here, using entirely my formula, I'm air-sealing a classic 2,000-square-foot stucco ranch built in 1979 in climate zone 3.

MULTIPLE LEAKAGE PATHWAYS

There are many ways air can leak in and out of a building. In this house, almost every switch and outlet box leaked air during a blower-door test, as did much of the baseboard and penetrations through the floor into the crawlspace. But the source of the greatest leakage was at the top and bottom plates.

The stucco was to remain, so we had limited access to seal the bottom-plate leaks at their source. Partial demo gave me insights into how the house leaked and ideas on how I might shut off the leaks. For example, along part of the exterior wall, we were able to slip a 16-gauge Simpson strap 7 inches behind the bottom plate shown in the photo above **(1)**; it exited outdoors between the stucco and framing. This gap provided an easy path for air leakage. Elsewhere, a section of stucco was removed for a new door, revealing the exact pathway of this bottom plate leakage: air flowed behind the weep screed, between the building paper and the plate, and into the wall cavity **(2)**.

In another area, I was able to slip a pruning saw under the bottom plate to reach the back of the stucco, which directly connected to the exterior. During a blower-door test, I held my hand 6 inches away from the outlet and the bottom plate **(3)** and could feel air coming out.

The photos and captions on the pages that follow describe how I implemented what I put in the proposal, and what the owner agreed to pay for, to correct these and other leaks.

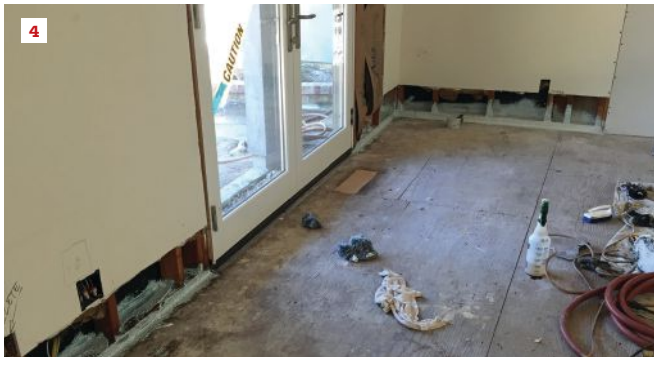
BOTTOM PLATE AND FLOOR LEAKAGE

Working from the inside, we RotoZipped a 12-inch strip of drywall off the entire bottom of the drywall along the exterior walls and a few interior walls loaded with bottom plate punctures **(4)**. We sprayed the elastomeric along the bottom plate sections, and then went back over the sprayed areas with a 2-inch brush to touch up any areas we missed **(5)**.

Using a hand-held hopper and gun, we are able to move quickly, covering nail plates, copper pipes, and the framing plates with a flexible seal in about 30 seconds **(6)**. The stuff goes on milky and dries clear **(7)**.

Leaks low on the building included penetrations through the floor that pulled air up from the crawlspace because of stack effect **(8)**.

Leaks through a plywood subfloor with gaps and holes also pulled crawlspace air inside. Here in the living room, where the floor is to be covered with carpet, we applied a flexible, airtight coating, 1mm to 2mm (one to two dimes) thick **(9)**. This took about five to six seconds per foot.



TOP PLATE AND ATTIC LEAKS

Because of the forces of stack effect, air leaks through the attic pull conditioned air out of the home. Sealing the attic has an enormous impact on indoor thermal comfort, as well as noticeable reductions in heating and cooling.

On this house we got lucky: It needed a new roof, so I had the rare opportunity to access some of the difficult attic air-sealing areas from the roof **(10)**. It took 35 minutes to cover 70 linear feet of top plate.

Before we sealed with elastomeric, big wiring holes were stuffed with fiberglass to prevent material from flowing through them **(11)**.

The attic **(12)** had 59 light cans, 410 linear feet of top plates, 57 wire holes, six plastic pipes, three fan boxes, and two metal pipes—all punctures through the ceiling. Some of those punctures leak a lot and some a little, but the only way to kill the stack through the lid was to go after all the potential leaks.

With the spray gun, you don't always have to be right up on the target. The spray rig could reach far back into the difficult juncture of rafter tails and ceiling joist **(13)**.

This was a fairly simple and roomy attic to work in. There were, however, sections with belly-crawl access only, adding time to the job **(14)**. Outside daytime temperatures hit 90+ degrees, so we started early and quit early.

Sealing all the top plates and rake wall **(15)** in the attic took about four to five minutes.

Wires need to be drenched in elastomeric, then pulled apart and wiggled so that liquid surrounds all the wires and sinks into the hole, thus sealing around each wire. We call this "puddle sealing." This section took about two minutes **(16)**. Big holes are stuffed with cotton insulation to act as a gravity dam before application **(17)**. Once the big holes were stuffed, the 22 wires above a sub-panel took about a minute to seal **(18)**.

This intersection of a rake wall, partition walls, and nailing plates **(19)** took less than two minutes to seal. In complex geometrical areas like this, it is difficult to evaluate just where the leak is. Sometimes these areas are partially done at best, but more often, they are ignored completely.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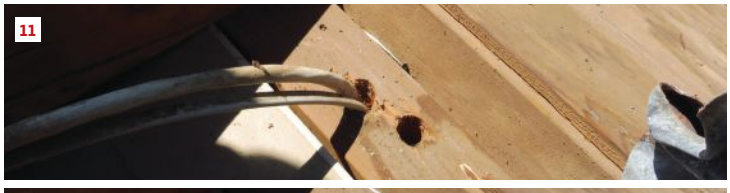
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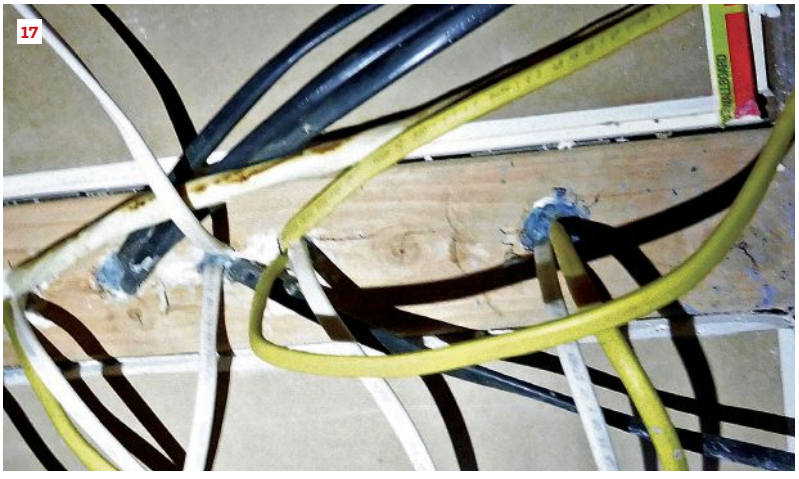
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DELIVERY MACHINES

You can spray the elastomeric using a small hand-held hopper gun with an air hose attached. It delivers the material well, but the fluid will spill out of the hopper if it is tilted much more than 45 degrees. The hopper also has a limited volume capacity of less than two gallons.

I have used several full-size spray machines to deliver the elastomeric sealant. The Benron shown here **(20)** is a quiet workhorse. It is lightweight and portable (but requires a separate compressor), can handle a 100-foot garden hose, and can pump strongly until the cows come home. Benron is discontinuing this exact model but will soon come out with the Rotortex 245E Pro, available with or without a compressor. Davlin (davlincoatings.com) will be selling the Rotortex 245E setup the way it works best with my product. (Please note: I do not make money or commissions on what Davlin sells.)

The Graco 1400 RXT (also available from Davlin) is light, noisy, and portable, and does a fine job **(21)**. It is limited by its 25-foot hose but will fit through a 24-inch opening. Graco also makes the 2000 RTX (not shown), a heavier-duty rig that accepts a 50-foot hose.


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MEASURABLE RESULTS

Successful air-sealing is first about access to the leaks, and second, about fastidious attention to detail. To ensure a successful job, you need to inform everyone on the crew what the goals are and how you are going to proceed, and you need to designate one person to be in charge and take responsibility of the entire air-sealing operation.

You get only one shot at air-sealing during retrofit or new work. After the stucco was originally installed on this house, access to the leaks was sealed up, and the leaks remained unaddressed for 38 years. We were able to significantly correct that, however. Before any work was done, we tested-in using a blower door with a whole-house air leakage of 11.2 ACH. The job tested-out near completion at 3.6 ACH.

The entire job took two people three days, and we used 24 gallons of elastomeric spray. Most of the work was in the attic, which took two guys one full day and 21 gallons of elastomeric. Because of the volume and throw of the material, we were able to cover potentially leaky areas in hard-to-reach places that typically never get fixed with other sealants. Actual spray seal time (covering the target) is very fast. What usually takes the most time in an attic is maneuvering around with the hose and gun. Another time factor is setup and cleanup.

Terry Nordbye, a long-time JLC *contributor, is a building contractor in Point Reyes Station, Calif., and recently launched Air Seal Pro. For information on the elastomeric spray and the machines to install it, go to airsealpro.com.*

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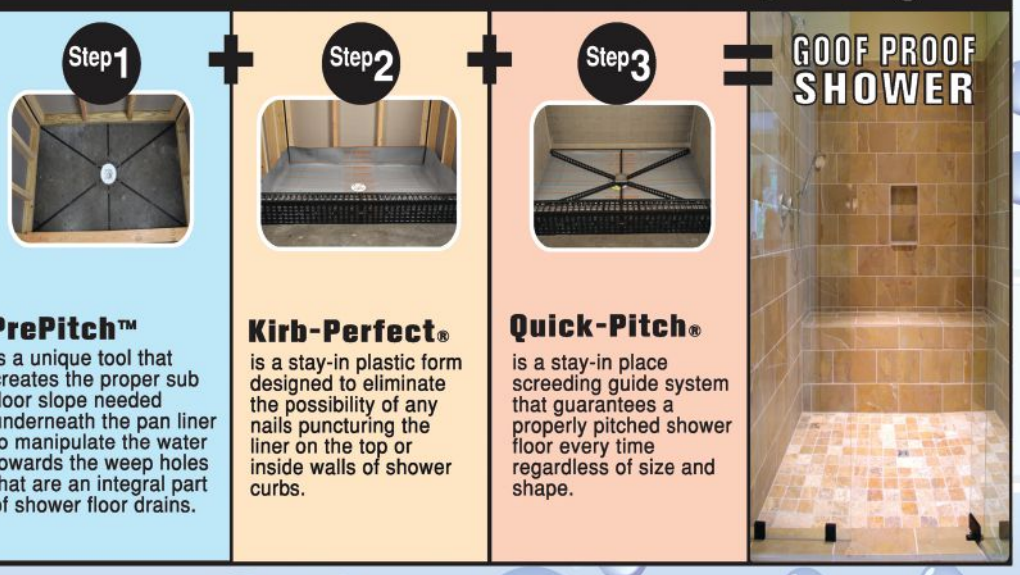

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Moving a Carriage House
How to resite a 15-ton historic structure

BY ELIOT LOTHROP

My company, Building Heritage, specializes in the preservation and restoration of timber-frame structures in Vermont. In addition to timber-frame repair, we perform all aspects of restoration work—everything from house-jacking and foundation replacement to slate-roof repair and window restoration. Our projects include houses, barns, churches, covered bridges, as well as all types of outbuildings.

Last spring, we began work on restoring a carriage house built in the 1880s in Montpelier. The owner wanted to renovate the slowly collapsing building into rental space, but because of its proximity to the property's main house, he needed to relocate the 26-by-35-foot structure to 60 feet away. This would increase parking on the site and improve the curbside visibility.

In this article, I'll focus on how we relocated this 15-ton building—a two-step process, requiring us to first lift the building and brace it for the move and then roll the structure (cribbing and all) along an I-beam track to its new foundation.

EXISTING CONDITIONS

When we arrived on site, we discovered the worst damage to the structure was to its west-facing front façade **(1)**. One side of the large gambrel dormer had collapsed. This failure had been caused by rot from a reverse-flashed valley and by an undersized beam rolling (it had been used to replace a bearing wall in an earlier remodel).

The rolled beam had contributed to sagging of the second-level hayloft floor, as well. The ground-level stable's original wood floor was long gone, and what remained was a thin layer of asphalt over dirt. Finally, the building itself had severely racked and was out of square 6 to 8 inches. Clearly, in order to safely move the structure, we first had to jack it up and straighten it out.

Photos by Eliot Lothrop and Tim Healey

The worst damage centered around a transverse dormer **(1)**. I-beams were inserted longitudinally to help level the second floor **(2)**. Sheathing the second floor helped square up the building **(3)**, and adding Zip System sheathing to the upper roof slope helped prevent racking **(4)**. The lower I-beams were inserted with the help of an excavator **(5)**. Cribbing supports a main beam (running right to left), which supports the needle beams (red). Running parallel to the needle beams was the I-beam track **(6)**.

SUPPORTING STRUCTURE

We removed the few remaining interior partitions in order to place our cribbing towers. Cribbing location is dictated by the steel-beam insertion points, with each tower centered on the steel. Fortunately, we were able to pass the two upper beams through a pair of south window openings and out through the lower portion of the exterior north wall, which also had been removed.

Next, we dug down about a foot to good bearing and carefully leveled four bases built from 6-inch-by-6-inch-by-4-foot lengths of cribbing (normally, we dig down all the way to the footing, but in this case, we didn't have to). As we assembled the cribbing towers, we checked for level at every layer. When we arrived at the desired height, we inserted the upper, 40-foot-long W10x45 main I-beams through the length of the building with the help of an excavator, placing them on beam rollers secured to the cribbing **(2)**.

We then inserted three smaller (W8x31) needle I-beams, running perpendicular to the main beams. The first two were placed on either end of the sagging gambrel dormer and ran on top of the main beams to take the sag out of the second-floor framing and to support the valleys. The third needle beam supported the chimney. We suspended the needle beams from the main beams with four heavy-duty, 12,500-pound-capacity Crosby clamps, then lifted the building approximately 2 feet off the ground.

STRUCTURAL REPAIRS

With the building in the air, we began our repairs. First, we removed the existing granite block foundation. This was a historic building, so we were preserving all of it. We marked each block's location to be reinstalled on a new foundation.

Moving on to the structure, the second floor had racked, so we

While the author's crew restored the structure's framing, the excavation sub broke ground on a new foundation **(7)**. A freestanding retaining wall was part of the foundation design **(8)**, which was built in line with the existing house **(9)**. A granite capstone, reclaimed from the existing foundation, lined the remaining foundation perimeter; here, the masonry sub maps out the rebar locations and angles to accurately line up boring holes **(10)**. Some capstone was installed prior to the move **(11)**.

squared it up by pulling it diagonally with come-alongs. We then installed new LVL support beams, floor joists, and a 3/4-inch-thick AdvanTech deck. The AdvanTech would make a diaphragm and help keep the second floor square **(3)**.

We reframed the sagging dormer and large sections of the west façade's roof. On the upper roof slope, we added a layer of Zip System sheathing over new 1-inch-thick rough-sawn decking to help prevent the roof from racking **(4)**. We then secured the chimney with 2-by bracing above the roof and added diagonal bracing where needed throughout the interior of building.

Once we had completed these repairs, we installed a pair of lower, 40-foot-long W10x45 main I-beams, which would pick up both the building and the upper portion of the cribbing towers during the move **(5)**. We didn't insert these as far into the building as the upper W10x45s.

Finally, in order for the bottom of the main I-beams to clear the top of the new retaining wall by 6 or so inches, we lifted the building up a second time, about 2 feet higher.

CRIBBING TOWERS

When we assembled the cribbing towers, we stacked the tiers with four to six 6x6s going each way. The more cribbing you have per tier, the more surface contact you have, layer to layer, and the less likely the tower will shift (it will also hold more weight).

As we assembled the towers, we needed to build-in the support gridwork of beams, starting with the needle beams. For the final lift, the cribbing stack also needed to be slightly reconfigured to allow us to insert the track rail I-beams; a "pyramid" stack of cribbing was assembled perpendicular to the main beams **(6)**. We installed Crosby clamps at the beam intersections.


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The crew installed the first I-beam track into the north gable-end cribbing **(12)**. An excavator and a beam roller placed on mid-span cribbing helped insert the south track **(13)**. Beam rollers were placed on a "pyramid" stack of cribbing; the pyramid stacking formation was used throughout the lifting process to transmit loads through cribbing towers **(14)**. The I-beam track needed to be ground smooth to eliminate imperfections **(15)**. Waste-blocks rolled into place served as anchors for moving the building **(16)**.

NEW FOUNDATION

While we restored the framing on the building, our excavation sub began work on the new foundation **(7)**. The basic plan was for the foundation to be built in line with the existing house, so the move would be in a straight shot. We knew ledge was located in the vicinity of the new foundation. So, last fall we dug out the site and mapped out the ledge locations, which our structural engineer was able to incorporate into the new foundation design; we pinned the foundation to the ledge in several places.

The new foundation was unique. A 10-foot-high freestanding retaining wall was required to support the gable-end wall on the north side. Because there were no return walls to stiffen this wall up, it needed to be heavily reinforced with a 12-inch-on-center #5 rebar grid **(8)**. The wall was 12 inches thick at the base with a 4-inch brick shelf a couple of feet from the bottom (the lower north wall would be brick veneer). #5 L-shaped dowels 12 inches on-center joined the wall to its 12-inch by 5-foot-wide oversized footing. Beam pockets for lowering the upper beams were cast into the top of the wall **(9)**.

The remainder of the new foundation consisted of 5-foot-deep frost walls capped with the reclaimed 8-inch-thick granite blocks, which would serve as a capstone. Our concrete sub left rebar sticking out of the top of the frost walls, which our mason cut to the same height and plumbed upright using a rubber mallet and level. The mason then mapped out the rebar locations and their angles to accurately lay-out holes into the block **(10)**.

Once the capstone blocks were ripped down for uniform height and bored, they were installed on top of the foundation and mortared in place **(11)**. We later pinned the blocks to the wall, as well, by drilling down through the granite (and new wood sills) into the concrete, and setting threaded rod in adhesive grout.

With the I-beam track set and leveled, the building was pulled with come-alongs anchored to the concrete waste-blocks **(17)**. Four 10-ton-rated Hilman rollers, two per track, were used to roll the building in place **(18)**. A turntable on top of the roller allowed for tweaking the roller's direction to keep it aligned on track **(19)**. It took an hour and a half to move the 30,000-pound structure **(20)**. Here, a video still from the author's GoPro camera shows the building nearly placed on its new foundation **(21)**.

I-BEAM TRACK

The I-beam track was composed of four, 40-foot-long W10x45 I-beams (two per track, butted end to end and bolted together). We began with W10x45s inserted into the cribbing, starting with the north rail **(12)**.

We assembled shorter, mid-span cribbing towers to pick up the track "in space" to a height where the track would be dead level. The crew maneuvered the beams into place using beam rollers on each mid-span tower and used an excavator with a beam-clamp attachment to help position the beams **(13, 14)**. The I-beam track needed to be ground smooth **(15)**, particularly at the ends of the beams where burrs were likely to occur. "Jumping" from one track section to the next is tricky enough (transferring the weight of the building from one track section to another) without having to deal with any imperfections.

MOVING THE CARRIAGE HOUSE

We planned to pull the building into place with a couple of come-alongs, so we positioned a couple of three-ton concrete waste-blocks to serve as anchor points **(16)**. We chained the come-alongs to the blocks and the lower W8x31 needle beams and began pulling the building into position at rate of about a foot per minute. It didn't take much to move it because it was on "wheels" (building rollers).

Even though we had two come-along setups, one come-along did all the work **(17)**. We used four 10-ton-rated Hilman rollers, two per track, to roll the building in place **(18)**. The rollers come with a turntable on top, which allows for tweaking the roller's direction to keep it aligned with the track. We use a handle tool, which we hitch on the end of the roller to straighten them as needed (you have to keep an eye on them, as there are no guides to keep them


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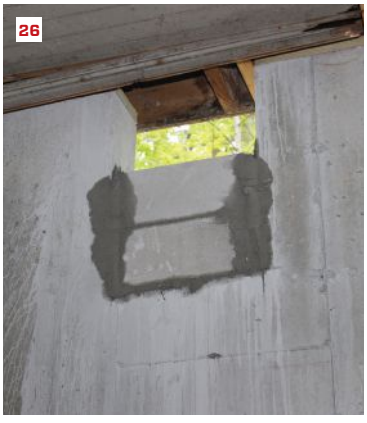
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The building was lowered onto new 6x7 sills set on the granite **(22)**. The cribbing towers were lowered one tier at time, the steel rolled out with beam rollers **(23)**. Hydraulic jacks were used for all the lifting **(24)**. A steel plate was inserted during removal of the chimney support beam; a tube steel support was added later **(25)**. The retaining wall beam pockets were blocked in **(26)**. Here, the carriage house is in position, ready for complete restoration **(27)**.

from rolling off the track's top flange) **(19)**. It took an hour and a half to move the building, including time to "jump" the rollers over the track seams **(20, 21)**.

BRINGING THE BUILDING TO REST

In many ways, lowering the building was the easy part of the job. The squared-up structure lined up with the new foundation nearly perfectly. We lowered the building onto new 6x7 sills set on the granite and toe-screwed the wall studs to the sill with TimberLoks **(22)**.

The cribbing towers were lowered one tier at time and the steel was rolled back out (a reverse of their installation) **(23)**. We used eight 22-ton Simplex hydraulic jacks for all our lifting and lowering needs (placed on metal bearing plates and in-line stacked cribbing to transmit the load through the tower) **(24)**.

A 3/4-inch-thick steel plate was inserted during removal of the needle beam supporting the chimney; a tube steel support was later welded to the plate for support **(25)**. The retaining-wall beam pockets were blocked in prior to installing the brick veneer **(26)**. With the building in position, it was ready for complete restoration **(27)**.

Because the owner is receiving a federal rehabilitation tax credit (an RITC) for the restoration, all the work had to conform to strict preservation standards. We were required to restore the building's original form, using as many traditional materials as possible (slate roofing, plaster interior), while using modern materials and systems like foam insulation and a radiant slab to bring it up to current standards for comfort and energy efficiency.

Eliot Lothrop operates Building Heritage, specializing in timber-frame restoration, in Huntington, Vt.

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WHERE TO BUY

BY LAUREN SHANESY

1. Ovens for the Multitasker

As part of the revamping of its Chef Collection line of appliances, Samsung recently redesigned its 30-inch built-in wall ovens, in single or double configurations. The new ovens feature a removable "Smart Divider" that splits the bottom oven cavity into sections to create three independent ovens that can be set at different temperatures. Wi-Fi enabled, the models connect with a Samsung app. Two finishes are available: stainless steel or matte black stainless steel. Pricing is not yet available. samsung.com/us/home-appliances/

2. Smart Security Lighting

Lighting manufacturer Eaton has introduced the All-Pro MS180BT, a Bluetooth-enabled motion sensor that allows users to control outdoor security lighting from up to 60 feet away with a smartphone app. The sensor is compatible with any LED or incandescent security lighting product that has a standard 1/2-inch threading connection. The fixture is available in white or bronze for $50. cooperindustries.com

3. An Engineered Wood Shingle

The new LP SmartSide Perfection Shingle is an engineered-wood-fiber lap shingle with a 5 1/2-inch to 6 1/2-inch reveal. The company says that it looks like cedar and has a fine-sawn wood texture with no knots. The shingle is the newest addition to the SmartSide Trim & Siding product line and can be used for accents and gables or for full walls. Shingles install with blind nails for a clean look. Check with local dealer for pricing. lpsmartside.com

4. Prefabricated Wall Panels

Polymer-manufacturing company Covestro's new prefab PureWall panels are made using conventional wood frames, with polyurethane-based insulation between the framing and with a rigid polyiso board that provides continuous insulation to reduce thermal bridging. Configurations reportedly can offer R-values ranging from R-17 to R-33. The company claims that PureWall provides a similar unit shear capacity to continuously sheathed wood structural panels. The all-in-one panel arrives ready to install. Pricing unavailable. purewall.covestro.com

5. A Compact Home Comfort System
Honeywell's new HM750A1000 Advanced Electrode Humidifier brings indoor air comfort to homes with a small footprint. The humidifier—which comes in 11- or 22-gallons-per-day-output models—reportedly adjusts to changes in the weather, is compatible with several models of Honeywell thermostats, and can be controlled through the company's Total Connect Comfort and Lyric apps. The company claims that the small unit can be installed quickly by a single contractor in both ducts and walls. The company declined to provide pricing. honeywell.com

6. Built-In Home Security
The Ring Video Doorbell Elite is a flush-mounted doorbell hardwired to the home and powered over ethernet, with the option to connect via Wi-Fi, for uninterrupted connection. The doorbell allows homeowners to remotely monitor home security via smartphone and has a video camera and built-in microphone and speakers with two-way audio capability so homeowners can interact with those at their door through Ring's app. The camera can be customized with motion zones and motion-activated alerts for those zones. The doorbell is available in four colors, for $500. ring.com

7. A Liquid Air Barrier
Kemper System America's Wall Guardian FW-100A is a liquid-applied fibered acrylic air barrier that reportedly acts as a vapor-open (17.3 perms) water and weather barrier. The water-based, low-VOC material is designed to resist air and water infiltration and to bond to a range of wall materials, including extruded polystyrene, CMU and brick masonry, and concrete. Applied in a single coat with a heavy-duty sprayer, roller, or brush, the barrier offers unified substrate protection, even on curved or other unconventionally shaped walls. stscoatings.com/our-products/wall-guardian/

8. Nature-Inspired Privacy
Adding to its Obscure Glass line, MI Windows has launched Rain Glass, a glass pattern that adds privacy to windows by mimicking the look of rain. The design lets in natural light while softening the view, and it masks fingerprints and stains, as well. Available as 1/8-inch DSB (double-strength) with annealed and tempered options, the glass comes in a maximum size of 72 inches wide by 140 inches tall and in thicknesses of 2mm, 3mm, 4mm, and 5mm. miwindows.com

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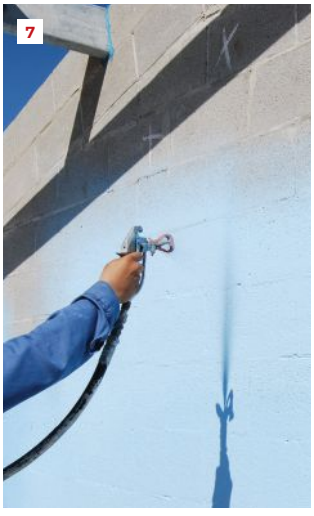

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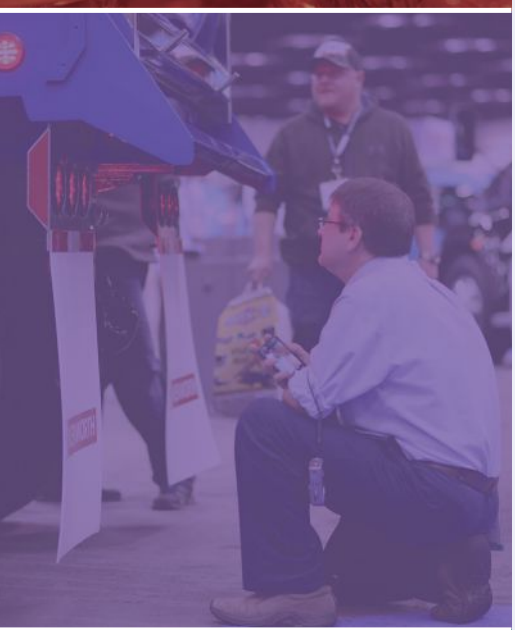

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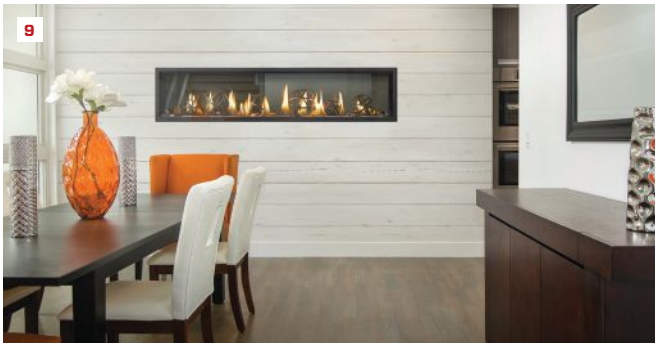
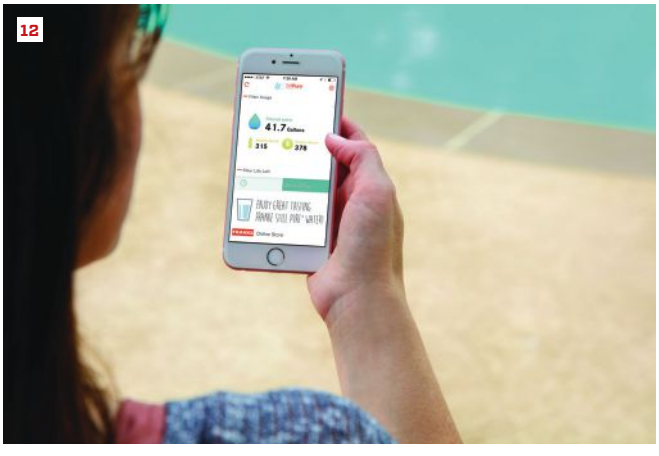
9. Cool-to-the-Touch Fireplace Glass
The new Napoleon Luxuria Linear Series features the company's proprietary "Dynamic Heat Control" and "Glass Guard" systems. The company claims that heat is quietly redirected from the fireplace opening and that the clear glass covering the fireplace is safe and cool to touch. Four sizes ranging from 38 to 74 inches long are available in single-sided or See Thru configurations, and in natural gas or propane with up to 50,000 Btu. A 38-inch single-sided fireplace costs $6,100 online. napoleonfireplaces.com



10. Integrated Barn-Door Locks
Responding to the popularity of sliding barn doors, Inox created a Barn Door Lock. Installed inside the door jamb instead of on the door, the lock's bolt slides securely into the door's strike. The locking mechanism is activated by a thumb turn and can be locked from inside the room. The strike, mounted on the door, has a spring-loaded dust cover with a decorative cap on the opposite side of the door. The lock comes in six finishes and ranges in price from $88 to $98. unisonhardware.com

11. An Easy Guide for Shower Subfloors
The Pre-Pitch is a stay-in-place spreading tool for use underneath shower pan liners. It creates the proper slope for water to flow towards the weep holes in the floor drain, helping to keep water, which could encourage mold and mildew growth, from being trapped between the mud bed and the liner. The Pre-Pitch is easily cut with a hacksaw, PVC cutters, or grinder and can be used on wood subflooring or concrete. The Pre-Pitch Standard Kit costs $23 and the Extended Kit costs $24. Using both kits, a contractor can pitch a 10-foot-by-10-foot area with a centered drain. goofproofshowers.com

12. Water Filtration From a Smartphone
Franke's Bluetooth-enabled StillPure Filtration System lets homeowners monitor their kitchen sink filtration from a smartphone. Franke claims the under-sink filter removes harmful bacteria, parasites, cysts, chlorine, and lead from water and is compatible with any of Franke's faucets. An Apple or Android app receives data from the FM100 module—a monitor connected to the filter that tracks how many filtered gallons of water a household consumes—and alerts homeowners when a filter needs to be changed. Users can reorder filters in the app. The system is sold for $95 to $945, depending on components selected. franke.com



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BY MYRON FERGUSON

Festool's Cordless Screw Gun

Photos courtesy Festool

Preloaded screws, no cord. The author advocates the use of collated fasteners for their speed when you are initially hanging a sheet. He likes the convenience of cordless, as well as the added safety of not having a cord, which is a trip hazard around scaffolding and ladders.

It takes about 3,500 screws to hang 3,500 square feet of drywall—which is how much an average crew can hang in a day. That's a lot of screws. Professional drywall hangers are adept at loading those screws one-by-one on a single-feed drywall screw gun, so they're able to move rather quickly. Autofeed screw guns, by comparison, use fasteners that are preloaded on a strip (50 screws in a strip is typical) so you don't have to load the screw each time, making them faster, easier to use, and less stressful on the body. I know plenty of drywall contractors who are devoted to their single-feed screw guns; however, I fully endorse the use of autofeed screw guns—especially cordless versions—for hanging drywall. In fact, I haven't used a single-feed drywall screw gun in at least 15 years.

While there are a number of brands available in both corded and cordless versions, almost all of which I've used, I chose to review the Festool DWC 18 because it has some standout features that I like. It's relatively new to the U.S. market (it was released in September 2016), but it's been in Germany for about seven years, so its design is well-developed. The tool is equipped with an EC TEC (permanent magnet, remotely commutated, 3-phase) brushless motor, uses readily available collated screws, and has an on-demand drive system and precision depth control—all key features that I like.

Like many other collated screw guns, this model will work with any collated strip on the market. That's a baseline feature of any collated screw gun for me because it means I don't have to order screws if my local supplier doesn't stock them or runs out—I can get them anywhere. The Festool magazine can be turned in various angles in order to get the strip out of the way in situations where it might get hung up or be a nuisance. Also, the depth of drive is set right on the nose of the magazine and can be fine-tuned using a green dial, so you can precisely adjust the depth of drive. (Note: Every feature that is green on a Festool tool is a feature you can adjust.)

The magazine can also be removed easily to change the bit, or to access improperly-set screws. When pressure is applied to the bit in this instance, it engages a "pulse" mode that acts like an impact drill. The impact is slow and each hit turns the screw in only about .5mm. This allows the screw to be set precisely.

Interchangeable head for single-drive mode. Some contractors prefer the single-feed action, which this head offers. It also improves accessibility in inside corners.

The feature that I like the most is the on-demand drive system, which has two modes: manual and auto. In manual mode, you have to engage the trigger in order to drive the screw, though the motor only turns on when pressure engages the clutch. In all the time that I've been using this tool, I had never used it in manual mode until writing this review, though I can see its usefulness for backing screws out.

In auto mode, you don't have to engage the trigger—you simply choose the mode on top of the gun. In this mode, the screw engages when pressure is applied to the tip, as it does in manual mode. But with auto mode, you can just keep going without ever touching the trigger. This is an incredibly efficient design because it saves on battery life, and it's also incredibly quiet because the gun is on only when you're driving a screw. Some newer cordless single-feed screw guns aren't on all the time, but still require pulling and locking the trigger to engage the motor.

The motor spins at 4,500 rpm, which is typical of a drywall screw gun. I found this to be adequate most of the time. There are a few exceptions—with fire-coded drywall, for example, or with older framing that is harder than new spruce or fir—when there just wasn't enough power to effectively drive the screw to full depth. My guess is that because the motor doesn't run constantly, it doesn't have enough time to ramp up to the full rpms when working in these materials.

The gun is designed to be used in both wood and metal framing. I did find it tough to insert a screw to the proper depth in tight inside corners, however. A lot of framers still don't give us a wide-enough nailer in the corner to insert the screw without having to get the nose tight into the corner—so I blame them more than the gun. If the screw isn't set square to the drywall in this scenario, it won't go in straight and, as a result, will not be set deep enough. The gun does come with an alternative nose and bit attachment that can be used in place of the collated attachment. This helps with inside corners, but I find it inconvenient when attaching a sheet to switch attachments. Instead, I use a secondary, small cordless drill with a Dimpler screw setting attachment that I find faster to pick up and use for inside corners.

Another nice feature on this gun is a ladder/scaffold hook on one side of the tool (opposite the belt hook, which is a standard feature on most tools). This can be folded out of the way if it's not needed.

According to Festool, you can set about 10,000 1 1/4-inch screws on a 5.2-Ah battery. If you're not using that many screws, the 3.2-Ah battery is lighter and you can still get about a day's worth out of a single charge. Cost: $300 for the tool only in a Systainer Sys 2 box; $540 for the tool, charger, and a 5.2-Ah battery in a Systainer Sys 2.

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

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The FrameFast System

BY TIM UHLER

Just outside Seattle, where I live and build, code often requires a structural connection between trusses or rafters and walls. Traditionally, this connection has been made with hardware like a hurricane clip. FastenMaster's TimberLok is a structural screw that also meets that code requirement; it's faster than clips but still needs to be installed with a traditional driver from a ladder (usually). In our testing, TimberLoks install twice as fast as a Simpson H2.5a or H1 hurricane clip off of a ladder.

FastenMaster now has a new tool dedicated to tying trusses and rafters to walls that don't require special hardware. It's called the FrameFast. The FrameFast system looks like a typical screw gun with an extended drive attachment that straddles a truss or rafter and guides the screw into place at the correct angle. This lets me attach the fully threaded, 6-inch screw to the top-plate-rafter connection up to about 10 feet without using a ladder. The tool has "wings" on top to align it on a truss or rafter. One wing folds out of the way—nice for us because we stick-frame every roof. Folding the wing away lets us fit the tool next to the ceiling joists nailed to the side of each rafter.

I typically install hurricane clips with a Hitachi NR38AK Strap-Tite positive placement nailer. To do some comparison testing, we first installed the 6-inch TimberLok screw using our Milwaukee impact wrench. When you can reach the top plate without a ladder, the impact gun and the FrameFast gun seemed to be identical in speed. But for most connections, because we don't need a ladder up to 10-foot ceilings, we went about three times faster with the FrameFast. If we had made more connections, the difference in speed would likely have been even greater.

The tool worked very well. My only complaint is that when the heel of the rafter wasn't within about an inch of the inside edge of the top plate, the FrameFast didn't drive the screw properly. That isn't a common framing condition for us, so I can't fault the tool. Since most framers will use this tool in a truss-to-top-plate application, it'll work well every time.

The FrameFast tool retails for $550. That is too much money for me in custom residential, but I think in larger developments for production crews, it would make sense. The more connections you have, the greater the time savings.

I priced out the FrameFast screws and they cost about $0.55 a screw, whereas the H2.5 we use costs $0.49 + $0.16 for nails ($0.65 total per connection). Factoring in labor, I would recommend that wherever possible, ask the engineer or code official to go the screw route over hardware. Even without the FrameFast tool, it is cheaper and faster, and easier on the body, to install FrameFast (or any fastener in the Lok line; these are our go-to structural fasteners as a replacement for hurricane clips on all our jobs). The hi-torque impact wrench we've been using for about three years retails for $230 (tool only) and has been very reliable.

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

Ladder-free installation. The FrameFast proves to be a much faster way to make code-approved truss- and rafter-to-top-plate connections.

Photos: Tim Uhler

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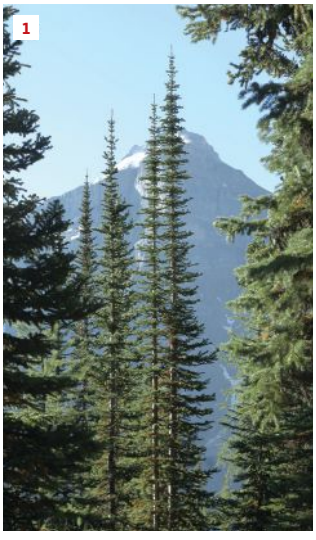
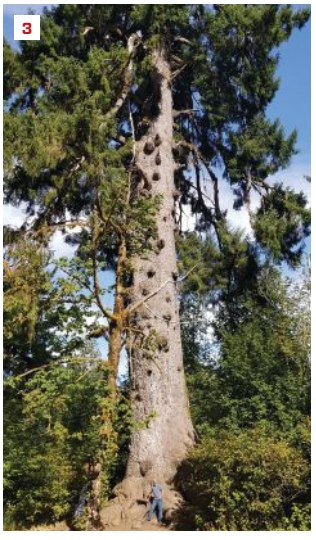
October Advertising Index

BY ROE OSBORN





Old-growth trees near the tree line in the Canadian Rockies are tall and thin with dense trunks **(1)**. In Washington's temperate rain forests, trees—like this giant red cedar **(2)**—are much larger. Another rain forest "champion" is this giant Sitka spruce **(3)**.

Forest of Champions

I grew up in New England, where old-growth forests flourish only in history books or in the dreams of old carpenters like me. On recent trips to the Canadian Rockies and the Olympic Peninsula, I had a chance to see my old-growth dreams become reality.

While my wife and I were hiking near Moraine Lake, in Alberta, I asked our guide where the old-growth forests were. On cue, she stopped the group, gestured around, and said, "You're looking at 'em." Out of her backpack, she pulled a "tree cookie"—a thin cross section about 4 inches across of white-bark pine. On it, dots bunched together in a radius from the center—each dot representing a decade of growth. This tree—tiny even by New England standards—was more than 150 years old. She quipped that the trees along the path that were a foot or more in diameter were probably more than 500 years old **(1)**. She explained that the altitude and cold, harsh mountain climate make for a slow growth rate.

From Canada, we made our way to western Washington state, where an abundance of moisture and a milder climate had produced trees on a whole different scale. In the rain forests, graceful giants shrouded in moss kept the understory cool and damp despite the hot, dry weather in the area.

Then, on the drive back to Seattle for our flight home, we saw signs for "The World's Largest Cedar Tree." As a tourist, I felt the "hook," as if being sucked in to see the world's biggest ball of string. And as a tree nut, I couldn't resist. A short detour and a brief walk brought us to a mammoth gnarly red cedar, a large chunk of which had fallen off in 2012. The base of the tree had rotted a bit and I could walk inside the trunk **(2)**. On the outside of the cedar, many other trees had rooted in its cracks and crevices—trees with trunks that had much larger diameters than the trees we'd seen in Canada.

A little farther down the road was another sign, for "The World's Largest Sitka Spruce," near the shore of Lake Quinault. A short scenic drive and walk brought us to an enormous spruce tree **(3)**. Unlike the giant cedar we had visited, this tree was solid and looked as healthy as the day it sprouted—estimated at more than 1,000 years ago. This so-called "champion tree" is listed by American Forests as being 191 feet tall and just less than 59 feet in circumference.

Back home, I learned that the area is called "Valley of the Rain Forest Giants" and is home to four more "champion trees." I only hope that this oldish-growth human will have the chance to revisit the area someday and see them.

Roe Osborn is a senior editor at JLC.

Photos by Laurie Sullivan

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