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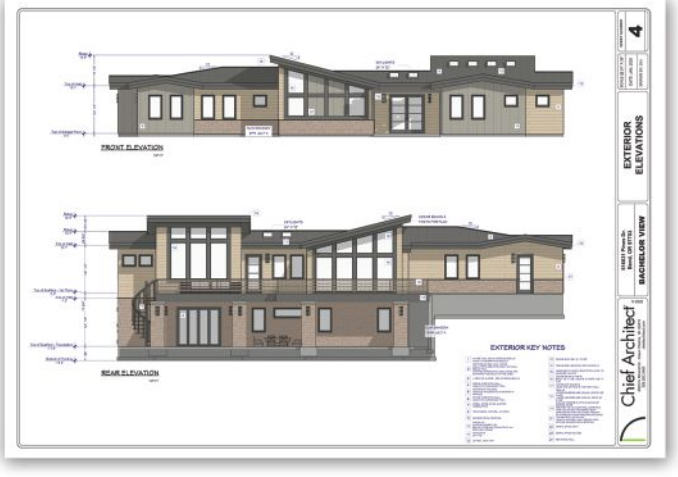

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On the cover: Mark Pollard of Thompson Johnson Woodworks applies edge sealant to the EPDM flashing of a drain scupper on a low-slope roof in Portland, Maine. See the story on page 33. Photo by Ted Cushman.

FEATURES

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Chief Editor, JLC Group Clayton DeKorne, cdekorne@hanleywood.com
Executive Editor, JLC Group Andrew Wormer, awormer@hanleywood.com
Senior Design Director Tina Tabibi, ttabibi@hanleywood.com
Managing Editor Laurie Elden, lelden@hanleywood.com
Senior Editors Ted Cushman, tcushman@hanleywood.com;
Tim Healey, thealey@hanleywood.com;
Roe Osborn, rosborn@hanleywood.com
Assistant Editor, Products Symone Garvett, sgarvett@hanleywood.com
Freelance Designer Melissa Krochmal, mkrochmal@hanleywood.com
Contributing Editors Mark Clement, David Frane, Dave Holbrook, Tom Meehan, Matt Risinger, Emanuel Silva, Gary Striegler, Tim Uhler

Senior Web Developer Braddock Bull, bbull@hanleywood.com

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The Journal of Light Construction,
Hanley Wood LLC
1152 15th St. NW, Suite 750
Washington, DC 20005
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INFORMATION DIRECTORY

CONTACT INFORMATION

jlconline.com; 202.452.0800
JLC
Hanley Wood LLC
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[2] When applied in accordance with ZIP System® sheathing and tape Installation Manual instructions.

No two jobs are alike, and, whether big or small, every job presents its own set of challenges to troubleshoot. Whether you're trying to simplify recessed window flashing or ensure a snug, watertight fit around windows and door frames, achieving continuity of air and water barriers is always a stage that deserves attention to detail. Since 2006, ZIP System® products have been streamlining the way teams reach rough dry-in and ensure protection against water and air leaks in high-performance builds. Now with 10 different integrated sheathing solutions and 13 flashing options, ZIP System® building enclosure products offer a full spectrum of combinations so builders can find the right integrated system for their job.

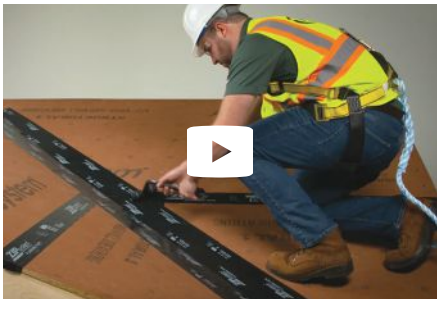
With a recent expansion of its ZIP System™ sealing solutions line, the ZIP System brand now offers five ZIP System stretch tape options and five ZIP System flashing (straight) tapes as well as ZIP System™ liquid flash products. In addition to new widths and lengths of tape, the company enhanced the tape formula to provide an even stronger bond in a broader range of temperatures.

"While builders and framers may not notice much of a visual difference to our flashing tapes, with this formula enhancement, we now warrant application of ZIP System™ tapes down to 0 degrees Fahrenheit," said ZIP System product director Allen Sealock.

The new tape sizes in varying lengths and widths provide a solution for multiple scenarios on the jobsite. For example, shorter rolls can be used for smaller remodeling projects while wider rolls can help easily seal roof valleys with a single piece of tape.

For added peace of mind, all ZIP System tapes are backed by a 180-day Exposure Guarantee and a 30-year limited warranty[1], and all tapes can be applied between 0 degrees and 120 degrees Fahrenheit[2].

"True to Huber Engineered Woods' innovation philosophy, these new products are a direct result of customer requests," said David Wescott, product director of accessories at Huber. "They have also been put through the rigorous R&D process our customers expect from our products."



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SALES OFFICES

HEADQUARTERS

Ron Spink
Executive Vice President, Build / Design Group
202.736.3431
rspink@hanleywood.com

Dan Colunio
Vice President, Sales, Remodeling & Distribution Groups
617.304.7297
dcolunio@hanleywood.com

EAST / SOUTH

Paul Pettersen
Strategic Account Director
516.252.8020
ppettersen@hanleywood.com

MIDWEST / SOUTH CENTRAL

Kay Ross-Baker
Strategic Account Manager
773.824.2576
krossbaker@hanleywood.com

WEST COAST

Carol Weinman
Senior Strategic Account Director
831.373.6125
cweinman@hanleywood.com

CANADA

John Magner
York Media Services
416.598.0101
jmagner@yorkmedia.net

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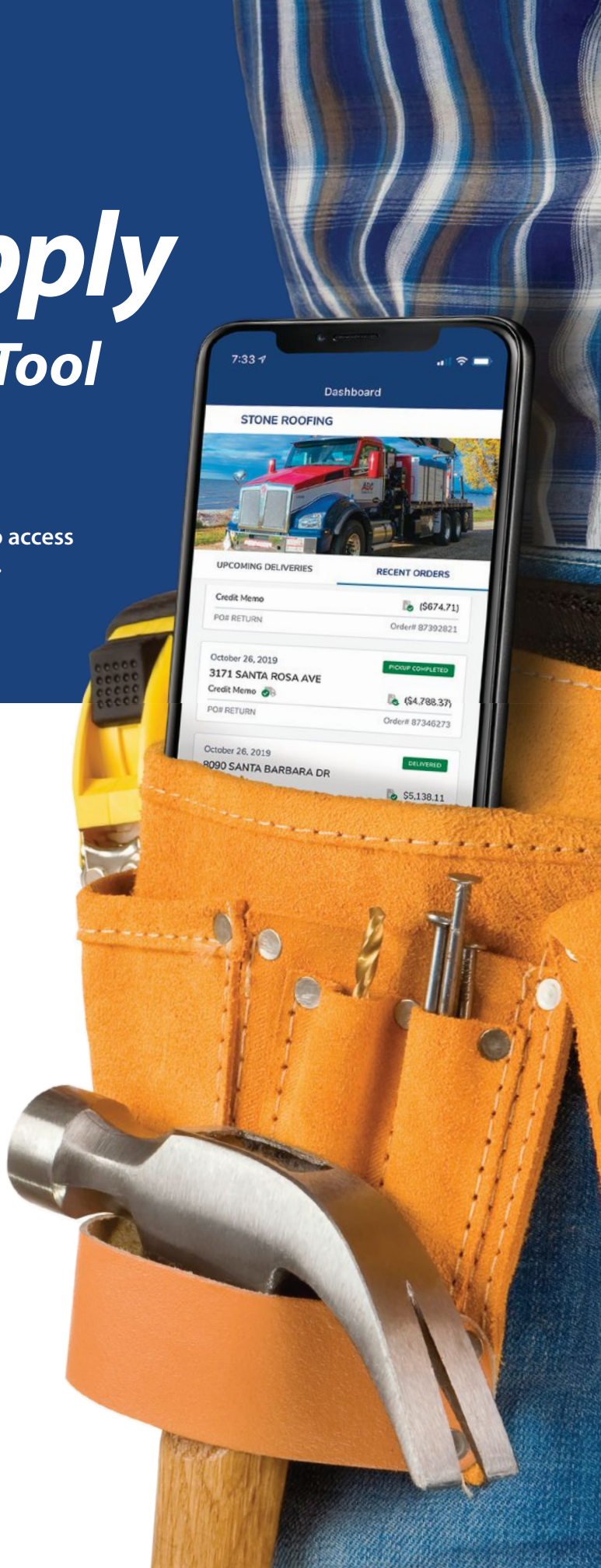

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BY ROE OSBORN

Sheathing Walls

Sheathing is the covering applied over a wood-framed building before the siding goes on. Sheathing helps the frame to resist racking, and when applied according to strict engineering specifications, sheathing can be a major component in shear-wall construction to resist seismic activity or excessive wind. It has also become an integral part of making today's homes airtight and weather-resistant.

Sawn softwood boards—usually pine—were once used to sheathe framed walls, but during the post-World War II building boom, plywood was introduced as a way to speed up the pace of production. Instead of laying down individual boards, builders could cover the framing much more quickly with large sheets of plywood.

Oriented strand board (OSB) sheathing is a less expensive alternative to plywood. Improvements in adhesives and manufacturing have resulted in an engineered product that is stronger and more stable—even when exposed to moisture—than when it first started gaining popularity in the 1970s and 1980s. And in the new millennium, some manufacturers are even producing sheathing with integrated water-resistive barriers (WRBs) and insulation.

One aspect of wall sheathing that is part regional, part personal preference, and part engineering specified is the orientation of the sheathing on the building frame. The photos in this article cover the basics of both vertical and horizontal installations, but most of the same installation rules apply regardless of the orientation and regardless of the sheathing material. For in-depth discussions of sheathing orientation, installation of sheathing with an integral WRB layer, and the basics of shear-wall construction, check out the online version of this article, which you can read at jlconline.com.

Roe Osborn is a senior editor at JLC.

Photos: 1–9, Roe Osborn; 10–15, Tim Healey

Equal diagonal measurements between the corners ensure that the wall is square **(1)**. The crew then tacks the sheathing to the studs, using a tape measure to follow the layout **(2)**. The sheets are flush with the top plate and split a stud on this home **(3)**.


4


5

With the sheathing tacked in place, this worker uses a router equipped with a bearing-guided bit to cut out window openings **(4)**. Some framers prefer to cut out the openings by sawing along snapped chalk lines. The cut-out openings then provide easy access for nailing off the perimeter **(5)**. Typically, the edges of the sheets and the opening perimeters are nailed 4 inches on-center, while nails along the studs are driven every 6 inches. Most jurisdictions require 6d ring-shank nails or 8d common nails for attaching sheathing.


6


7

The crew installs the sheathing so that the panels overlap the bottom plates, rim joist, and mudsill. After determining how much of that length is needed to cover the rim joist and mudsill, a worker snaps a chalk line and cuts off the excess sheathing with a circular saw **(6)**. When the crew raises the wall, the sheathing at the bottom of the wall covers the rim joist **(7)**. Once all the walls are in place, the crew will nail the sheathing to the mudsills and rim joist to tie the wall framing to the floor framing.


8


9

Certain sections of the walls on this house were engineered to increase their racking strength. Placement of the sheets meant that small strips needed to be filled in after the walls were raised. Short jogs were also raised without sheathing and were filled in afterwards **(8)**. These sections overlap onto the corner studs to help tie adjacent walls together. When all the sheathing has been nailed to the studs, a crew member goes around the perimeter of the house to make sure the sheathing is nailed to the mudsills and to the rim joist **(9)**. Because of the infill sheathing sections, the crew installed housewrap after the walls were raised.

With horizontal sheathing, the crew squares the wall and snaps a chalk line to guide sheathing placement **(10)**. With the studs visible, they can adjust the stud spacing to keep the studs straight **(11)** and tack the sheathing in place **(12)**.

The second course begins with a half sheet to stagger the end joints **(13)**. One person cuts out the window openings with a router, as before, while another nails off the sheathing **(14)**. Then they staple housewrap to the sheathing **(15)**.

For a more detailed discussion of sheathing walls, go to **www.jlconline.com/training-the-trades/sheathing-walls**.

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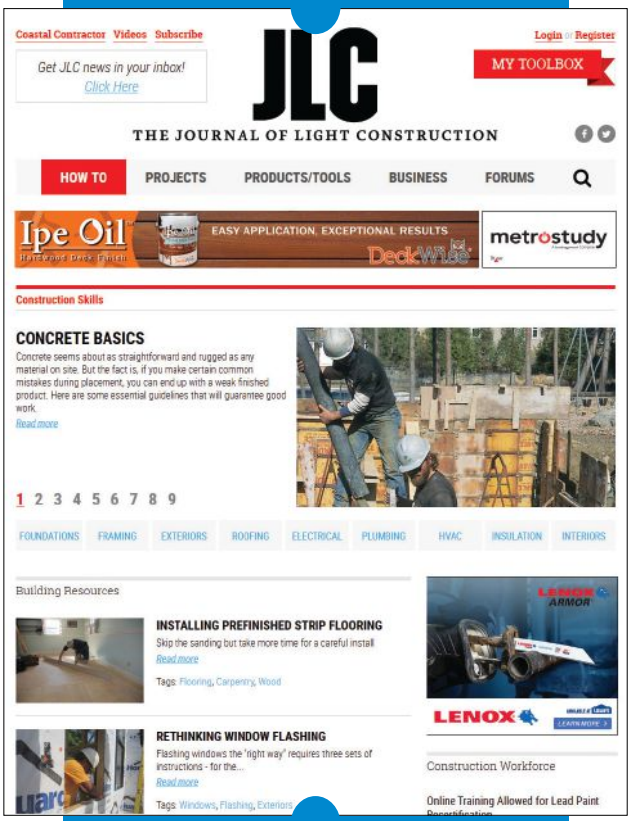

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Q In a current remodeling project, the clients need to replace their gas boiler. Does it make sense to upgrade to a condensing boiler?

A Foster Lyons, an engineer and building-science consultant, responds: Because condensing boilers are 10% to 12% more efficient than equivalent non-condensing models, you'd think this question would be easy to answer—just figure out fuel costs and the cost of the equipment and run the numbers, right? But it's not quite that simple, because of the differences between the two types of boilers.

With a traditional (non-condensing) boiler, the exhaust gases are very hot, typically around 400°F. Those hot exhaust gases are immediately sent up a chimney and take a lot of thermal energy with them, which limits the energy efficiency of traditional boilers.

A condensing boiler, on the other hand, has components in the flue system that transfer some of that thermal energy from the hot exhaust to the water that is being heated. In the process of transferring that energy, the exhaust gases cool enough to cause condensation of the water vapor from those gases, hence the name "condensing boiler."

The exhaust from a condensing boiler is typically around 100°F—much cooler than the exhaust from a traditional boiler. In short, compared with traditional boilers, condensing boilers take a greater percentage of the energy inherent in the fuel and transfer that energy to the water being used for heat.

However, this increase in appliance efficiency adds a variety of complications. First, the controls for condensing boilers are more complex. Water returning to the boiler (after heating the house) is used to pull the thermal energy out of the hot gases in a heat exchanger. The temperature of that return water can't be too high; otherwise, the exchange of heat doesn't happen properly. Maintaining an optimum return temperature requires more controls than on a traditional boiler.

Second, the liquid condensate that is generated in the exhaust heat exchanger needs to be drained off somewhere, which usually requires a reservoir and a pump of some sort **(1)**. Third, the condensate liquid has a pH in the range of 3 to 5 (not as acidic as lemon juice, but more acidic than milk and about the same as tomato juice). That means the exhaust heat exchanger—and anything else the condensate liquid may touch—needs to be chemically resistant to acid. Stainless steel or aluminum-silicon alloys are the materials of choice. Also, because of this high acidity, the exhaust cannot exit through the same masonry chimney that is being used for the existing boiler without an acid-resistant liner.

Fourth, because the exhaust from a condensing boiler is relatively cool, it's not particularly buoyant. It doesn't go up a chimney very easily, like the 400°F exhaust from a traditional boiler does. So the exhaust needs to be pushed out with an exhaust fan. These added components boost the cost of condensing boilers compared with that of non-condensing boilers with the same output.

In addition to the fuel-efficiency benefit, the exhaust flue for a condensing boiler doesn't need to be masonry or metal. It can be made from ABS, PVC, or CPVC pipe with a high-temperature rating **(2)**. Because these less expensive materials can be used, gases from a boiler are commonly exhausted through a sidewall or rim joist rather than through a chimney, which can make a condensing boiler a good option for new construction. In your replacement scenario, the clients need to weigh the potential long-term fuel savings against the immediate added cost of upgrading to a condensing boiler.

Condensate from a condensing boiler drains into a reservoir and is then pumped safely to the outdoors **(1)**. With relatively low exhaust temps, the flue can be a plastic pipe with a high-temperature rating (gray) **(2)**. This jurisdiction requires rated pipe for just the first 5 feet from the boiler.

Photos by Roe Osborn

Q Can screws be used instead of nails for attaching wall sheathing to framing?

A Nick Robertson, product application specialist for Huber Engineered Woods, responds: There is a common misconception in the building industry that screws always outperform nails when attaching wood to wood. It's true that screws have a highly effective withdrawal resistance, which makes them excellent fasteners for tasks such as avoiding squeaks in flooring assemblies, resisting uplift forces that occur in roofs, and holding deck ledgers tight to a building. However, there are certain applications where nails are superior for fastening.

By design, nails are less brittle than screws, which leads to an increase in shear strength for nails. In other words, if two pieces of wood (or wood and metal) are fastened together and those materials are forced in opposite directions, the forces acting on the fastener are likely to cause the shank of a screw to break. A nail subject to the same forces is much more likely to bend without breaking, which in turn keeps the two pieces of wood joined together.

Let's take this simple concept and apply it to a braced wall application. Braced walls are areas of framed wall that contain no door or window openings (although some engineered braced-wall designs do allow for openings). These walls must have let-in bracing, diagonal board sheathing, or some sort of code-approved sheet material to stiffen the structure against racking. In a typical braced wall, the framing is primarily secured by a structural sheathing panel, such as OSB or plywood. The most important force at play for this wall is a shear force from the wall moving back and forth laterally due to wind or seismic activity.

The sheathing panels brace the framing to stop the wall from toppling over, and increasing the number of fasteners increases the wall's shear resistance. Now imagine if some of those edge fasteners start to fail. For every fastener that fails, the shear resistance of the entire wall decreases; in the worst-case scenario, the entire wall might end up failing, ultimately causing failure of the entire structure.

Because of this concept, many building-standards groups specify that only nails and staples are to be used for wood structural panel attachments in wall applications: ANSI National Design Specification, NDS Chapter 12: Dowel-Type Fasteners; AWC Special Design Provisions for Wind and Seismic, Chapter 4: Lateral Force-Resisting Systems; and the 2018 International Building Code, Section 2304.10: Connectors and fasteners.

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Windowsill Retrofit

BY EMANUEL SILVA

Replacing windows and exterior window trim is a remodeling task that I do quite often. Sometimes, I am called when a faulty installation has caused a catastrophic failure, and I end up rebuilding the opening, then reflashing and retrimming the window from scratch (see "Fixing a Poorly Installed Window," Feb/19). I also do complete window replacement projects (see "Retrofitting New Windows in an Older House," Apr/15). In both of these situations, I typically tear out the old wood trim—including the windowsills—and replace everything.

In some window projects, however, I find that some of the existing trim is in good shape, so I replace just the sections that are rotted to save the client the added expense. That often means replacing just the sill or just the casing.

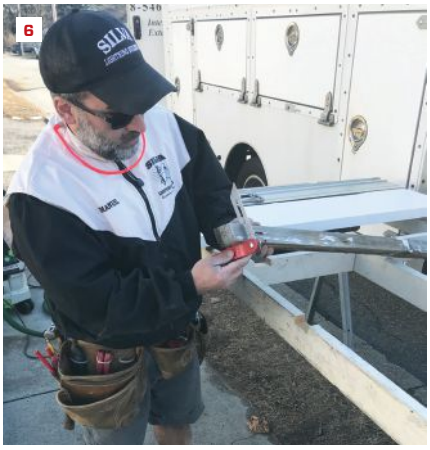
I recently returned to a replacement window project that I had completed some years ago. In that case, the 1 1/2-inch-thick old-growth wooden sills had been in great shape at the time, so I left them in place, though I replaced the rest of the trim with PVC. Those sills had finally given out, and it was time to retrofit new ones. My first task was cutting the nails attaching the old sills to the original jambs and removing them. The new PVC sills matched the original sills and slid in easily from the outside. Adding the PVC sills brought all the window trim up to date and will keep the windows performing well for years to come.

Emanuel Silva, a frequent contributor to JLC, owns Silva Lightning Builders in North Andover, Mass. Follow him on Instagram @emanuel.a.silva1996.

The wood sill had been in good shape when the author originally installed the replacement window and new casing **(1)**. Since then, however, the sill had rotted and needed to be replaced **(2)**.

To make the sill stock, the author rips two pieces of 3/4-inch-thick PVC sheet stock **(3)**. He applies PVC cement to both mating surfaces **(4)** and then drives screws to join the two sections together while the adhesive sets **(5)**.

Photos by Carter Silva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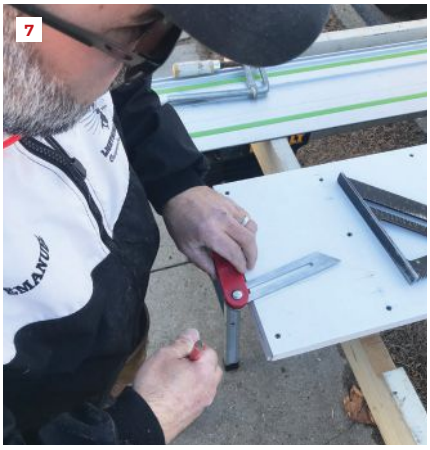
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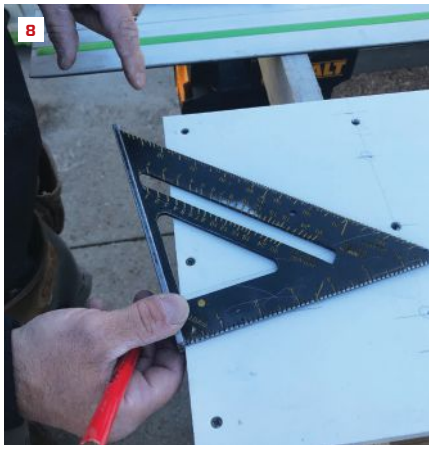
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The original sill was cut and installed at an angle (about 13 degrees) to shed water readily. The author records the plumb angle from the front of the sill with a bevel gauge **(6)**. He places the bevel gauge against the edge of a straight board and records the angle **(7)**. Next, he places a rafter square on the line to find the angle measurement for setting the saw blade **(8)**.

With the track saw set at the proper angle, the author makes the plumb cut for the edge of the windowsill **(9)**, then flips the sill over and rips a shallow drip groove on the underside **(10)**. The sill has horns on the sides that fit under the side casings, and the author cuts them out with a jigsaw **(11)**. After the horns are trimmed to length, the sill is ready to be installed on the window **(12)**.


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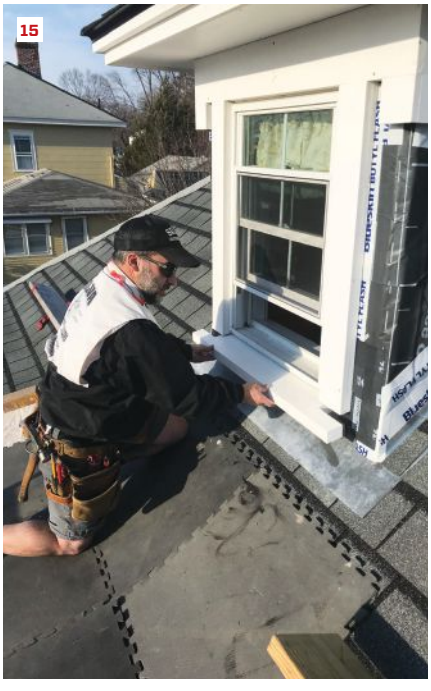
While the window opening had been properly flashed and waterproofed at the time of the replacement window installation, the author air-seals the opening by applying low-expanding foam before installing the sill **(13)**. After the foam insulation cures, he applies a thick bead of clear silicone sealant to bed the sill in place **(14)**.



The author carefully slides the new PVC sill into position below the replacement window and the side casings **(15)**. To lock the new sill in place, he drives galvanized screws from the edges of the casing and into the horns of the sill **(16)**. The screw heads will be hidden by the siding. With the corner boards installed, this dormer is trimmed and ready for siding **(17)**.

Streamlined Ipe Decking Installation

BY JIM WOLFFER

Our company installs a deck on just about every home we build, and our decking material of choice is usually ipe. For years, we never really gave the decking installation process much thought. Layout usually consisted of starting on the outside perimeter of the deck and working towards the house, laying down one row at a time until we reached the house wall.

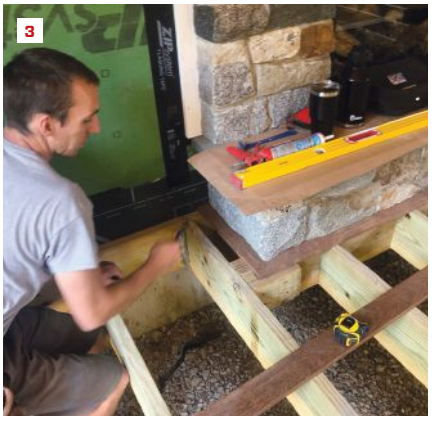
That system worked, but it was tough keeping the boards straight and getting the last few rows of decking to hit the house just right. Depending on who on the crew did the layout, gapping and nailing down the boards could be a slow process. We often found ourselves making corrections, and occasionally we'd end up pulling and refastening a few boards to make the deck look just right.

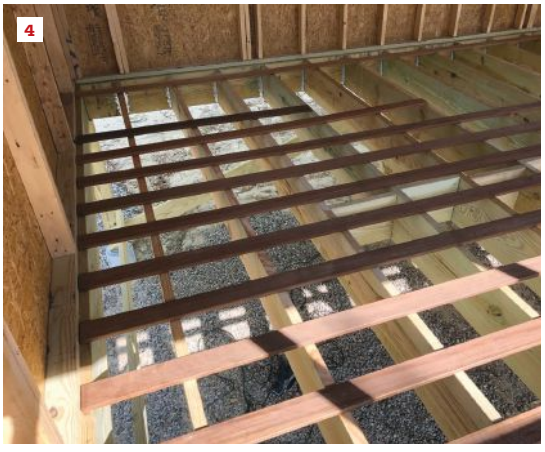
A different approach. Several years ago, we began trying different ways to speed up decking installation. To resolve our layout issues, we tried snapping lines across the joists for all the boards before any decking went down. This strategy gave us straight lines to work with, and although it was a step in the right direction, it did not solve all of our problems. The lines helped us keep the boards a little straighter, but it was tough to install them right on our lines. And we were still laying down decking one row at a time, which was particularly challenging on a deck that had a long run of boards.

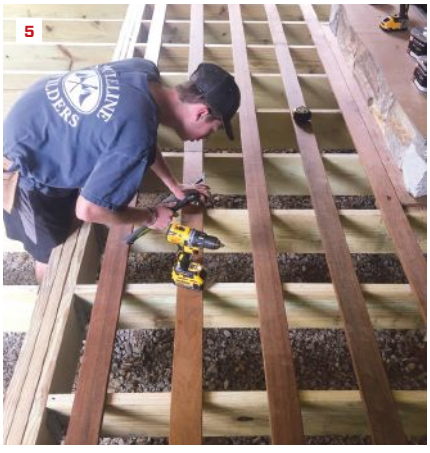
Then we decided to install every third board on our snapped lines. Once those boards were tacked in place and perfectly straight, it was easy to fill in the two rows between, even with long runs of decking **(1)**. We set the infill boards in place and straightened them with wedges, just eyeballing the gaps to keep the spacing even.

Layout. Whether we are laying out an enclosed porch or an open exterior deck, we always start with the basic deck board layout. Decks or porch floors that are simple rectangles are obviously the easiest. In those cases, we typically start at the rim of the deck and work the layout back towards the house.

The math comes down to determining the distance between the leading edges of every third board. It's easy to set up a few boards to verify the spacing. Because we have always fastened the boards

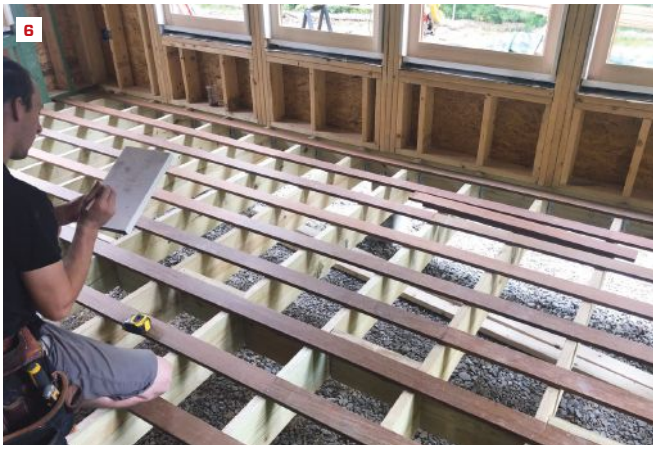


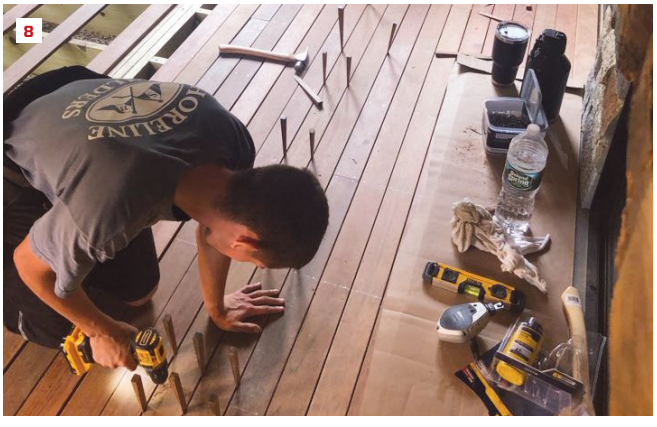




Photos by Jim Wolffer

The system for installing every third board works well for long runs of decking **(1)**. The crew snaps layout lines across the joists for every third row **(2)**, as well as lines down the middle of each joist for nail alignment **(3)**. Then they lay the boards down **(4)**. After predrilling, a crew member tacks the decking on the snapped lines **(5)**.





Once the crew has tacked every third row in place, one person makes a cut list for the infill boards **(6)**. The crew cuts the infill boards and racks them between the tacked boards **(7)**. Wedges straighten the infill boards and keep the gaps consistent while a crew member tacks those boards in place **(8)**. Erasable white chalk lines keep the nails in a perfectly straight line **(9)**.

with stainless trim-head nails, those nails (which are about 1/8 inch wide) became our spacers. For most of our floors with 1x4 ipe decking, three boards at 3 1/2 inches plus three 1/8-inch gaps yield a total distance of 10 7/8 inches between the leading edges of the first and fourth boards (leaving space for two boards between them).

Adjusting the layout. We mark out 10 7/8-inch intervals along both sides of the deck. It's nice, but rare, when the layout works out to exactly a full board at the end of the layout, but at this point, we can adjust the gap size to modify the layout if need be.

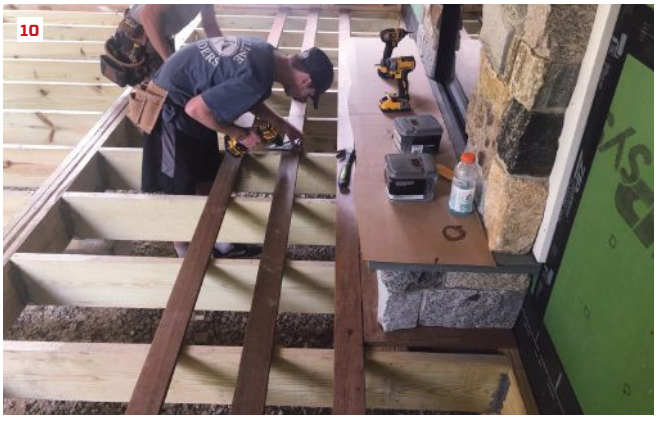
Optimally, we want the last board to be no less than two-thirds wide, avoiding a narrow sliver if at all possible. A calculator can be a big help here. In the project shown in the photos, the distance between the outer wall of the porch and the house wall was 212 inches. With a 3 1/2-inch board plus a 1/8-inch gap, each row is 3 5/8 inches wide. Dividing the total width of the room (212 inches) by 3 5/8 yielded 58 and a half rows.

The width of half of a board is 1 3/4 inches and half of that is 7/8 inch. To achieve an even reveal at both walls, we simply started the layout 7/8 inch back, or at 10 inches. In most cases, the porch wall material or the house siding will cover the edge of the last board.

Snap and go. Once we've marked the layout for every third board, we snap chalk lines across the joists between our marks **(2)**. Before installing any boards, we also snap chalk lines down the center of each joist to help keep the nails in a straight line **(3)**.

With the lines snapped for the leading edges of every third board, we set boards on those lines **(4)** and tack them in place with one nail driven into each joist about 3/4 inch from the edge of the board **(5)**. After every third board is tacked in place, a crew member makes a cut list for the infill boards **(6)**.

We cut the infill boards to length and set them in place. Much like "racking" strip flooring prior to installation, we haven't begun actually installing the boards at this point **(7)**. When a few rows of infill boards are racked, a couple of crew members can begin installing them, first tapping wedges between the boards to create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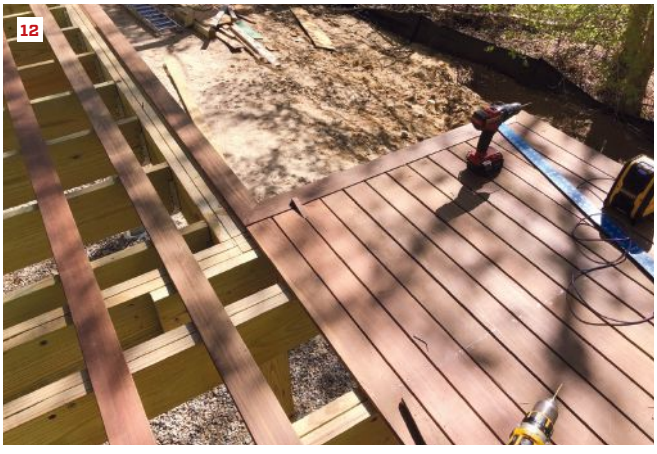
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When there's a fireplace (or similar structure) that the decking layout has to accommodate, the crew first establishes the overall layout, then determines the width of the picture frame around that structure based on the layout **(10)**. For areas where the decking is continuous from one area into another, the crew lays out every third board in one area, and then projects that layout into the adjacent area **(11)**. For L-shaped decks, the layout starts from the corner where the two sections meet, and extends in both directions from that point **(12)**.

uniform gaps, then drilling and tacking the boards in place **(8)**.

As the infill boards are tacked down, we snap erasable white chalk lines over the nail locations to keep the nail heads in a straight line **(9)**. Any member of the crew can then drill and drive the rest of the nails without the installation needing to progress from one side to the other, and crew members can be working on different tasks in different parts of the deck at the same time.

Special situations. In a three-season porch we built recently, there was a stone fireplace on the house wall. Instead of scribing the decking to the stone, the masons built the edges of the fireplace on top of temporary pieces of 3/4-inch-thick PVC trim. When they finished the fireplace, we removed the PVC trim and slid deck boards in to create a picture frame around the fireplace.

To determine the width of the frame, we just did our every-third-board layout, and then sized the ipe picture frame around the fireplace to fit within that layout **(10)**. That particular layout gave us just over five full boards to the house wall, and with the 3/4-inch-thick wall paneling, almost a full board was visible at the wall.

We also often run into the situation where a deck adjoins a porch or another deck and we want the decking boards to be continuous from one area into the other. Usually, a doorway between the spaces is the critical transition area, so we determine which space is less flexible in terms of layout and lay out that section first. We work the every-third-board layout, and at the doorway, we project our lines through into the adjoining space **(11)**. We then work our layout in both directions to the perimeter of that space.

If the deck has an "L" shape, we start the layout at the corner where one area of the L transitions to the next **(12)**. Working back from that point, we can usually adjust the size of the gaps slightly so that we have a full board at the outside edge of both sections.

Efficient workforce. The decking installation method described here won't work with every fastening system, but for face-nailing or screwing down deck boards, it works incredibly well. After a small investment in time to figure out the layout and snap the lines, installation is faster, and the decking ends up perfectly straight and evenly spaced.

Best of all, this system doesn't require a high level of skill. We usually break in new employees on the decking crew, and they become master decking installers after just a day or two.

Jim Wolffer owns Shoreline Builders (shorelinebuilders.net), a custom home builder in Scituate, Mass. Follow Jim on Instagram @shorelinebuildersma.

BY TED CUSHMAN

Controlling Ventilation With Pollution Sensors

Codes governing ventilation typically focus on system sizing, not operation. Required ventilation exhaust capacity is based on the square footage of the house, the number of bedrooms, and the number of occupants. The presence or absence of pollutants doesn't figure in, and control of the ventilation is left up to the occupants.

But ventilation-system manufacturers are starting to evolve a more sophisticated approach: They're introducing fan systems that can be controlled with pollution sensors in the house. That way, ventilation can turn on when it's needed, and turn off when there's no practical reason to exchange air.

An example of this was on display in the Panasonic booth at the International Builders' Show in January. With Panasonic's Cosmos control system, fans in bedrooms, baths, and kitchens can be managed to respond to signals from a Foobot air-pollution sensor. The Foobot indoor-air-quality sensors measure pollutants in the home: volatile organic compounds (VOCs), carbon dioxide, humidity, and particulate matter (PM2.5, the small particles that are capable of passing through the lungs into the bloodstream). When a sensor detects elevated levels of pollutants, the system's control center signals the nearest fan to turn on and exhaust the room air.

Each of these triggering pollutants offers a different cause for concern.

VOCs are a complicated topic. They're chemicals given off by a variety of sources, including cleaning products, furniture, and carpets. They can react with each other to form new gases or tiny particles, or react with particles to change the particle composition. According to the American Lung Association, "Breathing VOCs can irritate the eyes, nose and throat, can cause difficulty breathing and nausea, and can damage the central nervous system as well as other organs. Some VOCs can cause cancer. Not all VOCs have all these health effects, though many have several."

PM2.5 is a serious health hazard in the outdoor environment. It's linked to heart and lung disease, and it's a good idea to control it in the indoor environment. According to the EPA, "numerous studies link particle levels to increased hospital admissions and emergency room visits—and even to death from heart or lung diseases."

Cooking can be a source of PM2.5, but the outdoor air is the major source in most homes. Tighter homes have less PM2.5, and having a filtered fresh-air supply is a good way to lower PM2.5 concentrations indoors.

Carbon dioxide is usually thought of not as a pollutant per se, but as an indicator gas that reflects air freshness. People breathe out carbon dioxide, so elevated levels in a home generally reflect high occupancy or "stuffy" air. Only at very high levels (which you are unlikely to see in a home) does CO_2 directly cause health issues for humans. But it makes a handy surrogate for controlling air freshness.

Elevated humidity is a problem because it supports mold growth. On the other hand, air that's too dry can cause discomfort. The ideal relative humidity for health and comfort is about 40% to 50%, but in winter, the humidity may have to be held at a lower level to prevent condensation on windows.

> Cosmos hub: "The geeks call it 'computing at the edge.'" —*Russell Pope*

Panasonic's Cosmos system is capable of sensing and responding to all these pollutants. Humidity control is influenced by the moisture content of indrawn air and is a complicated topic of its own. In any case, Panasonic research and development manager Russell Pope says the Cosmos strategy emphasizes PM2.5 and VOCs.

The system consists of several components. Placed in living rooms, kitchens, and bedrooms, several Foobot pollution sensors in the house monitor air quality continuously. The sensors communicate via Wi-Fi to the Cosmos control center, or "hub." The hub looks like a Wi-Fi router, but it's more than that, Pope explains: It's a small computer. "The geeks call it 'computing at the edge,'" says Pope.

"It's actually doing some local control. We have the ability to program various scenes," says Pope. "So for instance, with the phone app, we can program in ASHRAE 62.2 continuous exhaust. You select drop-down menus—the size of your home, the square footage, the number of

The Foobot pollution sensor (at far left) communicates through the Cosmos control center (at left).

bedrooms, the occupants—and then you can select which version of ASHRAE 62.2 your code requires. And that will automatically turn the fans on and off to meet code and ASHRAE 62.2."

For more advanced control, however, the control center turns to the cloud, communicating via Wi-Fi through the home's internet router and modem. "It will operate locally if the internet goes down, and that is very important for minimum ventilation and code compliance," says Pope. "But if you need the advanced features of controlling products on and off based on indoor-air-quality readings, then the internet is required, because that information does go from the sensor to the cloud to be interpreted."

(Wi-Fi is not the only way the control center can talk. It's also fluent in other "Internet of Things" languages: Zigbee and Z-wave, two wireless protocols that are widely used in smart-house applications.)

The other essential component is the fans. "The fans that it is designed to work primarily with are the WhisperGreen Select, the WhisperFresh in-line fan, and the range-hood models. The installation of the fans really isn't any different, with the exception of the WhisperGreen Select fan," says Pope. "There are three options for wiring that fan. You have to make sure that there's continuous power going to the fan itself, so you just have to make sure that the WhisperGreen Select is wired with the installation method 3 in our video. It's the same way the fan would be wired if you had a humidity sensor or a motion sensor module placed in those fans. The range hood and the WhisperFresh are cord connected, so they're typically not switched."

The WhisperFresh fan is typically used for supplying indrawn fresh air. But it can be used as a transfer fan, says Pope. At the Builders' Show, Panasonic demonstrated that option. "We had it set up with the indoor-air-quality sensor in the bedroom. At night when you're sleeping, the levels increase—CO_2 and VOCs are the ones that really increase in the bedroom at night. So we have a scene that you can create and use the WhisperFresh fan as a transfer fan. The way that we demonstrated that at the Builders' Show was we had a fresh-air inlet that doubled as a recessed LED light set up in a living-room space to pick up air from the living room, bring it through the MERV-13 filter in the WhisperFresh, and then supply that fresh air to the bedroom. So you're utilizing fresh air that's already in the house; you're just transferring it from one space to another to save energy."

Going forward, Panasonic won't be the only player in this game: Broan-NuTone is also working on its own version of sensor-controlled ventilation, set to hit the market in the fourth quarter of this year. Details are still scanty, but Broan marketing manager Dave Jones says the system will involve four components: a wall plug, a wall switch, a pollution sensor, and a smartphone app that runs the system through the cloud. The smart plugs and switches can be wired to bath fans, kitchen fans, or ERVs and will respond to signals from the cloud, allowing the system to adjust appropriately to buildup of humidity, CO_2, or other pollutants, says Jones.

Ted Cushman is a senior editor at JLC.

Photo courtesy Panasonic

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Roofing With Self-Adhering EPDM

Builders can handle the job with their own crews

BY MARK POLLARD

Photos by Ted Cushman and Mark Pollard

This past fall was a wet one in coastal Maine. Our go-to roofing contractor was battling his schedule, and we needed to put an EPDM roof on our flat-roofed studio project in order to start the siding phase. We chose to do the work ourselves, rather than find another roofer, for a few reasons: The project is on an island, which scares off a lot of contractors; the roof had out-of-the-ordinary details for southern Maine; we needed only two days of clear weather; and I have experience working with EPDM.

I first learned about installing EPDM from an article in *JLC* many years ago. A couple of years later, I relied on that article to do a small, simple EPDM roof. Since then, I have completed about 10 more projects.

This project did have a few firsts for me: a parapet wall on all four sides, through-wall scuppers to drain the roof, and self-adhering EPDM. I wanted to try the self-adhering version because we could eliminate the time-consuming step of applying contact adhesive and we could install it in colder temperatures (down to 20°F). It was going to be mid-to-late November by the time we were ready, and the lead time on the kit of parts was about seven days.

As this was a flat roof, we would need to install tapered sheets of rigid foam insulation to provide the necessary pitch to drain water toward the scuppers. We are in climate zone 6, so there would also have to be adequate R-value above the structural roof sheathing to avoid moisture accumulation on the underside of the 5/8-inch

The crew builds the roof up with tapered sheets of foam, constructing valleys that lead to scupper locations in the downslope parapet wall **(1)**. The foam buildup is fastened down with long FastenMaster screws **(2)**.

plywood. The rafters were 11 7/8-inch I-joists filled with dense-pack cellulose (R-41.5), so following the recommendation from 2015 IRC Table 806.5 of roughly a 50/50 split of cavity to above-sheathing R-values, we needed 6 to 7 inches of polyisocyanurate insulation (PIR).

This 1,000-square-foot building is essentially two conditioned boxes connected by a breezeway roof and deck. We fully sheathed and waterproofed each box before we framed the breezeway roof system. We also delayed framing the parapet walls to simplify waterproofing and air control. This allowed for continuity of the air control layer: Henry Blueskin VP100 on the walls and Henry Blueskin RF200 Ice and Water Barrier on the roof. It is essential to have an air control layer between the roof sheathing and the tapered insulation system to keep air leaks from transporting water vapor into the PIR layers.

I figured out the parapet wall height based on the thickness of PIR at the scuppers, plus the 1/4-inch-per-foot slope of the tapered foam, and the desired height of wall above the high point of foam. The crew added the parapet framing, sheathing, and RF200 a couple of weeks prior to the roofing material delivery. We left a small strip of sheathing out at the breezeway to drain rainwater, and the crew was diligent about pushing ponded water through the gap with a floor squeegee.

I sent PDFs of the construction drawings to a local building supply company, which has a commercial division that quickly worked up a quote with PIR sheet types and counts, along with a layout showing how to build up the layers of PIR (that was great, because I was not looking forward to muddling through that). The same supply company offers self-adhering EPDM from Firestone, and again, its commercial division provides great technical support. Firestone's website also provides detailed construction drawings and links to well-produced YouTube videos. I chose a thicker offering (60 mil) and used my previous experience to put together the accompanying kit of parts. Here is my complete parts list:

- 1 roll 9"x50' GenFlex (GF) Peel & Stick EPDM Flashing
- 2 rolls 6"x100' GF EPDM Peel & Stick RPS Strip
- 1 gallon GF EPDM Splice Adhesive
- 1 gallon GF EPDM Primer
- 1 tube GF Waterstop Mastic
- 6 tubes Firestone FullForce Lap caulk
- 1 GF Peel & Stick EPDM Pipe Boot
- 1,000 count GF 3" round insulation plates
- 1,000 count GF 2" round insulation plates
- 2 pad holders with 4 scrubbing pads
- 2 disposable 4" paint trays
- Nitrile gloves
- Rags
- Paint stirrer with cordless drill
- Heavy-duty scissors
- Chalk or construction crayon

On delivery day, we prepped the site so that the boom truck could get as close to the building as possible, and we cleaned the roof. Self-adhering 10-foot-by-100-foot rolls of 60 mil weigh around 500 pounds, so the boom truck was indispensable; placing the shrink-wrapped bunks of PIR onto the roof with it was a bonus. While we were waiting for clear weather, I laid out the locations of the ridge and


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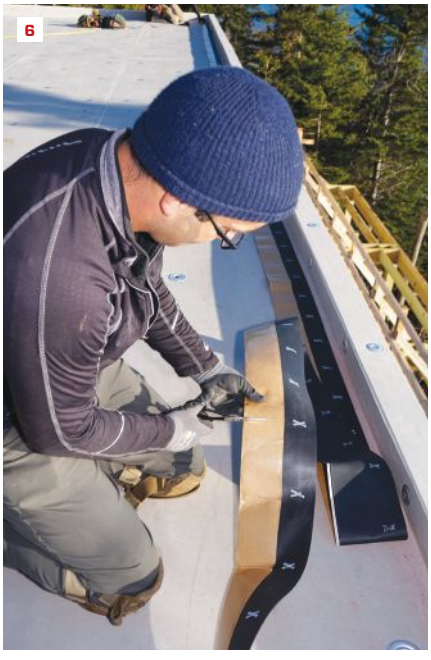
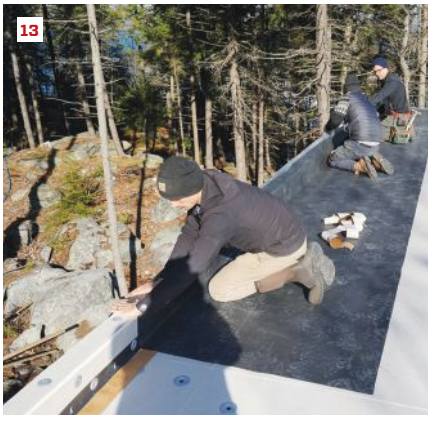

6


7

The crew rolls out the EPDM and gives it a half hour to relax **(3)**. To simplify the work on the valley portion of the roof, they split one section of EPDM in half **(4, 5)**; heavy-duty scissors easily cut the membrane. The reinforced perimeter strip (RPS) is cut to length **(6)** and screwed to the side of the parapet **(7)**.



The crew slits the backing plastic on the EPDM **(8)**, primes the surface of the reinforced perimeter strip (RPS) **(9)**, and then pulls the backing plastic off the EPDM where it lies on the substrate **(10)**. Next, they pull the backing paper off the RPS **(11)**, pull the backing plastic off the other edge of the membrane **(12)**, and carefully roll that edge up onto and over the parapet **(13)**.

valleys for the tapered foam system. This also allowed me to locate the openings for the two through-wall scuppers, cut them out with a hole saw, and apply liquid flashing (Henry AirBloc LF).

BUILDING UP THE ROOF

A couple of days later, when the forecast called for 2 1/2 days of colder but precipitation-free weather, we started work. We used wet vacs to suck up ponded water and swept up pine needles and other debris. While the Henry RF200 was drying, we patched and air-sealed the temporary drain and discussed insulation details with the crew. Part of the roof was covered with materials, so we started laying down the first layer of 2 1/2-inch PIR in the open area, then shuffled the bunks of foam and rolls of EPDM onto that layer. This positioned the materials on the upslope portion, away from the scuppers and the more complicated, downslope side. We completed the first layer of 2 1/2-inch PIR and added sheets of 2-inch PIR according to the layout map. We then snapped lines for the ridge and valleys.

We used 1/4-inch-per-foot tapered foam, which comes in 4-by-4-foot sheets. The thinner sheets range from 1/2 inch to 1 1/2 inches thick and the thicker from 1 1/2 inches to 2 1/2 inches, so to build up the taper after 2 1/2 inches, we installed another layer of 2-inch foam and started again with the thinner tapered sheets. We staggered the joints of each layer to avoid convective currents from warm sheathing to cold EPDM. I chose not to fasten each layer to avoid using a lot of screws and to avoid penetrating the air control layer more than absolutely necessary, but I was prepared to adhere the layers with gun foam adhesive and temporary ballast, if needed.

The roof is about 46 feet by 22 feet, with scuppers placed at the quarter points on one of the long sides, which we designated as the downslope side. We created the slope in the roof using the tapered sheets of foam. At the same time, we oriented the tapers on the sheets to establish the necessary side-to-side slope to funnel water away from the short sides of the roof toward the scuppers. We also created a built-up ridge in the center of the roof, running perpendicular to the long side where the scuppers are, to direct water away from the center and toward the scuppers.

Detailing the parapet corners is a tricky process best learned from Firestone's YouTube videos. Here, the author cleaned and primed the EPDM before executing his corner fold **(14)**. Crew member Zack Payne applied flexible uncured EPDM flashing over a corner joint **(15, 16)**. The author rolled a section of EPDM for better adhesion **(17)**.

Once this section was built up, we installed a layer of 1/2-inch high-density (HD) PIR cover board. These 4-foot-by-8-foot sheets take the place of the traditional wood-fiber cover board to which EPDM is usually adhered. The self-adhering EPDM sticks well to both varieties of cover board, but the PIR version is more moisture tolerant and has a slightly higher R-value. This HD cover board is flexible enough that it was unnecessary to cut it at the ridge and valleys; we made sure to add enough fasteners to pull it tight to the layers below. To secure the cover board, we used 3-inch metal washers from GenFlex and 5 1/2- to 9-inch FastenMaster HeadLok screws **(2)**. (Up to that point, the insulation layers had simply been laid in place.)

We did the dance again and shuffled the materials for the last time, to the finished side. Layering in the upslope area of the roof and fastening the cover board went relatively quickly. We then focused on installing more cover board to the sides and top of the parapet, since the EPDM would eventually be wrapped up, over, and down a couple of inches on the outside of the parapet. Two crew members tackled this task by using 2-inch metal washers from GenFlex and 2 1/2-inch R4 screws from GRK. The unused and offcut materials were taken down and stored, and the roof surface swept clean.

The weather forecast had changed (surprise!) and was calling for a 20% chance of rain overnight with temperatures around freezing. Planning for this, I had bought a monster 40-by-60-foot tarp, which we laid down, ballasted, and battened to the outside face of the parapet. It did indeed rain overnight, and we returned to a tarp covered in ice, slush, and water. If we hadn't covered the PIR, we would have been forced to remove it all, vac up the water, and wait for it to dry before reinstalling. The heavy-duty waterproof tarp was expensive (around $450) but worth every penny, and we'll definitely use it again.

INSTALLING THE EPDM

We started the EPDM process by installing a 6-inch reinforced perimeter strip (RPS) from Firestone **(6, 7)**. It is meant to lessen the fatigue the EPDM will experience at the roof-to-parapet transition. If we were to adhere the membrane directly to the cover board at this horizontal inside corner, it would likely debond over

Installing a scupper involves several layers of waterproofing. First, the author applies beads of waterproofing mastic to the EPDM **(18)**. Next, he sets the scupper in place **(19)**, screwing it to the parapet **(20)** and the roof **(21)**. Then he primes the EPDM **(22)** to prepare it for flashing and counterflashing with uncured EPDM flashing (see facing page).

time. We fastened the 3-inch parapet leg of RPS 12 inches on-center with 2-inch metal plates and 2 1/2-inch screws. The 3-inch half on the roof deck had a pressure-sensitive tape covered by selvage paper that we removed just before installing the EPDM.

While the last of the RPS was being installed, we rolled out and cut three lengths of EPDM about 2 feet longer than needed **(3)**. A pair of heavy-duty scissors works well for almost all of the cutting tasks associated with EPDM **(4)**. After unrolling, it needs to relax for about 30 minutes. We assessed our game plan, made sure we had the necessary materials on hand, and prepped for the first pieces. I wanted to start at the downhill side to properly shingle lap the subsequent runs. This also meant we had to do the more complicated ridge, valley, and scupper portion first. I didn't know if the EPDM would conform well enough to the undulating surface to avoid wrinkles or stretching, but after watching it relax, I realized it wouldn't be a problem. Even so, we decided to cut the first sheet in half lengthwise, roughly at the ridge, to simplify things **(5)**.

To transition the EPDM over the RPS, it is helpful to carefully slice the backing sheet so you don't have to remove all of it and risk the sheet adhering to itself or slipping out of position. (Just like traditional contact adhesive, the SA version is stuck if it goes sticky to sticky.) I cut an extra "ZipperKnife" from a ZipWall dust containment kit in half. It works perfectly for this task. We positioned the EPDM where it needed to be, folded it back to just before the RPS at both the long edge and the 10-foot edge, and used the modified ZipperKnife to slice the backer at the folds **(11)**. This allowed us to adhere the bulk of the sheet and start working the tricky transition areas.

While two of us started the transition, another crew member used a push broom to work any air bubbles out and to apply pressure for a good bond. It is not recommended to use a weighted roller if using PIR cover board. We removed the remaining backing sheet, as well as the selvage paper from the RPS; it is easiest to keep the EPDM folded back onto itself and push it over the RPS and tight into the inside corner. We used our hands to smooth it up and over the wall **(13)**, and let the remainder lie loose over the outside of the wall as we shifted our focus to the vertical inside parapet corner.

The author cuts short sections of EPDM flashing **(23)** and applies them shingle-fashion over the fasteners and the scupper flange **(24)**, rolling the flashing with a small roller for better adhesion **(25)**. Then he applies nuts to the preinstalled studs to fasten the scupper grille in place **(26)**, torquing the nuts finger-tight.

Installation at the vertical inside corner of the parapet is the trickiest part. I won't try to muddle through an explanation; Firestone's videos do an excellent job of illustrating this detail. It is key to have splice adhesive on hand to bond the non-adhesive sides of EPDM together **(14)**. Earlier, while the EPDM was relaxing, we had cut corner patches from 9-inch GenFlex Peel & Stick EPDM Flashing (uncured EPDM). This stretchy, flexible patch, applied over a quick scrub of primer, finishes off the corner detail **(15, 16)**. We did the other half of this run the same way, but with a little more confidence at the vertical inside corner.

At the ridge splice, we used primer to clean the talc off the face, waited for it to be dry to the touch (about 5 minutes), and then bonded the two sheets together. This is another area where the SA version shines. All it takes is a quick scrub with primer **(27)** to bond the adhesive side to the face of the membrane; no waiting for primer then splice adhesive to dry (especially handy on a 35°F day). Ensure a high-quality bond of all spliced joints and flashing tape with a good amount of pressure from a small silicone roller.

The second run of EPDM was straightforward with only the two 10-foot ends wrapping up and over the parapet. So while Finn Bradenday and Zack Payne tackled it, I set to detailing the scuppers.

DETAILING THE SCUPPERS

I purchased the aluminum through-wall scuppers from OMG Roofing Products. I began by cutting a hole through the EPDM slightly smaller than the 4-inch drainpipe, hoping that if it ever leaked, maybe this would provide some form of backup to keep water out of the PIR layers. Prior to pushing the drainpipe through, I applied beads of GenFlex EPDM Waterstop, again as a backup **(18, 19)**. It is a tenacious butyl-blend mastic that works well when using a compression-type seal. I fastened the scupper with appropriate-length screws **(20, 21)** and then cut four pieces of EPDM flashing tape **(23)**. I dry fit the 9-inch flashing tape by positioning it over the threaded studs and tapping and perforating it with my hammer, then I pushed it over the studs and traced its outer edge with scissors. The trace lines helped prevent overshooting with

Crew member Finn Bradenday primed the EPDM at the lap joint **(27)**. The crew pulled the backing plastic away from a full-width section of EPDM **(28)**. The author used a push broom to press the roofing into place, securing a good bond with the substrate **(29)**. Once all the EPDM was down, the author sealed every seam with lap caulk **(30)**.

the primer and kept things nice and tidy. After the primer dried, we installed the two sides **(24)**, followed by the top, and then finally, we adhered the roof deck piece to help shingle lap at least some of the tape joints. We then rolled the flashing tape to ensure a good bond **(25)**. The compression ring was installed with locking hex nuts to "finger tight," and the grate with wing nuts, again with moderate tightness **(26)**.

FINISHING UP

The third and final run of EPDM installed faster as we got more proficient. It helped to have three people installing the long runs. Once a sheet was positioned, we folded 3 or 4 feet onto itself, started removing each half of backing, and then rolled this 3 or 4 feet of membrane back to tack the adhesive side. At this point, two people can start pulling each half of the backing sheet out at a 45-degree angle while a third walks on the membrane to keep an eye on things **(28)**. There is a little bit of adjustability if it starts to slide off track (not much, though—proper positioning before pulling the backing sheet is key). Again, after the backing is removed, apply pressure with a push broom at a 45-degree angle **(29)**, and roll the 3- or 4-inch overlaps with a small silicone roller to ensure a good bond. It was tedious using such a small roller for the overlaps, but it was part of the manufacturer's installation procedure.

The final step is to apply lap caulk (Firestone Full Force Sealant) at all the field overlap joints **(30)**, flashing tape edges, and inside corner edges. A quick scrub with primer to either side of the overlaps and edges provides a clean bond for generous 3/8-inch-wide-by-1/8-inch-tall beads. Lap caulk should be inspected every four to five years as part of a maintenance schedule, and touched up as needed.

Mark Pollard is a project lead for Thompson Johnson Woodworks on Peaks Island, Maine.

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3 Game Changers for Deck Building

It's time to end deck design, construction, and inspection headaches.

Building a safe, referral-friendly deck in any size yard, even the postage-stamp variety, may be easier than you think. Here are a few ideas we've gathered that can help you leapfrog competitors (especially ones not reading JLC).

1. **Beyond code.** Building to code is always an option, but that minimum standard may not play well with homeowners that may sell one day. Some home inspectors take a tough hardline approach to deck safety. Building to code will earn you a failing grade.

   Bruce Barker of Dream Home Consultants of Cary, N.C. is a 33-year home inspection veteran is a good example. "Most decks that I inspect have multiple defects," he reports. "I don't consider a defect simply a failure to comply with code. Failure is ignoring best practice, which is presented in Prescriptive Residential Wood Deck Construction Guide, or DCA 6-15.

   "A deck that passes local code may still be unsafe. DCA 6-15 is the standard, regardless of what is allowed by local authorities," Barker advises. Barker recently identified common deck trouble spots for JLC readers. The pictures might surprise you.

2. **3D-design magic.** If you use a 3D design tool or compete against contractors that do, then you know the impact a professional-looking 3D deck design can have on a homeowner. For some, it's the tiebreaker at decision time. Yet, what contractor has time to be a computer wizard? Good news ... there's a new 3D design tool called VisualBuilder that's free and easy to use. This speedy, do-it-all tool creates colorful dream decks on the fly from your laptop, notepad, or smartphone.

   It's perfect for rookies with no previous design experience. Instantly toggle back and forth between 2D and 3D views of decks of all shapes, heights, sizes, and materials with tiers, stairs, walls, accessories, scenery, you-name-it. You can even adjust the visuals for daylight. Send or print finished designs with just a click. Did we say it's absolutely free?

3. **Small yard secret.** Homeowners with smaller yards are good sales prospects, in spite of that small space out back. Thanks to tools like VisualBuilder, overcoming homeowner reluctance ("My yard is too small!") is easier to overcome than ever before.

   Tim Quigley, owner and operator of Quigley Decks in Madison, Wis., swears by this small yard idea: "It's true a deck can easily overpower a small yard space," Quigley explains. "One way to tame-down deck size is to minimize railing infill. Keep sightlines as clear as possible. I always recommend cable rail. It's an easy upsell because of the aesthetics and easy maintenance. I've never had a customer regret installing it."

The business of deck building is constantly evolving with new materials, new practices, new ways of doing things. Look to top deck materials manufacturers like the folks at Feeney, the cable rail people, to support you with the products, tools, and service you can count on.

To learn more about VisualBuilder and other deck building ideas, visit **Feeneyinc.com**.

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Photo: New Dimension Construction; Illustrations: Tim Healey and Steve Bazcek

Understanding R-Value

When improving wall performance, pursue a strategy of "proportional development"

BY STEVE BAZCEK

The building industry loves its standards. Even more, the industry loves a standard it can quantify as a number, which is easy to understand and compare. However, when we embrace these standards, we need to make sure we are understanding each number correctly. I find R-value is one standard that is often misunderstood. R-value simply describes a material's ability to resist heat flow—the higher the number, the better the R-value. With performance modeling and testing techniques, we have the ability to calculate the heat flow through any one isolated material. In the case of an entire building, however, we never use just one material. We build assemblies, and these assemblies typically have multiple pieces, each with its own insulating properties.

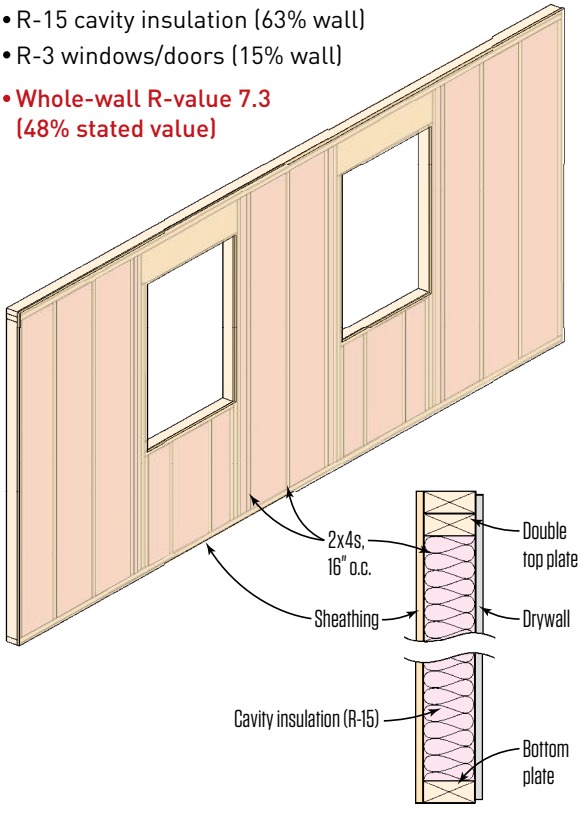
As builders and building designers, our goal, at its simplest level, is to create an indoor environment that is, by design, different from the outside environment. For most climates, this requires us to accommodate a difference (delta) in temperature, which in some cases can be extreme. The industry's answer to mitigating this delta is insulation. Typically, the higher the delta, the more insulation. The measurement of the insulation is R-value. While this numerical standard has served the industry well, it's only part of the equation.

EVALUATING WHOLE WALLS

As an industry, we tend to equate the R-value of a building's exterior walls with the R-value of the insulation in the assembly. For

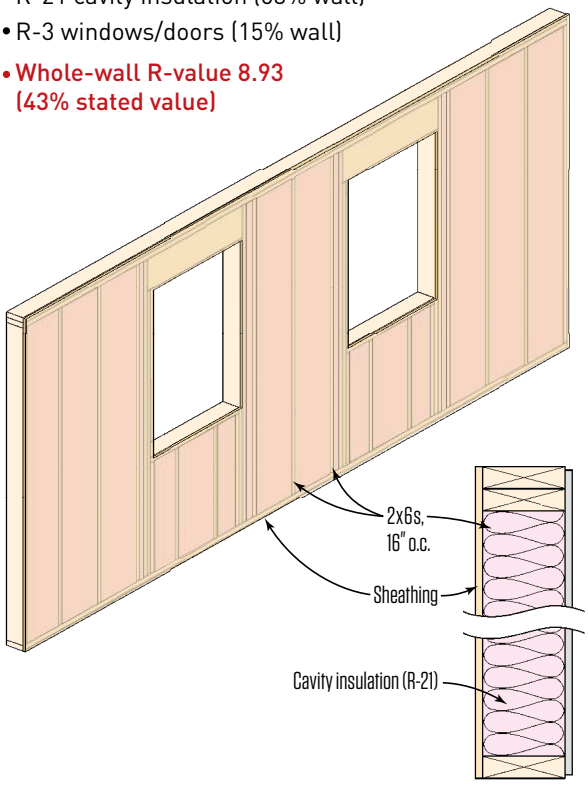
Wall 1

- 2x4 16" on-center wood frame, opaque area (22% wall)
- R-15 cavity insulation (63% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 7.3 (48% stated value)**



Wall 2

- 2x6 16" on-center wood frame, opaque area (22% wall)
- R-21 cavity insulation (63% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 8.93 (43% stated value)**



Conventional framing, 2x4 vs. 2x6. Wall 1 and Wall 2 compare typical wood wall framing at 16 inches on-center. The thicker stud cavity afforded by the deeper 2x6 framing allows for a slight increase in whole-wall R-value—only R-1.63, not the full R-6 that you might expect going from R-15 to R-21 cavity insulation.

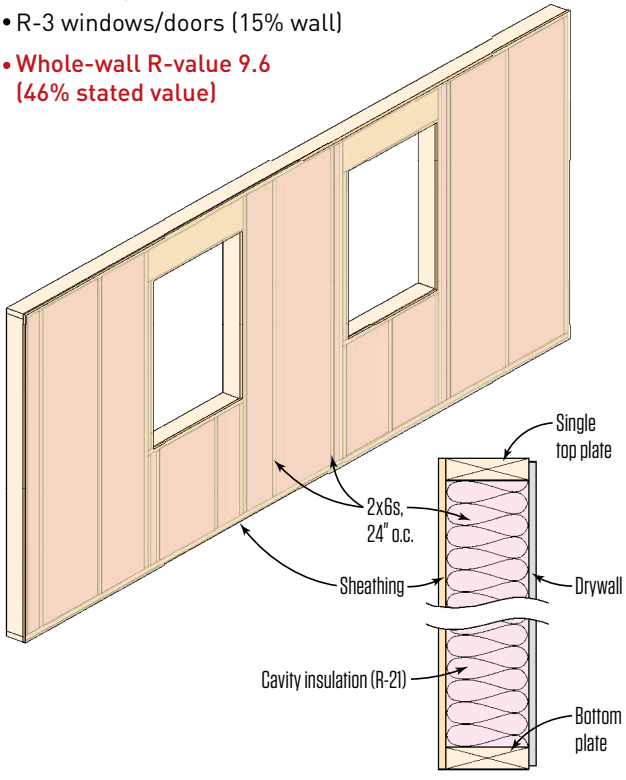
example, a 2x4, 16-inch-on-center wood-framed wall that is using an R-15 batt is labeled as an R-15 wall. This is where the standard and reality begin to part ways. Yes, the center of the stud cavity is R-15. The wall, however, is not just a stud cavity; it's a series of sticks that we call studs, plates, headers, sills, and so on. These sticks don't have the same resistance to heat flow that the cavity insulation does. Often termed "thermal bridges," these sticks have a significantly reduced R-value.

In addition to the sticks are holes. The holes are windows and doors, typically referred to as "fenestration." The fenestration in most cases has much lower insulating value than the center of cavity insulation. For marketing and standardizing purposes, we like to use the higher R-value of the insulation when discussing exterior wall assemblies. Using the higher R-value number, we feel better about our battle with the environment, and we look better. Reality, however, tells a slightly different story.

When we build exterior walls, we have three major contributors to the assembly—insulation (cavity or continuous sheeting), the wood frame, and the windows and doors. These three contributors when considered together make up what we call "whole-wall R-value." The whole-wall R-value is typically significantly less than the standardized value stated as the cavity insulation, mostly due to the significantly lower R-value of the wall frame and the fenestration. When we normalize the R-values of the components, we also have

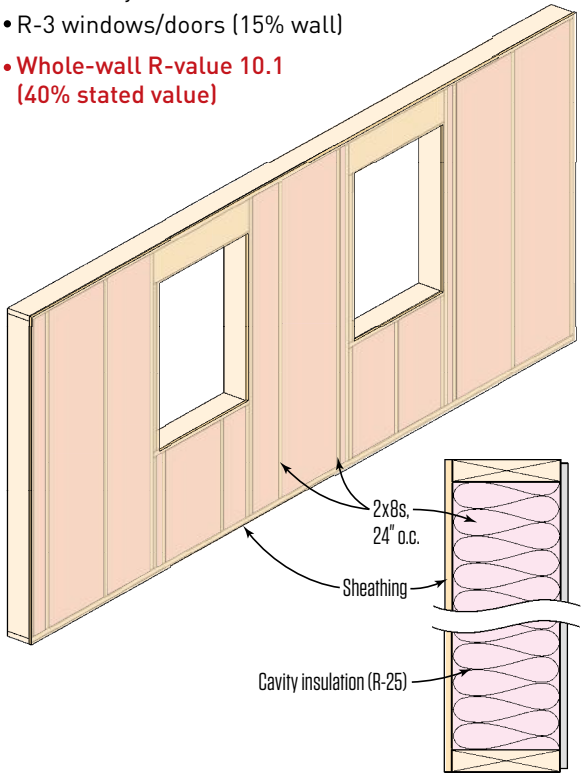
Wall 3

- 2x6 24" on-center wood frame, opaque area (14% wall)
- R-21 cavity insulation (71% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 9.6 (46% stated value)**



Wall 4

- 2x8 24" on-center wood frame, opaque area (14% wall)
- R-25 cavity insulation (71% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 10.1 (40% stated value)**



Advanced framing. Switching from conventional, 16-inch-o.c. framing to advanced framing techniques with 24-inch-o.c. spacing affords a slight improvement over a conventionally framed 2x6 wall, yielding a very modest boost of R-0.67.
Fat wall. Keeping with advanced framing, but using deeper 2x8 framing, adds a minor R-0.5.

to acknowledge their respective quantities in the wall assembly. Of course, the quantities available for selection are on a very wide spectrum. Although we could write books on this topic, let's boil this down to a clear, simple understanding that we can take away with some confidence.

Framing. Start with the first component of the exterior wall—the wood frame. The wood frame is typically 2-by material showing a 1 1/2-inch face to the exterior. For our discussion, we will call this the "opaque area." Framing has a spectrum of choices to adhere to, such as standard framing, advance framing techniques, and insulated headers (or no headers in non-bearing walls). Walls 1 and 2 (see illustrations on facing page) show a quick representation of a 16-inch-on-center wall compared with a 24-inch-on-center wall.

I have done numerous framing studies on houses and typically, the delta of opaque area in the walls ranges from about 5% to 12%. Yes, this could be lower or higher based on our level of aggressiveness, but for the sake of discussion, I will use an 8% framing factor to discriminate between a standard frame and an advanced frame. In a typical home, the wood frame comprises an opaque area of about 22%. With advanced framing measures, the opaque area falls to about 14% of the wall assembly. I use R-1.25/inch for R-value of framing lumber. This yields R-4.37 for a 2x4 wall and R-6.88 for a 2x6 wall. In summary, the opaque area makes up 14% to 22% of the wall assembly, yielding an R-value of 4.4 to 6.9 depending on framing thickness.

Cavity insulation, like framing, has options. A 2x4 wall cavity can be insulated from R-13 to roughly R-25. A 2x6 wall can be insulated from R-19 to R-39. Material selection, density, and cavity depth all play a role in the "cavity" R-value of a wall. For the purpose of our discussion, we'll use R-15 for a 2x4 wall, and R-21 for a 2x6 wall. The amount of cavity insulation has a direct association to the decisions of construction of the wood frame. This is simply because where there is no wood frame, there is typically cavity (except at windows and doors). So a decision for aggressive advanced framing techniques will yield a higher cavity percentage. Just like the wood frame, the delta of "cavity" area is 8%. Typically, the cavity area will vary from 63% to 71% of the wall assembly, directly tied to framing decisions.

Windows and doors are the last component of the exterior wall assembly. Not unlike their counterparts, the wood frame and cavity insulation, windows and doors have numerous insulating options, sizes, and performance enhancements, and most importantly, a wide spectrum of "fenestration" percentage. For the sake of our discussion here, we will use a window/door package with a U-value of .30. The U-value is the reciprocal of R-value; therefore, 1/.30 yields an R-value of 3.3. With the amount of glazing varying so widely, I resort to a simple colonial home yielding about 15% of the total wall assembly dedicated to "fenestration."

You can now see that as we construct our wall assemblies that the typically stated "R-value" (the cavity-insulation value) is not nearly the value of the whole-wall R-value, which normalizes the cavity area and cavity-insulation R-value with the areas and R-values of opaque and fenestration. Together, the three of them offer a not-so-staggering R-value. In the illustrations on pages 44 and 45 are a series of walls using typical residential construction materials. The takeaway of note here is how the "stated" R-value (the R-value of the cavity insulation) actually compares with the whole-wall R-value: In all cases, whole-wall R-value (what is actually happening) is considerably less than the stated value.

As noted, you can see a distinct compromise for what we label our wall's R-value and what we are actually constructing. In terms of the 2x4 16-inch-on-center wall, the whole-wall R-value is actually only 48% of the standard labeled value. Increasing the depth of the wall and cavity to 2x6, the whole-wall R-value is 43% of the standard labeled value. Instituting a level of advanced framing to the 2x6 wall yields a whole-wall R-value of 9.6, only 46% of the standard labeled value.

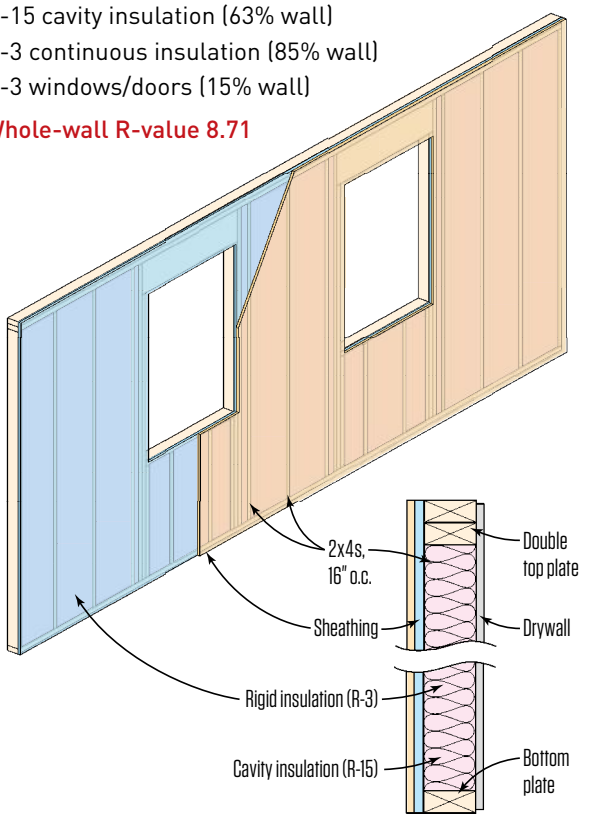
EVALUATING REAL-WORLD OPTIONS

Please understand: I am *not* advocating for not insulating or saying that insulation is a waste of time or that advanced framing isn't worth it. I am simply trying to share a better understanding of what we as an industry are actually doing. This understanding will assist us in making informed decisions as we move forward in developing solutions to our clients' problems.

In Walls 1, 2, and 3, we see that we didn't achieve even 50% of the standard labeled value. That's not a failure—it's the science of building. The important question we need to consider if we want to improve the science is, How can we create a better wall? Because the wall assembly has three major components—the wood frame, the insulation, and windows and doors—we need to evaluate each component separately.

Wall 5

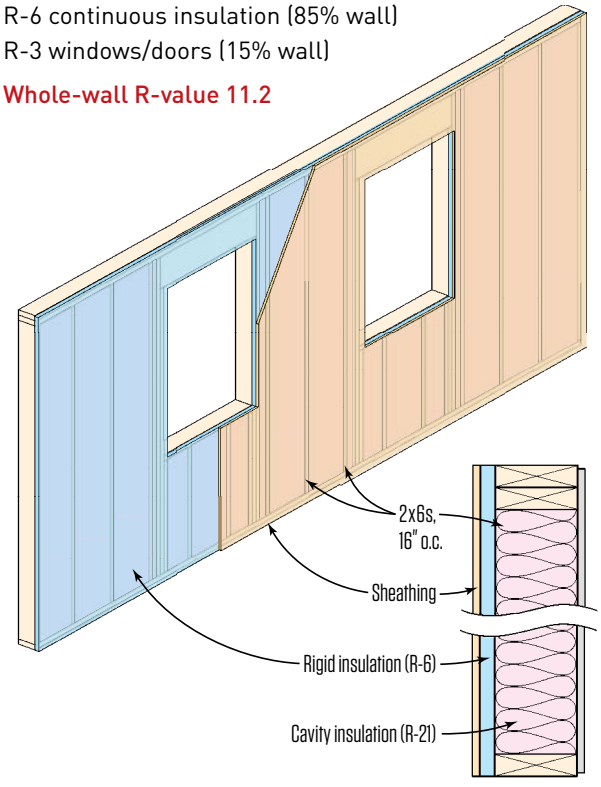
- 2x4 16" on-center wood frame, opaque area (22% wall)
- R-15 cavity insulation (63% wall)
- R-3 continuous insulation (85% wall)
- R-3 windows/doors (15% wall)
- Whole-wall R-value 8.71



Continuous insulation limits thermal bridging and enhances cavity insulation values. Wall 5 takes the same conventionally framed 2x4 wall in Wall 1 and adds 1/2 inch of rigid insulation, for a 19% boost in whole-wall R-value.

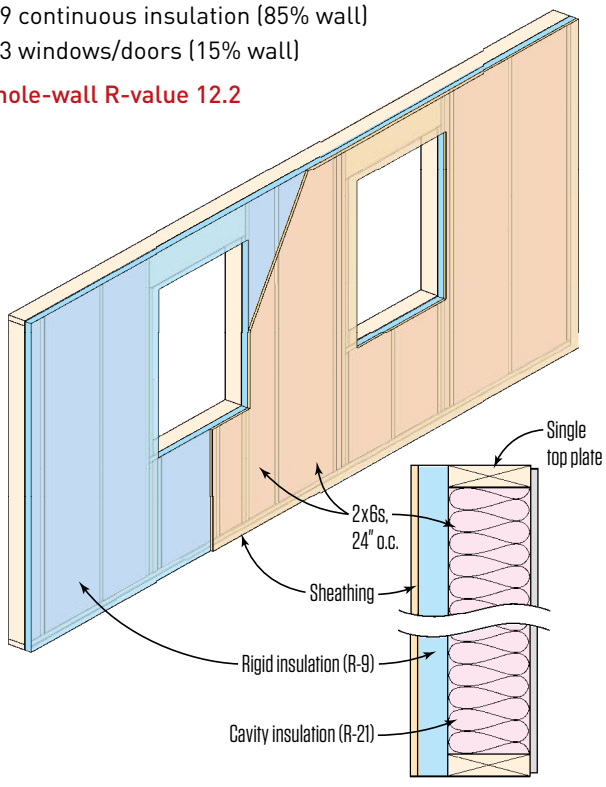
Wall 6

- 2x6 16" on-center wood frame, opaque area (22% wall)
- R-21 cavity insulation (63% wall)
- R-6 continuous insulation (85% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 11.2**



Wall 7

- 2x6 24" on-center wood frame, opaque area (14% wall)
- R-21 cavity insulation (71% wall)
- R-9 continuous insulation (85% wall)
- R-3 windows/doors (15% wall)
- **Whole-wall R-value 12.2**



Continuous insulation (cont.) Wall 6 adds about an inch of rigid insulation to the same wall configuration found in Wall 2, for a 25% boost in whole-wall R-value. Wall 7 adds 1.2 inches of rigid insulation to the advanced framing in Wall 3, providing a 27% boost to the whole wall. Continuous insulation makes sense in every climate zone, though you do need to add enough for condensation control in cold climates (see "Avoiding Wet Walls," May/17).

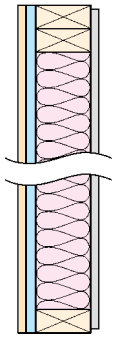
Framing depth. Let's start with the framing. Specifically, what happens when we increase the framing depth from 2x6 to 2x8 at 24 inches on-center?

As Wall 4 shows (see page 45), the increase in frame depth provides more insulation value in the cavity, but it doesn't change the whole-wall R-value much. The important point to understand here is that even though the cavity insulation R-value increases in a fatter wall, the R-value of the stud is only minimally enhanced, and more importantly, the stud remains a thermal bridge.

Continuous insulation. What's the next level of improvement? The wood-framed opaque wall areas with cavity insulation areas account for roughly 85% of the wall. If we step outside of the frame to the exterior and add rigid insulation, we not only add R-value, enhancing the cavity insulation, but we also shut down the thermal bridges created by the framing, which greatly enhances the R-values at the opaque areas. Walls 5, 6, and 7, shown in the illustrations above and on the facing page, show what happens to the whole-wall R-value of the first three walls when we add continuous insulation.

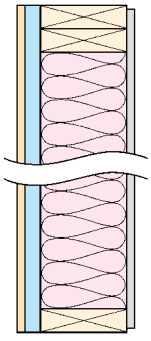
By using continuous insulation, we increase the whole-wall R-value. The thicker the continuous, the greater the increase. I am a big advocate for continuous insulation in any climate where we purchase energy to improve our interior environment. Its benefits also extend into realms of durability, health, and comfort. (In this article, we are focusing on energy performance, but it's important

Wall 8



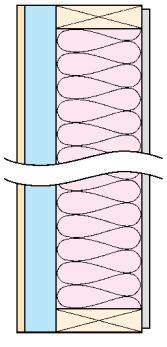
- 2x4 16" on-center wood frame, opaque area (22% wall)
- R-15 cavity insulation (63% wall)
- R-3 continuous insulation (85% wall)
- R-5 windows/doors (15% wall)
- **Whole-wall R-value 10.55**

Wall 9



- 2x6 16" on-center wood frame, opaque area (22% wall)
- R-21 cavity insulation (63% wall)
- R-6 continuous insulation (85% wall)
- R-5 windows/doors (15% wall)
- **Whole-wall R-value 14.05**

Wall 10



- 2x6 24" on-center wood frame, opaque area (14% wall)
- R-21 cavity insulation (71% wall)
- R-9 continuous insulation (85% wall)
- R-5 windows/doors (15% wall)
- **Whole-wall R-value 18.55**

Window contribution. Walls 7, 8, and 9 are framed like Walls 5, 6, and 7, but add better windows. Because the windows represent 15% of the wall, this move makes good sense only after improving the larger wall areas.

that we acknowledge the other critical performance factors that are affected by the energy performance of the wall, and which we can discuss in detail at a later time.) The interesting takeaway here is found when you compare images: Wall 5—a 2x4 wall with R-3 continuous insulation is arguably the same wall as Wall 2—a 2x6 16-inch-on-center wood-framed wall—at least from strictly an R-value perspective. But the science of our walls is not quite complete. Like insulation, windows offer a spectrum of performance. Let's see what happens when we alter the window performance in some of these walls.

Window options. Note that in all instances in Walls 5, 6, and 7, the window and door openings—at 15% of the wall—were the worst performing part of the wall.

Compare those whole-wall R-values to the last three wall examples: Walls 8, 9, and 10 (see illustrations, left). Notice that what we are doing is improving the wall proportionally. By addressing the largest areas of the wall first, we make incremental improvements, and as we do so, the smaller areas (in this case, our window/door area) become more and more important. Addressing the windows and doors once we have addressed the opaque and cavity areas leads to the best wall performance. So we start with insulation—a good thing—and then advanced framing is a preferred option that makes insulation look even better. Continuous insulation will always be a good choice. And better windows make sense, but only after we attack the higher-proportion areas of the wall.

Years ago, I had lunch with one of the best building-science minds in building history. As an aspiring young architect looking for a quick, down-and-dirty answer, I asked him, "What's the best wall I can design/build?" His reply was simple and confident, "Put as much insulation on the outside of the wall as you can afford." That's sound advice. In addition, know that windows, even the best ones you can find, will most likely always be the worst performing part of the wall. But to me, the most important takeaway here is the idea of "proportional development." It doesn't make sense to put a mediocre, R-3 window in a high-performance, R-30 wall. As we, the architects and builders (the professionals), address solutions with our clients, we need to understand that each of the components should be "proportional" to the whole—in this case, "whole-wall R-value." Long live our buildings.

Steve Baczek (stevenbaczekarchitect.com) of Reading, Mass., is an architect specializing in energy-efficient design and certified passive homes. Follow him on Instagram: @steven baczekarchitect.

New Tools From STAFDA

Eye catchers and innovators from the all-tool, all-pro show

BY MARK CLEMENT

The Specialty Tools & Fasteners Distributors Association (STAFDA) show is all tools, all the time. At the most recent show (this past November), I walked every aisle, checked every booth, and came away with a list of tools that are novel, new, news, or just plain cool—and that might be helpful on your jobsite to save you time and money. Here are the top 15 that grabbed my attention.

1. VERSATILE WORKBENCH

Disston, which has been around since the Industrial Revolution, is synonymous with items that might be on our business cards but are rarely in our hands: handsaws. But its 4-in-1 Omnitable looks outstanding. Folded down, it's a roughly 24-by-36-inch panel with four wheels (two that pivot) underneath that can be used as a creeper or—better—mover of things. Any number of items could be placed on this and moved around a jobsite: cabinets, for one. It also could be a cool way to keep tiles or flooring or other materials nearby rather than walking back and forth to retrieve them from a stack elsewhere. The wheels are small, so this isn't for off-road. With the legs extended half-way, it's basically a drywaller's bench. All the way out and, boom, it's a table. It has a 500-pound capacity and three on-board plugs. Collapsed, it carries like a briefcase by its integrated handle. At about $120, it's all around awesome. disstontools.com

2. FRIENDLIER CARBON FOOTPRINT

Walking by the booth of the Italian company Cofra, I spotted a sneaker-style work shoe—named Indiana I/C EH PR—with an aluminum toe cap. It turns out that Cofra sells all the types of boots we wear, like hunters (Ottawa: 8-inch upper, highly insulated), hikers (Montpelier and women's Wanda: 6-inch uppers), and slip-ons (Roughneck). The company is big into using recycled materials: polyurethane for the soles and inserts, yarns for the laces, and paper for the packaging. Plus, Cofra says, the Indiana—the reason I stopped in the first place—is comfortable. If you're serious about your carbon footprint, walk a mile in these shoes. If you can find them. They cost $110. cofra.us/en

3. REDESIGNED TOOLBELT

I know of few, if any, more tuned-in, more forward-thinking, and less "corporate" companies than your friendly neighborhood toolbelt store, Diamondback. In its redesigned Denali, Diamondback has combined and refined the best features of the Standard and XL versions in the form of main compartments that don't sag but still hold all the stuff we need held; lower pockets with better rims and resizing that keep them higher up the body; relocated tool holders; repositioned flat-bar/nail-pick sleeve; and more (I hasten to add, it has the best buckle on Planet Earth). While I was at the booth, I also learned that Diamondback is working on a real—not pink and cute—women's belt. Finally, though describing the features of its products is important, so is pointing out the company's evolving mission: to build a toolbelt system that'll last you—and change with you—for 20 years. Price: $440. toolbelts.com

4. FASTER SELF-FEED BITS

For drilling big holes for plumbing pipe or electrical conduit, Diablo's SpeedDemon self-feed bits are wood-gobblers extraordinaire. Their refined design—think tooth geometry with a unique hook angle that nets them speeds up to twice those of a typical bit, according to Diablo (and my eyes; I saw them work)—not only makes SPF corn flakes super-fast, but in doing so, proves the "time

is money" adage. Diablo says the SpeedDemons are designed for (what else) cordless tools and put a much lower strain on the batteries while doubling holes per charge. The brand also says it has redesigned the feed screw with a pull-out stop design that prevents it from slipping out when the bit is removed from the material. It has an aggressive low thread count, and there's no pitch build up. The company even amped up how it's made: While many bits are die cast, SpeedDemons are heat forged, resulting in better performance and longer life. Anything that takes some of the pain out of repetitive-motion wrestling matches to free up brain bandwidth for harder-to-solve problems feeds production. The bits are available in nine sizes, from 1 1/8 inches to 3 5/8 inches. They start at about $40. diablotools.com

5. SNAP BACK CHALK REEL

It was CE Tools' (CE = "Contractor Engineered") Red Edge Side View box beam levels that caught my eye. And they are cool, with a red tint to the vial fluid that makes the bubble more visible in bright light. They're also slim, and compared with other levels, easy to manipulate without a loss in durability. They have a periscope view, of sorts, enabling you to see the top vial from off-angles, which sounds like a seconds-saver plumbing posts or walls. But what made me gasp was the self-releasing Snap Back Chalk Reel. Contractor-invented, the Snap Back chalk reel itself is strikingly well-designed. Big, it holds lots of chalk. But it's not too big. It's a useful plumb bob. The line is high quality. And, it has a belt clip, yes! But the killer app is the self-releasing hook. After hooking the Snap Back and walking across a sheet of plywood—or roof or sidewall or deck—and snapping the line, giving the string a sideways tug releases the hook from whatever edge it's hooked over. Pop—the line is free to be reeled in without your having to walk back and unhook it. A 4.4-1 planetary gear makes for fast rewinds; the "pinch to open" reservoir is easy to open for refills but difficult to open by accident. And, CE sells the Snap Back accessory separately from its reel. The reel costs $25. cetoolsinc.com

6. TOP "PICK"

Where I work—and where WorkSafe products are made, coincidentally—"staging planks" are called "picks." Whatever you may call them, WorkSafe's Fall Protection Guardrail Safety System is designed to integrate with either pump jacks or ladder jacks to improve safety and efficiency. Components include brackets that secure ladder rails to the building to prevent kick-out ($21.50), an aluminum rail ($235) equipped with a rolling fall-protection harness ($290) that keeps you topside, and some sweet tool hooks ($12) that slot inside

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a ladder rung and look awesome for everything from siding to service work. WorkSafe says that most fall fatalities are from 6 feet and lower; one factor, it says, is that there's no time for a worker to react. Maybe being proactive is a good call instead. The total fall protection system shown costs $750. worksafecompany.com

7. PORTABLE AIR FILTRATION

Powermatic's PM 1250 air filtration system looks gold-standard-good. Built on the "box fan with AC filter" model, the PM 1250 looks like the Millennium Falcon of box fans. An impeller behind the filter draws dust-filled air in, and the filter removes and scrubs it down to 0.1 micron from a 680-square-foot space (think two-car garage). The easy-to-vac filter recycles air five times per hour and has a 3,000-hour rating. Its base, which is fine sitting on the floor, can be wall-mounted or suspended, getting it out of the way on a busy jobsite or crowded wood shop. And it's as quiet as a conversation, according to Powermatic. Price: $700. powermatic.com

8. LARGE-CAPACITY TILE SAW

The Delta Machinery Cruzer 96-110 tile saw has the largest cutting capacity in the industry, according to Delta. It also has some obvious creature comforts, like a large, grippy rubber table. Its dual water jets can be focused for optimum spray location and volume of water dispensed, which Delta says extends blade life. The unit comes with a nice-looking miter gauge that you'll probably use because you can now handle those 24-inch tiles on the diagonal without flipping them or propping them up over the edge of the table. Its pump is fully submersible, and its plunging motor head can cut full-size pavers. Price: $800. deltamachinery.com

9. CORDLESS SLIDER

At 30 pounds with a sweet carry handle and detents that lock in like safe doors at Fort Knox, Bosch's new 18-volt, single-battery, single-bevel 8 1/2-inch slider looks like an easy grab for pick-up work, flooring, trim, and any number of other jobs that do or don't require benches and all-day set-up. Its 24-tooth blade left a surprisingly crisp cut in southern yellow pine 2x10 and crown, and also crosscut 2x10 at 90 degrees and 2x8 at 45 degrees. With a 2 7/8-inch depth of cut, it doesn't quite make it through a 4x4, but deck builders who are tired of lugging big saws around houses may want to take a second look. Price: $600 (kit). boschtools.com

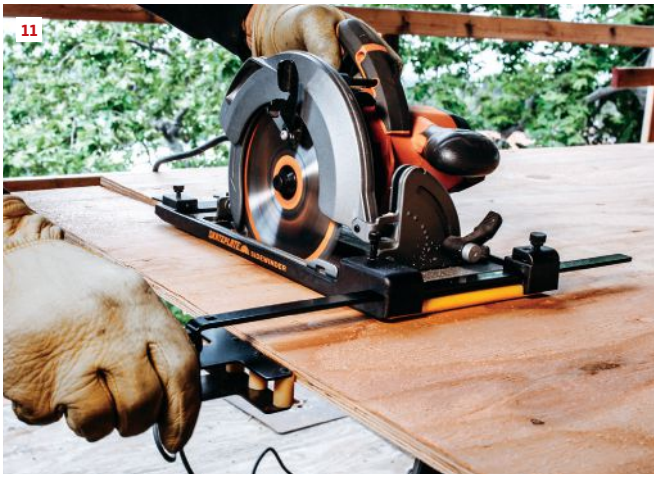
10. COOL NEW CORDLESS TOOLS

We all know the two faces of Skil: the one of Mag 77 might and the other of $20 big box tools. Well, Face 2 has been in the gym. Juiced by a new approach to

battery performance it calls PWRCore, Skil looks like the cordless tool version of a dragster smoking the tires. There are sub features of the PWRCore that are premium, too: "Assist" puts a USB into the battery. Of course, the motors are brushless. "Jump" gives a dead battery enough oomph to drive 100 drywall screws with a five-minute charge. The batteries—2 or 5 amp hour, depending on the tool—are said to run 25% longer than other batteries and stay cooler longer. While the brand seems to have a full suite of tools, the 2.0-amp-hour 20-volt rotary hammer caught my eye: It's light and well-balanced and looks terrific for small anchors. There's a 5.0-amp-hour hammer that drills and chips. Both are SDS Plus. The oscillating tool had zero vibration, and the impact driver's fit and finish was not the Skil of old by any stretch. There's an old new cowboy in town. The rotary hammer kit costs about $110. skil.com

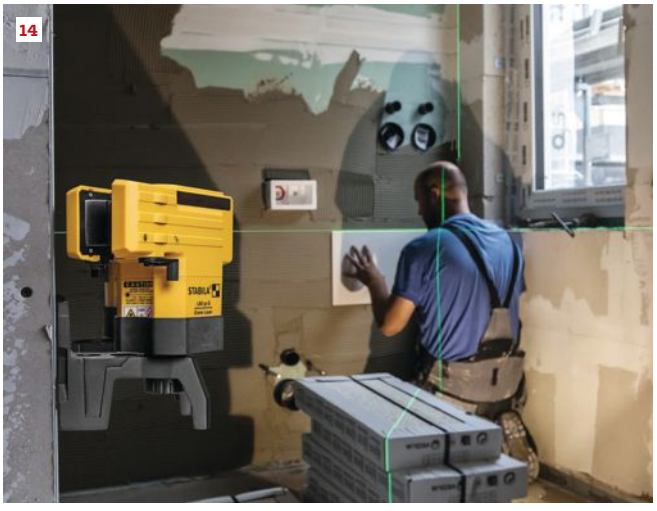
11. SUPER CIRC SAW ACCESSORY

You know the rip guide do-hickey included with your circ saw? SkatePlate takes that design and turns it into a completely new accessory—and maybe turns your average circ saw into a completely new tool. Rather than relying on friction from the saw's shoe (and guide, if you use yours), SkatePlate rolls on polyurethane rollers. While you can use it in what seems like limitless rip and cross cuts in wood, including sizing full sheets with the extension arm, the company also makes a GFCI-protected hydro attachment that turns a typical circ saw into a full-blown concrete cutter. This testimonial on a 30-year framer's website rings true: "I just did an 85-foot-long concrete cut on a freshly poured driveway ... and [SkatePlate] was ridiculously accurate and easy." The SkatePlate and SkateGuide Combo sells for $80; the SkatePlate H2O, for $90. skateplate.com



12. A BETTER GARDEN HOSE

Just about every time I scrape the skin off my knuckles or need to find a wrench to thread a garden hose off a fitting that is too close to a house, I find a new reason to rue those valves' hideous design. It appears Flexzilla has too. Its jobsite-tough but also flexible polyurethane-PVC-hybrid garden hose looks boss. The blend erases the "memory" and weight of rubber hoses. But the real -zilla might be in the hose-to-house fitting. The collar is fist-sized so you can get enough purchase on it to install it or remove it. In addition, the seventeen bearings inside it mean you don't have to pretwist the hose to travel along the threads with a modicum of ease. It comes in 3-, 10-, 25-, 50-, 75-, and 100-foot lengths. There's nothing wrong with the six-pattern, trigger-activated adjustable nozzle either. A 50-foot hose runs $45. flexzilla.com



13. TOUGH TOOL TOTES

Looking for lighter weight, tough, and mobile gang-box-style tool storage? Take a look at Toter Box. Basically a plastic version of the job-box-style tool container, it has beefy sides and a double-walled lid. It works like a job box but is lighter and has more features. It has a secure metal latch, so you're not relying on padlocks, unless you want to—it also has padlock locations in each corner of the lid. It has steel carry handles on each side and a 400-pound load rating, yet it weighs roughly half as much as steel boxes. There are three versions: a plain box (60 pounds); a box with receivers for forks and—this is cool—a receiver to mount on a receiver hitch (95 pounds); and a box with the features above with plus rolling casters (110 pounds). Load up. Prices start at around $500. toter.com

14. FEATURE-PACKED LASER

Green lasers aren't new, nor are cross-line lasers or magnets. But Stabila's LAX 50 G green cross-line laser has a handy blend of features. It is also serviceable. Other manufacturers' units, according to Stabila, are not serviceable, which helps hit a price point, but if you break the laser, well, good luck. The other subtlety is the lens. To hit a price point, some manufacturers use plastic lenses where Stabila uses glass: more breakable, perhaps, but it allows for a clearer beam. I can't measure this, but when we shot it inside the convention center, the beam was highly visible 50 to 75 feet away. Surely it'll hold up in a kitchen reno and even for ledgers and other outdoor jobs like decks or small foundations. The kit has a telescoping pole that clamps floor to ceiling; the unit is positionable anywhere along it via a smart squeeze mechanism. Price: $230. stabila.com

15. COMPACT CORDLESS CHAIN SAW

Makita's XCU08 top-handle chain saw is surprisingly powerful, compact, and agile. Because every chain saw I've owned is pretty much just like the previous one I owned, seeing some extra thought put into this design is refreshing. The 14-inch bar is big without being too big. At 36 volts (two 18-volt batteries), it quietly plowed through a 10-inch hickory log. If you feel like there's not enough oil making it to the chain, the feed is adjustable—great for high-heat applications like cutting a stump. The nut for the bar-and-chain housing is designed such that it releases the cowl but cannot fall off. Great detail. The see-through bar-oil reservoir is terrific. And if you do need to tow it up a tree, it has a loop for tying it off. The kit costs $450. makitatools.com

Mark Clement is a carpenter and contractor, JLCLive and Remodeling Show presenter, and content producer at @myfixituplife.

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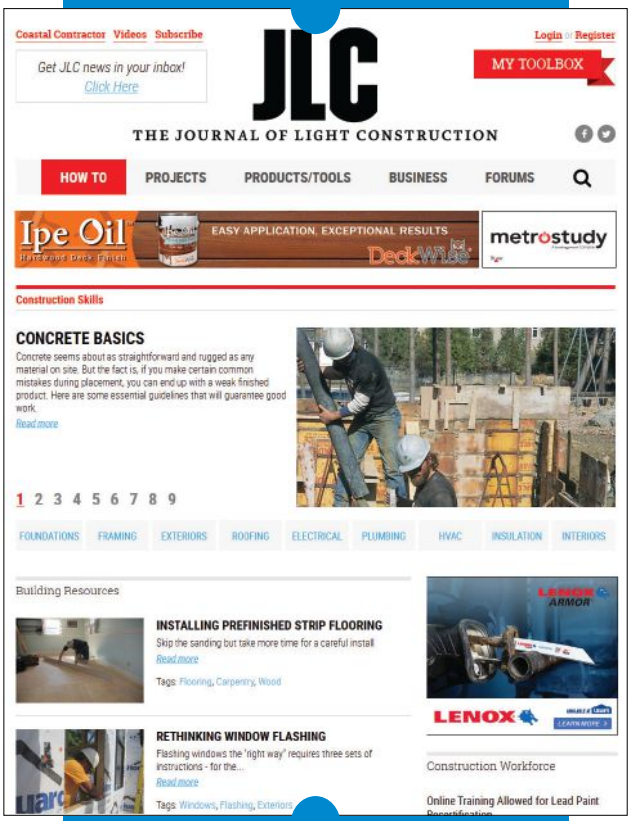

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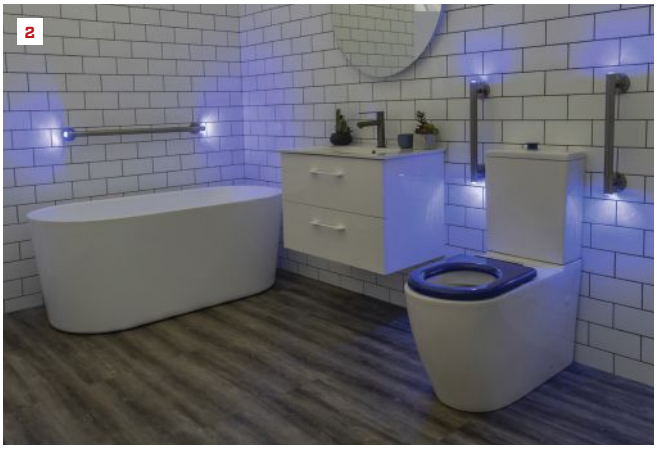
BY SYMONE GARVETT



1. American-Made Quartz
To mark its 20th anniversary, U.S.-based Cambria released 20 new quartz stone surface designs, featuring a range of whites, grays, and blacks. According to the manufacturer, the designs are "fabricator friendly," with random veining resulting in a higher yield as well as making the slabs ideal for larger applications. Slabs are available in Cambria Matte and high-gloss finishes, 19 different edge profile treatments, and 2- and 3-centimeter thicknesses. Contact a local distributor for pricing. cambriausa.com

2. LED Grab Bars
LED Grab Bars from Evekare, an Australia-based manufacturer of daily living aids, not only provide support as needed but also help users safely navigate bathrooms in the dark. The bars' integrated LED lights are sound-activated and are powered by two AA batteries that will last up to 6,000 cycles, with each cycle lasting from 20 to 30 seconds. Made from grade 304 stainless steel, the bars can support up to 550 pounds. The bars are available in 12-, 16-, 18-, 24-, and 36-inch lengths and in five finishes. Pricing ranges from $70 to $150. evekare.com

3. Flexible Window Screen
Designed to spring easily into nearly any window simply by being flexed, the spring steel frame on Sierra Pacific Windows' FlexScreen is made from phosphate-enhanced spring steel and coated with an exterior grade, high-performance PVC that provides scratch and weather resistance. According to the manufacturer, the custom product fits any rectangular window up to 55 inches wide by 82 inches high and offers fast, easy installation or removal. Contact a local distributor for pricing. sierrapacificwindows.com

4. Self-Cleaning Exterior Coating
Emerald Rain Refresh Exterior Acrylic Latex from Sherwin-Williams is an ultra-durable exterior coating that is formulated to have dirt wash away upon contact with rain or water for a clean, fresh look with minimal maintenance, according to the manufacturer. The new coating offers UV and weather protection and can be tinted in VinylSafe paint colors. Contact a local distributor for pricing. sherwin-williams.com

5. Water Barrier System
Georgia-Pacific's DensDefy Accessories line provides a new liquid flashing and transition membrane for the manufacturer's DensElement gypsum-board barrier system. DensDefy Liquid Flashing can be used to seal seams, rough openings, and penetrations in wall assemblies, while the DensDefy Transition Membrane is designed to seal the transition between OSB and gypsum assemblies, as well as wide gaps and other difficult transitions. Liquid flashing comes in 20-ounce sausage rolls; membrane comes in 75-foot rolls in 6-, 9-, and 12-inch widths. Contact a local distributor for pricing. densdefy.com

6. Pre-engineered Glass Alcove
The new Marvin Skycove is a glass alcove structure with an integrated bench that adds 16 to 20 square feet to a home. It arrives fully constructed and may be integrated into an existing home design using standard finishing techniques. The alcove is built on a steel structure designed to hold a heavier load than the average outdoor deck and includes bottom insulation, a fiberglass exterior structure, and a choice of dual- or triple-pane glass. Contact a local distributor for pricing. marvin.com

7. Wall-Mount Garage Opener
By attaching directly to a garage door's spring tube, Genie's new Wall Mount Pro Series (model 6170) garage door opener eliminates the traditional rail and powerhead design. The opener's compact design fits in tight spaces between the track and wall and offers homeowners complete open ceiling space for storage. Once installed, the unit provides quiet opening and smart garage control through Aladdin Connect integration, according to the manufacturer. Pricing starts at $500, not including installation. geniecompany.com

8. Floor-Warming Thermostat
Emerson's new line of smart thermostats is designed for use with floor warming systems. The standard Warm Tiles ES ColorTouch and the wireless, Wi-Fi-enabled Warm Tiles ESW ColorTouch both feature a 3 1/2-inch backlit touchscreen through which users can monitor and control the system. Users can access data on their system's power consumption for the previous 24 hours, seven days, or 12 months, and calculate the cost of electricity. Pricing for the ES model starts at about $195, and pricing for the ESW model starts at $235. emerson.com

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9. Large-Format Showerheads

A new lineup of large-format showerheads from California Faucets offers sleek, streamlined design and a wide spray experience. Styles include Arched Rain, Convex Rain, Ultra-Thin Rectangular Rain (shown), and Ultra-Thin Rectangular Rain and Waterfall. Each showerhead is handcrafted from solid brass and is offered in 28 finishes, including nontarnish and ultra-durable Physical Vapor Deposition (PVD) finishes. Pricing starts around $1,400. californiafaucets.com

10. Extruded Beadboard

Manufactured with expanded cellular PVC, a new beadboard from Kleer Lumber is extruded as one piece and sealed on all four sides, eliminating any open cells that may be prone to dirt intrusion. The boards feature a center bead and a reversible tongue-and-groove profile with a shiplap nailing flange. Available in two widths, 4 inches and 6 inches, each 16-foot-long board can be painted or be left the original standard brilliant white. Contact a local distributor for pricing. kleerlumber.com

11. Waterproof Interlocking Wall Panels

Norwegian manufacturer Fibo Group has launched a new series of its waterproof interlocking wall panel system. Panels consist of a plywood core faced with a decorative high-pressure laminate; the long sides have a proprietary tongue-and-groove construction for locking the panels together. According to the manufacturer, the Fibo system does not require a water vapor barrier or waterproof membrane behind the panels and can withstand both direct water exposure and large temperature fluctuations. Each panel measures 23.62 by 15.74 inches and may be directly mounted onto wood or steel studs, over existing walls, or over ceramic tiles. Contact a local distributor for pricing. fibosystemusa.com

12. Floating Wood Stair

The Terrace floating stairway, Viewrail's newest stair system, uses a rigid steel stringer system concealed inside a series of stacked wood boxes to create a modern, "waterfall"-style stair with no visible fasteners or means of support. Tempered-glass railing panels, which appear to "slice" through the wood steps, flank both sides of the stair. The wood components are available in 15 species, either unfinished or in the customer's choice of wood stains and colors. Pricing ranges from $11,000 to $19,000 for the complete system. viewrail.com

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Classifieds

April Advertising Index

BY TED CUSHMAN

A Dovetailed Stick Frame

Timber framing is all about fine joinery. Stick framing, usually, is not. But if you can think of something, somebody somewhere is going to try it. This year, on a lakeshore in Maine, Maine Passive House is building a set of rustic cabins that combine typical 2x4 framing with dovetail joinery, for a unique result. Devised by architect Adam Wallace of Kaplan Thompson Architects, in Portland, Maine, the exposed walls feature tightly fit dovetail joints at the plates and windowsills. With no drywall or insulation, the cabins are designed for use in the summer only—when the careful joinery will be on full display.

Craftsmen Matt Friel (right) and Pat Connery (below) detailed every stick in the shop with a handheld router and simple jigs, then labeled the members and brought them to the site, where they pieced the cabins together like furniture. The living will be basic, but technically speaking, the cabins aren't primitive—steel flitch plates, engineered wood, and bolts and metal fasteners hidden in the structure meet the engineering loads.

Ted Cushman is a senior editor at JLC.

The crew fabricated the mortised and tenoned pieces in the shop, then fitted the frame together on site. The resulting joinery will be visible to summer lodgers when the rustic cabins are in use.

Photos by Ted Cushman

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