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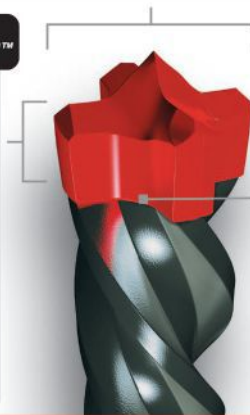


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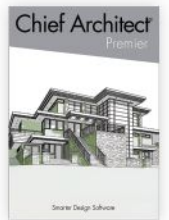
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On the cover: To remove flooring boards without damage, *JLC* editor Clayton DeKorne cuts off the nails at the floor using a multitool. For more on tools and techniques for surgically demolishing existing woodwork, see the story on page 7. Photo by Elenai Studios.

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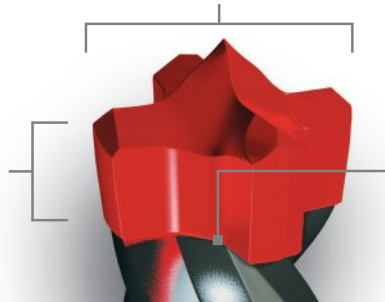
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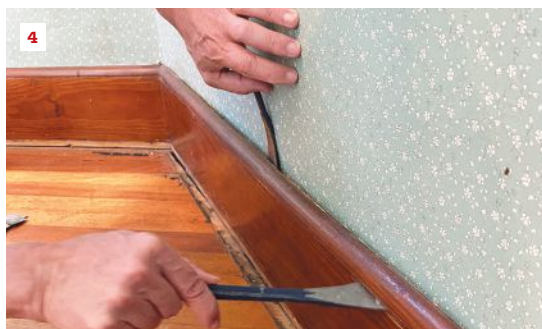


youtube.com/diablotools

BY CLAYTON DEKORNE



Either side of the mitered quarter-round cap can be removed first, but the overlapping baseboard on the right dictates starting on that side (1).



Wide-chisel pry bars have a thin, sharp blade that does minimal damage to soft woods. Use two in tandem, overlapping as you work along the entire length of the board (2-4).

Photos by Elenai Studios

Surgical Demolition

When we think of what finish carpenters do, we think mostly of what it takes to create beautiful woodwork. But carpenters working on existing homes spend a lot of time taking things apart. If we intend to restore the woodwork—often a desirable option in an old house full of exquisite old-growth woods and deep, well-proportioned profiles—we need to surgically remove the pieces, inflicting as little damage as possible so they can be reassembled and refinished.

That was the case in the 1867 house photographed here. In a room built over a low crawlspace, the task was to take up a beautiful vertical-grain fir floor and cut out sections of subfloor so the crawlspace walls could be insulated with spray foam. The operation depended on removing the baseboard and flooring without damage; the photos show some of the key tools and techniques needed to pull off that trick.

Here are some principles to keep in mind:

Reverse order. A big part of removing woodwork is knowing how it was assembled in the first place. You need to remove it in the reverse order it was installed. Look at joints first. Miters can usually be taken apart from either side. Look at both ends of each piece of trim before you act. The ends of baseboard usually butt each other in the corners, and you have to take off the overlapping piece first. The last few boards of strip flooring usually are face-nailed, and you need to identify and disable those nails to begin disassembly. It's a lot easier to determine the installation order of clear-finished woodwork than it is with painted woodwork. (See the online version of this article at jlconline.com for more on removing painted woodwork.)

Loosen up everything along the entire length before you start pulling a piece off. Disable finish nails by driving them clear through the wood with a pin punch. You may not get them all, but the more nails you disable, the less hold the board will have. Use a utility knife to slice through paint or varnish along seams to break the bond of the finish. Work with two pry bars in tandem. (I like the wide-blade Japanese pry bars by Yamaguchi, Dogyu, or Shark Grip.) Pry against walls at studs to avoid punching through wall surfaces. Avoid prying against finished boards, and when you can't avoid that, use a wide, flat trowel under the fulcrum point of your pry bar to protect the finish surface. As the board becomes looser, it will be easier to identify fasteners that are still holding a piece in place.

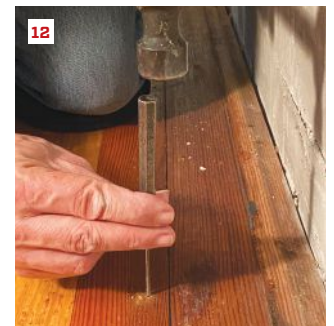
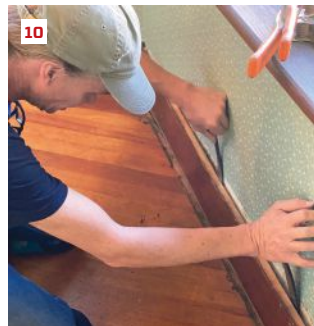
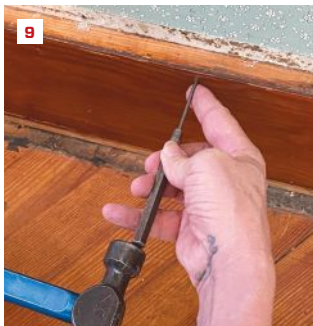
Vacuum at every step. A good industrial vac is an indispensable demolition tool. I vacuum after each piece of wood is removed to make it easier to see my next step and to protect the woodwork. Paint and varnish chips, and especially drywall and plaster dust, are abrasive. In the end, you want clean, unmarred woodwork.



End-cutting nippers (5) are a primary tool in a restoration carpenter's tool bags. Yes, they are great for snipping wires, but their main use is pulling finish nails from the *back* of trim. The back surface will get dented (6), but only a small hole will be visible on the face.



If you do need to pull a nail from the face, use a wide, flat trowel to protect finish surfaces (7). (Note: The trowel will get dented and won't be of use for taping drywall.) It helped to pry these long 10d finish nails from both sides (8).



Drive finish nails all the way through with a pin punch.

With most nails driven through, work a pair of flat bars in tandem (10) to loosen the board before trying to pry it off (11).

Installers face-nailed the last floor boards. Start here (12).



A flat bar can be used "backwards" to push open a joint (13). Push straight back; don't rotate the bar, or you may dent the edges. Split the tongue off the last full-width floor board with a chisel to allow the board closest to the wall to come loose (14).

With the tongue removed, work in tandem with two bars to pry up the first board (15). Once the two courses of face-nailed boards are removed, the blind nails in the flooring can be sliced off at floor level with a multitool (16).



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5 Cable Rail Secrets

This California contractor thrives through the pandemic with outdoor living projects.

Dave Fraser operates by two simple rules.

“One, we only advise what we would do on our own home. And two, we build like we’re building on our own home,” says the award-winning San Diego contractor.

Those two rules work pretty well. Business is booming for 19-year-old company Fraser Decks & Patios. His team of 14 complete up to 100 replacement deck projects a year, most in the \$20,000-range.

Deck replacement means Fraser has seen his share of bouncy, flimsy, and sloped decks. The worst one? “It violated code and manufacturer guidelines 47 times. The footings, framing, and fasteners were all wrong. The rim joist was hanging by a thread. The weird part? It was built by a well-known licensed contractor. Our rebuild was showcased by a major deck material manufacturer,” Fraser says proudly.

JLC readers should never face a deck permitting issue, especially over cable rail in-fill. Here are five tips to help ensure your projects go off without a hitch:

1. ADD INTERMEDIATE PICKETS

Intermediate pickets (also called ‘vertical spacers’) help maintain proper cable spacing and reduce the chance for cable deflection (sag). Pickets are typically 1”x 2” or 2”x 2” wood strips, 1” copper water tubing, 1/4” thick metal flat bar, or other slim material. Cable rail manufacturer Feeney offers pre-drilled 3/4” square powder-coated aluminum pickets and 316 marine-grade stainless steel pickets at just 5/8” in diameter.

2. THREE INCHES APART

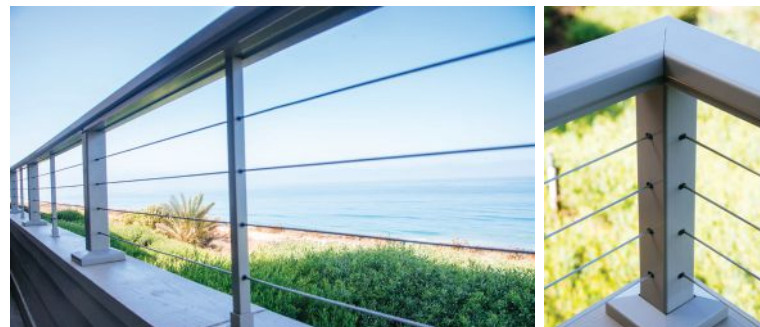
The International Building Code says a 4”-ball cannot pass through any opening in a railing. Because cable is non-rigid and deflects, it’s a good idea to space cables no more than **three inches apart**. Always check with your local building department to find out if there are special local requirements for spacing.

3. THREE FEET APART

Space a cable rail post or intermediate picket **at least every three feet**. Spacing the posts/pickets three feet apart and the cables three inches apart ensures safe, taut spacing.

4. CORNER POSTS

In most instances, cables terminate at a single corner post. End and corner posts carry most of the cable tension, ranging from 200 to 300 pounds on each cable, so be sure to use posts that meet



All photos courtesy of Feeney, Inc.

or exceed the minimum requirement. To run the cables around a corner, consider installing double posts at the corner, or use a post manufactured for this purpose, such as Feeney’s Single Corner Posts.

5. RUN LENGTH FOR STRAIGHTAWAYS OR BENDS

Cable rail straight runs (no corners or bends) should not exceed 70 feet. Runs with corner bends (utilizing double corner posts or a single post made specifically for a corner bend) should not exceed 40 feet or include more than two corners per run. If you use swage-type fittings like Feeney’s CableRail Conceal Kit, you may want to shorten run lengths.

To avoid callbacks, Fraser advises contractors to follow best practice and team-up with a cable company that values your reputation as much as you do. “If you do cable rail right, it’s invisible,” as his Instagram page vividly demonstrates. As for a go-to partner, Fraser made his mind up four years ago. “It’s Feeney. They’re one of very few companies I stake my reputation on,” Fraser reports.

One final word of advice. If you’re looking for profitable projects that can weather economic uncertainty, yes, even in a pandemic, think decks. “I predicted last spring if the governor allowed us to stay open, we’d have tons of work,” says Fraser. “That’s exactly what’s happened.”

For assistance with your next project, visit [Feeneyinc.com](https://www.feeneyinc.com).

Q Stick-framing an irregular hip or valley often calls for an acute compound bevel that exceeds the capacity of my circular saw. Instead of using a handsaw to make this cut, is there an easier way?

A John Spier, a veteran carpenter who owns Spier Construction on Block Island, R.I., responds: The situation you're referring to, framing irregular hips or valleys, calls for jack rafters that die into the sides of the hip or valley rafters. Jack rafters have compound cuts; that is, cuts that are both angled and beveled. The angles are plumb cuts, and the

bevels are cut to the angle at which the jack rafters meet the hip or valley. A regular hip or valley has the same roof pitch on both sides, so the bevels are 45 degrees regardless of pitch. But an irregular roof has different pitches, so the bevel is less than 45 degrees on one side and greater than 45 degrees on the other.

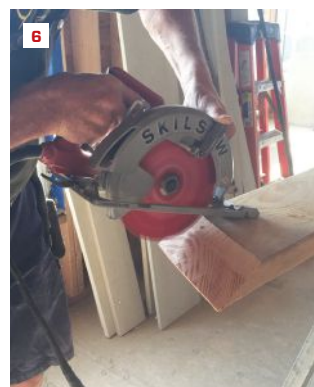
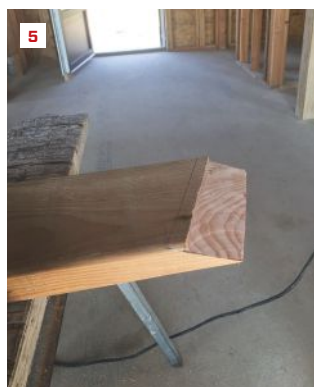
You can cut bevels up to 53 degrees or so

with some saws, and I cheat that up to 60 degrees by tilting the saw base with my hand or a small stick. But many irregular roofs call for bevels of as much as 75 degrees. In my bad old days of production tract-house framing, we'd just cut a square plumb cut and side-nail it—perfectly strong and legal, but ugly. Here's how I cut a serviceable compound bevel up to about 75 degrees with my

circular saw. It's not for amateurs, and it's not very pretty, but the jack rafters look fine once they're nailed up.

I start by marking and cutting the plumb cut angle, with a bevel the complement of the desired angle and in the opposite direction. Here, I'm cutting a 20-degree bevel to get to 70 degrees (1). Next, I scribe a line along the end cut about 1/4 inch from the short edge (it's OK to leave a little shoulder instead of a feather edge) (2). After clamping the rafter up on edge, I cut along the line with the saw set square and to maximum depth, keeping the base flat on the bevel cut (3).

This cut won't go all the way through, so then I mark the rest of the cut around the edges and across the other side (4), and rough-cut most of the waste off (5). Finally, holding the blade guard up, I plant the front of the base firmly on the rafter and carve down to the line with a series of sliding cuts, moving the saw across sideways and not taking too much off at once. With practice, it's possible to make a smooth, flat surface in about 20 seconds (6).



Cut the plumb cut angle with the blade set to the complement of the desired bevel angle and in the opposite direction (1). Following a line marked along the end cut (2), make the next cut with the blade set square and to maximum depth (3). Mark the rest of the cut (4) and make a shallow pass to remove most of the waste (5). Finally, carve down to the line with a series of sliding cuts, moving the saw sideways across the face of the bevel and not taking too much off at once (6).

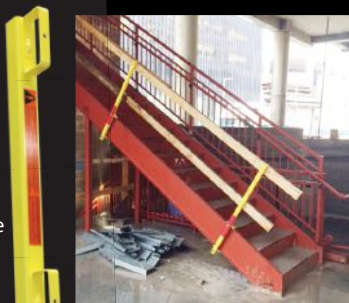


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Q&A / Latent vs. Sensible Loads

How does “latent heat” (used by installers of air-conditioning systems) differ from sensible heat?

A Clayton DeKorne, editor of JLC, responds: Air conditioners are designed to cool the air, but air temperature is influenced by humidity, and that needs to be part of the evaluation when you are sizing an air-conditioning system. HVAC designers need to track two types of loads: sensible load and latent load.

The sensible cooling load refers to the air temperature in the building. Factors that influence the sensible load include sunlight striking windows, skylights, and glass doors; the insulation value in exterior walls, in ceilings under attics, and in floors over open crawlspaces; air infiltration through cracks in the building; and (primarily in commercial work) the heat output of lights, appliances, and other equipment. All of these factors are included in the energy load calculation.

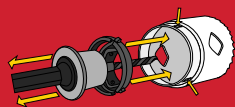
Latent cooling load refers to the energy carried by humid air. Water vapor holds heat and requires energy to remove it.

Conduction, convection, and radiation are the heat transfer mechanisms of sensible heat (see “Heat Transfer Through Buildings,” *Training the Trades*, Jul/19), while evaporation and condensation are the transfer mechanisms for latent heat. When water evaporates or condenses, it changes phase. In evaporation, latent heat is the energy required to overcome the molecular forces of attraction between water particles. This energy allows the molecules to separate; the liquid becomes a vapor where the attractions between molecules are minimal. When water changes from a liquid to a vapor (evaporation), or from a vapor to a liquid (condensation), there is no change in temperature between the liquid state and the vapor state. But while there is no sensible change in temperature, the air gains latent heat by gaining moisture (evaporation), or loses latent heat by losing moisture (condensation).

HVAC system designers must account for the latent heat carried in the volumes of air in a home, because it directly impacts the amount of heat that the system must add or subtract to maintain comfort. From a system designer’s point of view, latent heat can be removed by condensation (which occurs when an AC unit runs and humid air passes over the cold evaporator coil). The longer an AC unit runs, the more water condenses out of the air. Difficulty arises during shoulder seasons in a hot, humid climate, for example, when the air temperature is not high, but humidity is. Then, the AC unit doesn’t need to run very long to reduce the sensible heat, but it does need to run to remove the latent heat. The result: The system overcools the air. This becomes even more of a problem when codes require continuous ventilation (and hence, a continuous stream of humid air entering the house). In both situations, dedicated dehumidification (which pulls water out of the air by condensation but does not disperse cool air throughout the space) is needed to maintain comfort.



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Log Cabin Envelope Makeover

BY MATT BURSTEIN

In spring 2019, a potential client contacted me about an energy upgrade project on behalf of his father, who lived in a log cabin in Vermont, right on the U.S.-Canada border (if you crossed the road, you would be in Quebec Province). During our brief conversation, he mentioned a couple of times—almost in passing—that “some of the walls needed to be replaced,” and that he had reached out to a number of other builders but none was interested. I told him I was willing to visit the home and arranged an on-site meeting. On the long drive north to see the property, I kept wondering what the son meant by “some of the walls needed to be replaced.”

Upon arrival, I could see that the cabin’s exterior had seen better days. Built in the early 1980s by the father, its white pine log walls were severely deteriorated from a combination of years of hard

Northeast weather, the exposed location (the cabin sat in the middle of hundreds of acres of open hayfield), and a lack of regular maintenance with wood sealer. After a long conversation with the father and son, I agreed to take on the gnarly building-envelope retrofit, which encompassed removing the existing log walls, windows, and doors all while working around the homeowner and his indoor cat.

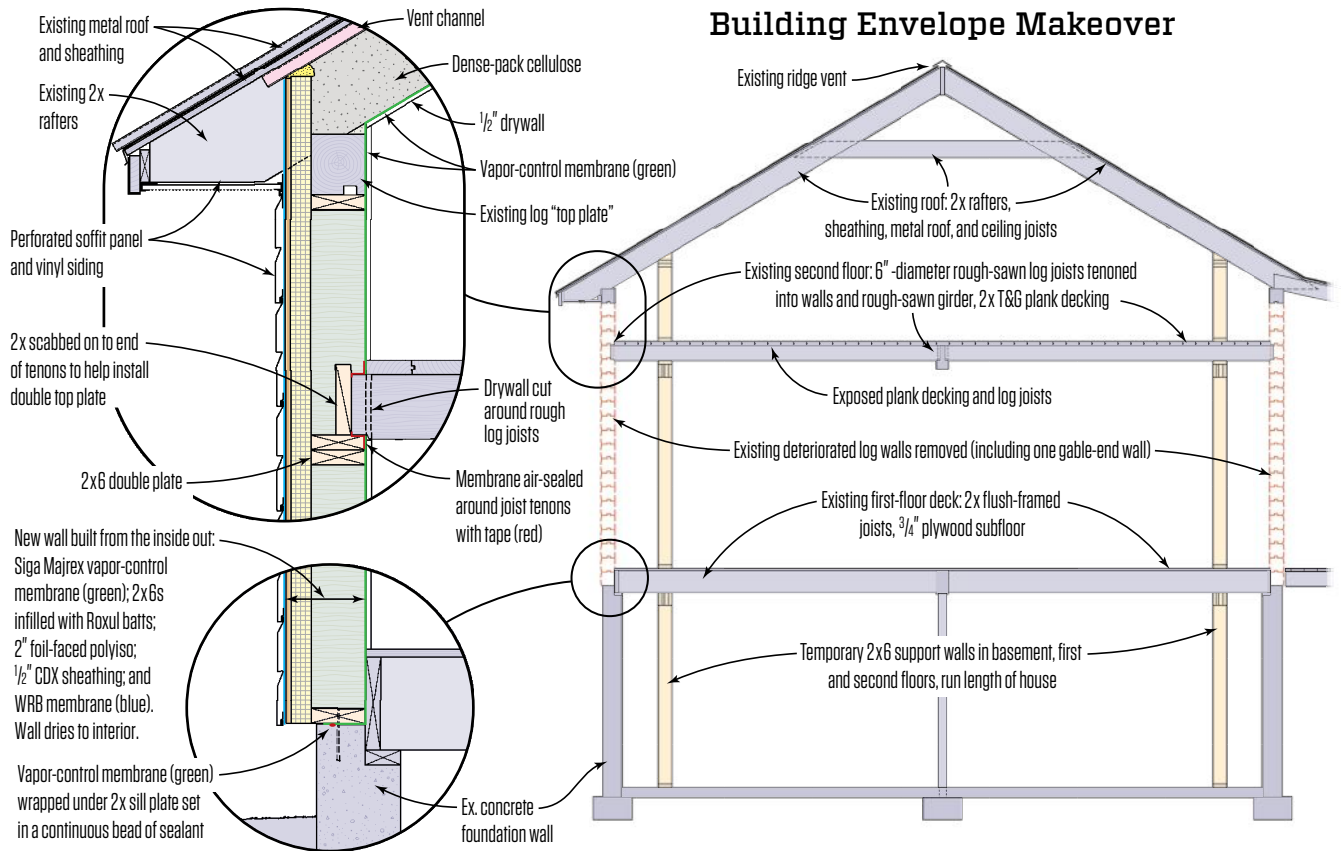
Starting out, it took some time to have an energy audit done and organize funding (the homeowner qualified for the maximum level of a state-sponsored Heat-Saver Loan program, which made the energy upgrade possible). We planned to start demolition in spring, so, before winter set in, I temporarily sheathed the home’s exterior walls to help keep wind and snow from entering the home through holes in the deteriorated walls. In late winter, the



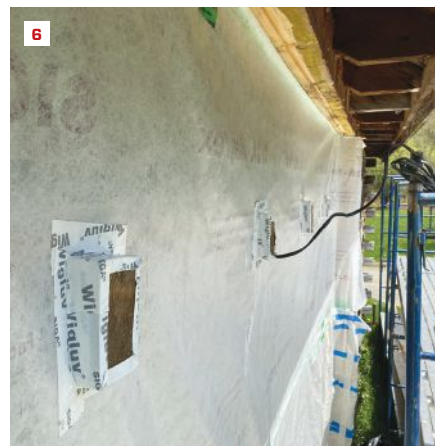
The 40-year-old cabin was built on an exposed site in a region notorious for strong prevailing “Quebec” winds out of the Northwest (1). Rot had penetrated 2 to 3 inches into the 8-inch-wide log walls, with the worst damage at sill locations (2). The log wall was cut into manageable pieces and removed (3).

Photos by Matt Burstein and Tim Healey, Illustration by Tim Healey

Building Envelope Makeover



For safe removal of the home's deteriorated log shell, temporary support walls were installed to pick up roof and floor loads. The remaining floor and roof systems were in decent shape (the home was re-roofed with metal AG panels a few years ago). The new replacement wall was installed as plumb and level as possible, given that the home's roof had flexed somewhat over time.



Working piecemeal, alone, the author removed only as much of the log wall as he could replace and seal up in a day (4). The new wall was built from the inside out, starting with a continuous bead of sealant applied to the top of the existing foundation (5). The vapor-control membrane was taped from the foundation up to an existing rough-sawn square top plate (6).



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The replacement wall was pieced together from the inside out (7). The author worked his way down the rear wall (8), then the front bearing wall, and finished up with the gable end (9, 10). Although the home was clad with vinyl siding (11) and the exterior “essence” of the log cabin was removed, the main goals were to improve the comfort and longevity of the home.

homeowner hired an insulation contractor, who dense-packed the rafter bays with cellulose just before COVID-19 hit and a statewide lockdown was imposed.

Working piecemeal, alone. After the lockdown ended, I installed temporary support walls running the length of the home to support the roof and floor loads. I laid out the framework as well as was possible around homeowner’s living space, then began to remove the rotted log walls in small sections beginning at one end of the rear bearing wall. I worked piecemeal, removing only as much wall as I could replace and seal up in a day.

With one section of the wall open, I began building the new wall from the inside out. I applied a continuous bead of Pro Clima Contega HF sealant to the top of the existing foundation in the opened-up work area and installed an interior Siga Majrex vapor-control membrane. I turned the bottom edge of the membrane onto the

foundation and set it in the sealant, then ran the membrane up the wall and taped the top to the remaining rough-sawn square top plate. I had to cut and seal the membrane around existing log “joist” tenons, which were supported by a new 2x6 double top plate.

Next, I pieced together the studwall and infilled the bays with Roxul batts. Then I applied 2-inch foil-faced rigid polyiso, 1/2-inch CDX plywood sheathing, and a WRB membrane. With that wall section sealed up, I moved on to another section of the wall and repeated the process, working my way around the house.

The result was a 72% reduction in airflow, which was a vast improvement considering the home still had a leaky basement bulkhead in need of replacement.

Matt Burstein owns Practical Construction, based in Fairfax, Vt. He is a general contractor who specializes in building efficiency and durability.

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Making Open-Joint Siding Work

BY JLC STAFF

Open-joint cladding systems have been getting a lot of attention in part because they allow designers to add texture and depth to the wall plane. On a recent project, Michael Ansel, principal of Otogawa-Anschel Design-Build in Minneapolis, Minn., told *JLC* he had a lot of fun designing the exterior façade because he was no longer limited to the geometry of typical cladding materials (see photo, below). “Mixing the open-joint system with a panel system, I could draw shapes with the panels and create patterned texture with the open-joint areas wherever I wanted,” Ansel explained. Nevertheless, while this may be liberating for designers, he admitted that some builders question the performance of open-joint claddings.

CLADDING PERFORMANCE

We tend to think of cladding as a kind of armor. That’s still the case with open-joint cladding. The outer boards will protect the building from lawn mowers, baseballs, and tree branches, and from the destructive forces of ultraviolet light. But with an open-joint system, Ansel says, we are no longer pretending that the exterior cladding is a water barrier. Almost no cladding—certainly none of the usual suspects used for residential work, such as fiber cement, engineered wood, stucco, or brick—is a complete barrier. “They all leak,” Ansel contends, “and most of us know we need to create an effective water-control layer behind the cladding. Many of us have been installing ventilated rainscreens as a regular practice behind our cladding for a long time.”

Rainscreens work incredibly well if the water-resistive barrier remains intact (that is, it’s continuous, well taped, and well flashed at openings, penetrations, and intersections), because the vents at the bottom and top of the wall allow about 80 to 90 cfm of air to flow across the surface of the wall. This helps dry the droplets of water that cling to the WRB or that might be held at a tape edge. Ansel submits that an open-joint system works even better than a rainscreen because you have hundreds of cfm of airflow across that surface. “It’s impossible to keep it wet,” he says. He believes the airflow also helps deter insects, and says, “I’ve never seen a problem with spiders and wasps in the open-joint systems I’ve installed.”

An open-joint system might be more vulnerable to degradation from UV light. Anyone who’s seen black paper turn brittle and crack from a month or so of exposure to full sunlight knows that a WRB is susceptible to damage from sunlight. Our eyebrows go up when we think about opening up the joints of cladding boards from 3/4 inch to 2 inches. But while UV degradation might be an initial concern, it seems to be a manageable one. To better understand how, let’s look at the system Ansel put together on a recent project.

RECIPE FOR RESILIENCE

Cladding. The horizontal cladding boards Ansel used were Azek Vintage Collection deck boards from TimberTech. These are four-sided cellular PVC boards capped with a PVC coating formulated to resist fading. The product is a full inch thick, and Ansel used all three available widths—3 1/2-, 5 1/2-, and 7 1/4-inch-wide boards—to create a pattern on the open-joint areas of his walls. He installed the boards with Cortex screws so the fasteners would disappear on the face.

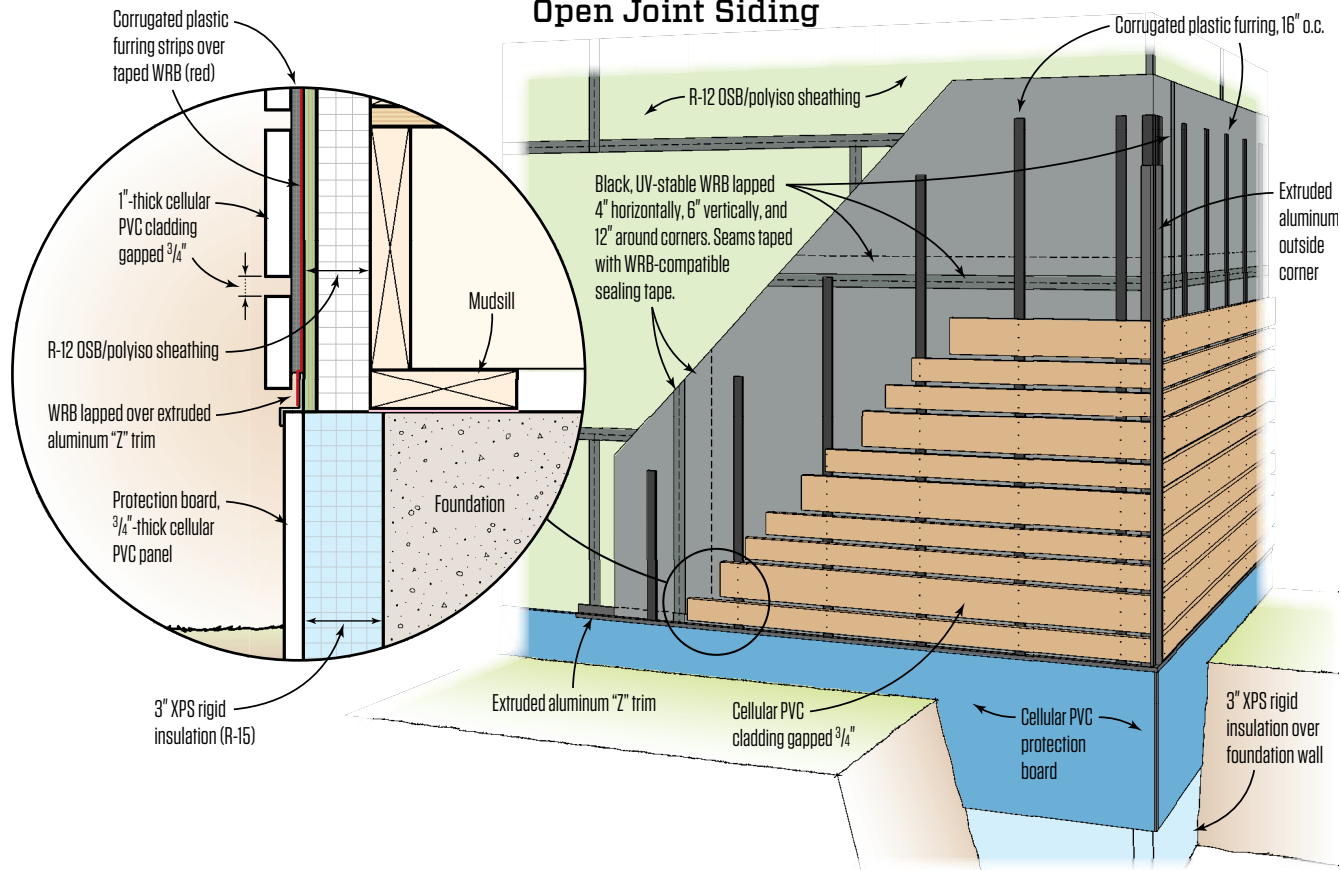
We were surprised that Ansel opted for vinyl, since in the past he has expressed displeasure with vinyl siding from a sustainability perspective. But his thinking has evolved, he says. “I’ve come around to see that, as a 100% recyclable product that requires zero maintenance, its embodied energy is very low.” And keep in mind, he argues, that a deck, which this material was made for, sees substantially more sunlight and has snow and water laying on it for long periods, to say nothing of the impact abuse it is designed to withstand—conditions that these boards aren’t going to see. “I have no doubt this material will withstand the elements for as long as just about any material I could choose,” says Ansel.

Battens. Ansel used Benjamin-



Photo: Otogawa-Anschel Design-Build; Illustration: Tim Healey

Open Joint Siding



Obdyke's Batten UV corrugated plastic battens. These $\frac{3}{8}$ -inch-thick by $1\frac{1}{2}$ -inch-wide polyethylene battens are black and are designed to disappear from sight in an open-joint cladding system. Ansel likes the corrugated material, which has open cells across the width of the batten that allow cross ventilation. And the polyethylene is impervious to water, so any water that might collect on the leading edge of the cladding boards at each batten will simply evaporate; it won't lead to rot as it might over time with wood. The plastic battens are also very light, so they can be attached to the sheathing with a few staples prior to the installation of the cladding. The fasteners for the cladding, which are driven into the sheathing, then hold the battens in place. You don't need to line up battens on the studs.

Invisible layer. Along with the battens, Ansel opted for Benjamin-Obdyke's InvisiWrap UV—a flat-black, nonwoven building wrap. He taped this wrap with Benjamin-Obdyke's HydroFlash UV+ seam tape, and flashed penetrations through the wall with 4- and 6-inch HydroFlash UV+ flexible flashing. These products all have an acrylic adhesive, and they are flat black to blend in with the InvisiWrap, so they essentially disappear from sight behind the open joints in the cladding.

Primary water-control layer. In this cladding system, the pri-

mary water-control layer is the taped WRB facing on Zip R-Sheathing. From a water-control perspective, it is a redundant system—"a seatbelt and air-bag approach," as Ansel likes to say. This is what gives him confidence in the UV protection. Benjamin-Obdyke provides a 25-year warranty when the whole "UV-stabilized" system (wrap, tape, and battens) is used. "I'm not a fan of warranties, but they are helpful to understand what the manufacturer sees as product limits," Ansel explains. In this case, the warranty allows for a 2-inch gap and defines the maximum exposure to direct sunlight as one full year. The gap Ansel used on this project was $\frac{3}{4}$ inch and the cladding was a full inch thick—both are variables that will affect the exposure to sunlight in service. He feels confident that it will take a long time for the invisible layer to see a full year of sunlight. And even if the WRB does become brittle after 40 years or so, he knows that a tear in that membrane will only expose a pristine Zip System that is itself fully taped and flashed. The wall assembly is not likely to ever see any water.

Ansel's goal is to build projects that will last at least 100 years, and he hasn't relaxed on that here. He's confident that the PVC deck board installed as a cladding over both the Benjamin-Obdyke and the Zip systems will perform as intended for at least that long.



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WHEN TO CHOOSE FLUID-APPLIED FLASHING



Fluid-applied flashing materials have gained popularity alongside the trend in tighter building enclosures. While advanced acrylic flashing tapes can produce a tight seal, when flashing applications call for maneuvering around corners and curves, more teams are turning to fluid-applied flashing for ease of installation and assurance of continuous coverage. Here are a few situations when pros say they choose to use ZIP System™ liquid flash.

“We prefer to use liquid flash because it leaves little room for error and provides a supertight water and air barrier.”

Doug Cameron
ESS Design+Build

Flashing Recessed Windows

When taping corners and angles with flashing tape, it's important to layer, or shingle, tape segments appropriately to make sure you're creating a continuous air barrier with the water-resistant barrier on the sheathing. While newer tape innovations such as ZIP System™ stretch tape can eliminate the origami of multiple tape segments around sill pans, for more complex installs on recessed windows, for example, ZIP System liquid flash flows into

every crevice to create a smooth, continuous flashing membrane between the transitional levels of the recessed windowsill.

“Any time you have an overlap in material, you're creating a possibility for water leaks to occur,” said Doug Cameron, owner of ESS Design+Build. “We prefer to use liquid flash because it leaves little room for error and provides a supertight water and air barrier.”

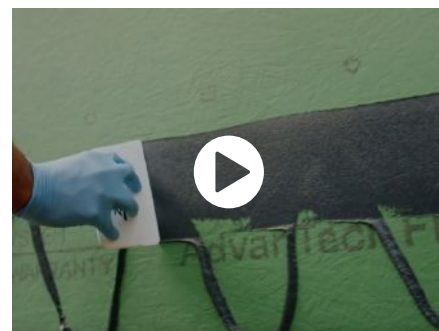
Fluid-applied sealants simplify the flashing process around air vents and pipe penetrations as well. ZIP System liquid flash is formulated to combine the durability of silicone with the bonding strength of urethanes in what's commonly called STPE (silyl-terminated-polyether) technology. This high-performance formula applies easily, using a plastic trowel or paintbrush to tool around curves to provide the right mil thickness for an air- and watertight seal.

Sealing Transitional Details

Sealing the connection between the foundation and wall system can be difficult, and not all tapes are created equally. Depending on the type of adhesive backer used, tape may not adhere to all substrates. That's why builders such as Doug Cameron have switched to ZIP System liquid flash for a fluid-applied flashing option on this transitional detail. ZIP System liquid flash is designed to chemically bond two materials together, so there's little

chance for air or water leaks in this important area of the enclosure that is gaining more and more attention from teams building to net-zero standards.

“We seal all critical junctures where water can and cannot hit in order to provide both a water-resistant and air-resistant barrier,” Cameron said. “I call it our ‘block and caulk’ system.”



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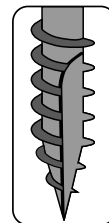


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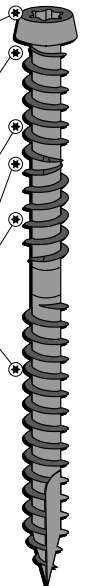
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BY MELANIE HODGDON

How Do You Know You're Making Money?

A client recently sent me an e-mail asking an accounting question. But first, he provided a brief update: "I have been busy working and, I believe, making money?"

What stood out to me was that he added a question mark to what might otherwise have been a celebratory statement. And that reminded me of how easy it is to get lost in the work and lose sight of the profit—and to fool yourself into thinking things are going one way when they may not be. In these challenging times, as the pandemic forces the work to slow down, ramp up, and potentially slow down again, it's even more important to pay attention. Here are two tips that can help you keep your finger on the pulse of your business.

TIP 1: CHOOSE ACCRUAL-BASIS REPORTING

Many people mistakenly view their financial reports on a cash basis, either because it makes more sense to them or because the reports look better or healthier to them. Don't do it! Remember that even if you file your taxes on a cash basis, you can (and should) run your business on an accrual basis, because it gives you a far more accurate picture of what's going on. Most accounting software will allow you to toggle between accrual basis (for managing) and cash basis (for tax preparation) reporting, so check out yours.

What's the difference? There are two kinds of transactions:

"One-step" transactions. These include writing a check and using a debit card (where there is no accounting delay between writing the check and considering that cost to be debited from your checking account). On the income side of things, a one-step transaction would be creating a deposit to record money (such as payment from a customer) going into your account.

"Two-step" transactions. These include entering a bill, entering a credit card charge, and creating an invoice. Each of these transactions has a second step: You must pay the bill, pay your credit card account, and process payment from the customer before making the deposit.

In accrual-basis accounting, you enter all of the two-step transactions, and these will be included on your financial reports.

In cash-basis accounting, you typically record only one-step transactions, which will be included on your cash-basis financial reports. Alternatively, you may record some two-step transactions, but these will not be included when you run your report.

Almost all companies generate invoices (a two-step transaction) from their accounting software, but many don't enter bills and delay entering credit card charges until they actually get their statement (entering the total in bulk as a single entry when they're ready to

pay). Such companies are operating in a hybrid mode in that income is treated on an accrual basis and costs on a cash basis. If these companies run an accrual-basis profit and loss (P&L) statement, the invoices will be included (inflating income) but the costs will not be; and if they run a cash-basis P&L, any unpaid invoices will be excluded. Either way, they don't get an accurate picture.

I'm going to focus on "above the line" transactions (income and cost of goods sold, or production costs), but the theory applies to overhead as well as balance sheet accounts.

Accrual-basis accounting and reporting. In accrual-basis accounting, you input data about all incurred expenditures and income (two-step transactions including bills, credit card purchases, and invoices). When a financial report is set to be viewed on an accrual basis, you will see all these costs and all the income in the report.

In the example below, let's look at just the transactions that occurred within the month of August. If you are running your books on an accrual basis, you will enter all the invoices for customers and all the bills and credit card charges you may have received for subcontractor services, materials, and other direct costs (such as equipment rental) in August. Since you are entering these as they come in, on any day you will see the accrued costs on your P&L (as well as on your job cost reports)—whether or not they have been paid. The invoice gives you a more accurate picture of what is owed to you, and the bills and charges give you a more accurate picture of what you owe others within that time period. If you have invoiced more than you have incurred in costs, that's good! In the example, invoices for \$38,750 were sent out, and total costs for the same period were \$30,156.

Transactions dated Aug. 1–Aug. 31		P&L, ACCRUAL BASIS Month of August	
Invoices to customers	\$38,750	Income	\$38,750
Bills from subcontractors	\$12,750	Cost of Goods Sold	
Bills for materials	\$16,511	Subcontractor Costs	\$12,750
Bills for equipment rental	\$895	Materials Costs	\$16,511
		Equipment Costs	\$895
		Total Cost of Goods Sold	\$30,156
		Gross Profit	\$8,594
		Gross Margin	22.18%

In accrual-basis accounting, you enter all of the two-step transactions, and these will be included on your financial reports.

Cash-basis accounting and reporting. Now let's look at cash-basis reporting for the same period (see table, below). On a cash-basis report, the only transactions included are cash inflows or outlays. In other words, if you received customer payments within the month of August, those dollars will be included. If a customer pays \$25,000 on a \$40,000 invoice, only \$25,000 will be included on the report. If you paid bills in August (even if they were payments for charges from prior periods such as July or even June), those dollars will be included. As with invoices, if you paid \$500 on a \$1,200 bill, only the \$500 will be included.

Transactions dated prior to Aug. 1 but paid between Aug. 1 and Aug. 31		P&L, CASH BASIS	
		Month of August	
Invoices paid by customers	\$52,779	Income	\$52,779
Bills paid to subcontractors	\$18,705	Cost of Goods Sold	
Bills paid for materials	\$14,269	Subcontractor Costs	\$18,705
Bills paid for equipment rental	\$217	Materials Costs	\$14,269
		Equipment Costs	\$217
		Total Cost of Goods Sold	\$33,191
		Gross Profit	\$19,588
		Gross Margin	37.11%

In cash-basis accounting, you typically record only one-step transactions. Note the reported margin here is much higher than on the accrual-basis P&L (see previous page) for the same business.

Notice that when you ran the P&L on an accrual basis, the gross profit for August was \$8,594 and the achieved gross margin was 22.18%. But when you ran the P&L on a cash basis, the gross profit for August was a whopping \$19,588, yielding an achieved gross margin of 37.11%. What happened and which can you believe? In the cash-basis P&L, income is reported as \$52,779. This amount reflects payments on invoices created prior to August (assuming that none of the August invoices were paid in August). So these payments may have been for invoices from July, June, or even May if you had some late payers. You can't determine when that income was requested since the report includes only the payment.

Now let's look at the bills you paid. Presumably, in August you were paying for bills from July (and possibly June, if you have good-natured subs and suppliers). But how do you know whether you paid for everything? Remember, you aren't seeing any unpaid bills on a cash-basis report. Or you may have made a partial payment. So that achieved gross margin of 37.11% may be wrong in part because you haven't paid all your bills.

And that's the biggest shortcoming of cash-basis reports: If you don't have the cash to pay for something, it won't show up. Since you only see a partial picture, you cannot draw accurate conclusions.

Earned vs. unearned income. Be aware that to be accurate, your reports should show *earned* income only. If you invoice for a large deposit (customer pre-payment), those dollars should not be considered income until the job starts and has generated a matching amount of costs. Unless you are adjusting for unearned income,

including this income on either a cash or accrual P&L could be misleading and lead to overstating your gross profit and margin. More information on earned income is available in numerous articles on WIP (Work in Progress) adjustments.

TIP 2: MONITOR YOUR BALANCE SHEET

Although most people are more comfortable and spend more time with their P&L than their balance sheet, the balance sheet can provide two quick ratios that will give you a sense of how well a company is doing overall.

Current ratio. This ratio is derived from two numbers on your balance sheet. It is simply a measure of how well the company is able to cover short-term debt (liabilities) by using short-term assets.

On your balance sheet, short-term debt will be termed "other current liabilities." (In accounting parlance, current refers to a term of 12 months or less.) Examples of short-term (current) debt include payroll tax liabilities, credit card debt, bills, and lines of credit.

Short-term (current) assets include cash (bank accounts, money markets), accounts receivable (will be turned into cash in less than 12 months), and inventory (can be sold and turned into cash in less than 12 months).

There's nothing magical about this ratio. Simply look at your balance sheet; the total current assets and the total current liabilities will each be subtotaled. Divide the current asset subtotal by the current liability subtotal. Ideally, you should have \$1.25 of current assets available to pay off each \$1 of current liabilities. If your ratio is smaller than that, you are headed for a cash crunch and need to send some invoices out. You can create a simple calculator that will give you the ratio. Then every month, just input the subtotals and see how you're doing.

Current Ratio		
(should be 1.25 or higher; higher is better)		
Total current assets	\$349,687.59	= 1.262
Total current liabilities	\$277,145.61	

The current ratio shows your ability to cover short-term debt with short-term assets (anything that includes cash or assets such as accounts receivable that can be turned into cash within a 12-month period).

Debt-to-equity ratio. The purpose of this ratio is to show the degree to which your company is running on borrowed money. For example, let's say that you took out a five-year loan for \$120,000. That would certainly increase your cash (current assets). Your current ratio would probably look great since that five-year loan would be excluded from the other current liabilities subtotal. But that loan, which would be classified as a long-term (longer than 12 months) liability, should be included when considering your total debt, both current and long-term. That's where this ratio comes in.

In an extreme oversimplification, equity can be considered the net worth of the company, assuming that all assets were liquidated

in order to pay off all debt. Whatever is left over would be the company's equity. So it's helpful to understand how the amount of debt a company has compares with its equity. Hopefully, the total debt will be smaller than the company's equity. The formula simply divides the company's total liabilities by total equity.

Both of these figures are provided on the balance sheet. Again, create a simple spreadsheet to track these. You want debt to be smaller than equity, so the resulting number should be less than 1. In the example at right, this company's debt is too high. The business is being sustained by borrowing. To improve the ratio, it will be necessary to reduce debt. To reduce debt, the company will need to increase income (not borrow more), which means revisiting pricing and production strategies.

IN SUMMARY

Consider operating your business on an accrual basis—entering “two-step” transactions and monitoring financial reports on an accrual basis to get a truer picture of how what you've asked others to pay you (income from invoices) aligns with what others have asked you to pay them (bills and credit card charges) for any given period.

And track your short-term cash requirements and overall debt position using the current ratio and the debt-to-equity ratio.

Debt-to-Equity Ratio (should be less than 1; lower is better)

Total liabilities	\$384,805.55	=	1.50874
Total equity	\$255,050.36		

The debt-to-equity ratio shows the degree to which a company is being sustained by debt. Debt reflects all the monies owed to others. Equity (loosely speaking) reflects the value of the company. Within equity are capital stock and net profit, which should add to equity; distributions, which reduce equity; and retained earnings, which reflect how much money the company has kept for its own maintenance and growth. Ideally, retained earnings and net profit figures increase over time, permitting you to increase distributions accordingly.

It's challenging enough to make money; at least these simple tools can help you know whether it's truly happening.

Melanie Hodgdon, president of Business Systems Management, provides management consulting and coaching for contractors.

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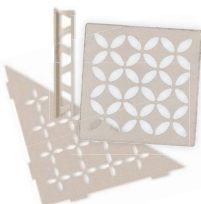
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Cream



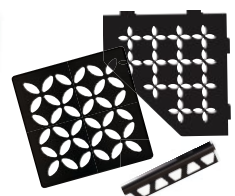
Greige



Stone grey



Bronze



Matte black



BY JIM BRADLEY AND CHRIS WEST

Tracing Air Leaks With a Blower Door



To begin a “smoke check,” the authors fill a home with dense fog produced by a high-volume theatrical fog machine (1).



With the blower-door fan blowing inwards, co-author Chris West starts to pressurize the home, pushing the fog to the exterior (2).

Part and parcel of being home-performance consultants based in northern Vermont is promoting the importance of a pre-drywall inspection for new homes. For us, the inspection includes establishing a home’s ACH rating (air changes per hour) as well as visually examining the primary air barrier for air leaks while the interior shell is still open. Although we still use an infrared camera to help locate air leaks, we find fogging homes or “smoke checking” to be the most effective method.

To perform smoke checks, we use a theatrical fog machine (1). We first fog a home’s interior, then set up a Minneapolis Blower Door to pressurize the home and push the fog to the exterior through any open seams or gaps (2). This pressure test helps locate what we refer to as “areas of opportunity”—a last chance to easily tighten up the home’s air barrier prior to drywalling and installing the exterior cladding. Putting the effort in to track these down can often add up to hundreds of cfm worth of leakage reduction.

In addition to reducing a home’s energy performance, air leaks can be a health and safety issue. Small rodents can easily squeeze through small gaps in an air barrier and decimate a home’s insulation package, causing IAQ problems, or gnaw on Romex wiring, causing a potential fire hazard—a common occurrence in the rural North Country where we work.

Immediate feedback. A key advantage fogging offers is that it immediately demonstrates to the builder, his or her crew, and the homeowner problem spots in need of remediation. Also, air exfiltration at large unsealed gaps in the air barrier can be visually compelling, with fog jetting out of the building envelope like a vape pen.

Using an IR camera to find air leaks is effective, but when the temperature differential is low between the home’s interior and outdoors, the smoke test offers better results. We often use the two in tandem, fogging a home to get a quick overall sense of where leaks are, and then fine-tuning the search with an IR camera.

Tightening up your game. We recommend familiarizing yourself with your state’s status regarding impending IECC rules and preparing accordingly. In Vermont, where we work, the new 2020 Residential Building Energy Standards (RBES) was implemented on September 1, 2020. As a result, blower door testing by a certified tester is now required for the RBES Base and Stretch codes. All newly-built



With the building pressurized, fog could be seen escaping from two doghouse dormers at their roof-to-wall junctures (3).



Co-author Jim Bradley points to smoke leaking from double-hung windows in living space above the garage (4). After checking the window openings and dormer framing, workers determined that the window units themselves were leaking (5).

homes are now required to be blower-door-tested for air leakage to certify a maximum airflow of 3 ACH50—it's no longer just a visual inspection. "Self-certifying" is allowed, but in Vermont, all testers must be certified through the Building Performance Institute (BPI) or Efficiency Vermont. Although Vermont is one of only 10 states that is currently implementing the IECC rules as is, other states will soon follow. It's important to stay informed on energy codes where you work, as energy standards tend to become more stringent over time, not less.

For us, the newly-enacted VT RBES mandate means the need for pre-drywall blower door testing—combined with a smoke check—will be all the more crucial, particularly on new homes built to code where air-sealing may be part of a builder's job scope but may not be applied to the nth degree. We expect to see more demand in the near future for pre-drywall testing on newly built code-compliant homes, in an effort to achieve better certified ACH numbers.

SMOKE CHECKING A HOME

Even well-sealed homes may be in need of tightening up. Earlier this year, we did a pre-drywall inspection and smoke check for an architect known for his high standards regarding energy efficiency. We discovered numerous problems with the air-sealing and insulation detailing that would have made his high-performance house project much leakier than it should have been, given the time and energy devoted to designing and building it. As a result of our findings, the builder was able to mitigate the leaks prior to drywalling, saving the energy-conscious architect the headaches he would have had if the mistakes had been covered up and the building had then underperformed.

Also, it's not out of the realm of possibility that building crews and subtrades who have bought into the concept of building well-sealed, high-performance homes but are rushing to meet a scheduling deadline can accidentally miss air-sealing penetrations or seams. Sometimes, crews have a bad day or "night before" and do not do the greatest air-sealing job on a particular day—these things happen.

Air-sealing is not always the problem. On another pre-drywall inspection we did last June, we were asked by a local home-building company to perform a blower door test and smoke check on a new custom house. At first glance, we could see that the builder's crew did a top-notch job air-sealing the interior side of the framing and the usual hard-to-seal spots.

Starting out, we set up the blower-door assembly with the fan oriented to blow inwards. We then filled the entire home with "smoke" using a high-volume theatrical fog machine (chauvetdj.com). The machine burns a special fluid to create the fog, which is innocuous but has a faint odor. It took about 20 minutes to fill the entire 4,500-square-foot

home. We then pressurized the house with the blower door to push the fog out through the home's primary air barrier and inspected the home's exterior perimeter for air leakage.

We could see smoke coming out a pair of second-floor doghouse dormers along the rake edges of their roofs (3). Dormers are somewhat notorious; because they are framed above the roofline, they are difficult to air-seal and small air leaks are common. More noticeable was the smoke emanating from the double-hung windows located at the second-floor living space above the garage (double-hungs are known to be less airtight than casements or European tilt-and-turns). The three windows were identical, but one of them was leaking more than the other two (4). The builder's crew broke out their ladders and determined the smoke was leaking from around the window's frame and not from its taped-off flanges (5). The window manufacturer was notified about the leaky unit.

Blower door test. With the smoke check completed, we can turn the fan around and depressurize the house to find our baseline ACH rating numbers for the client, which turned out to be 1 ACH50, well under the code maximum airflow of 3 ACH50, negating the need for another test (6).

As an aside, we now use a TEC DG-1000 Pressure and Flow Gauge manufactured by The Energy Conservatory to calculate a home's ACH rate. We've found its new DG-1000 manometer much more intuitive than its old workhorse DG 700 model (7). A high-resolution touchscreen graphically shows you such items as what size rings you need on the blower door fan, and what pressure taps to hook the red and green diagnostic tubing to, depending on the airflow-measuring task (8). TEC also has an app available that enables you to sync your smartphone to the manometer, which allows you to operate the DG-1000 remotely—it's a big step up from the older model.

We've heard many builders say, "We foamed everything," and think that's it with respect to air-sealing, but it's not. There are usually air-sealing opportunities waiting to be fixed. That's why a pre-drywall inspection is so valuable. It's a great fail-safe that will show air leakage pathways that need to be considered, such as penetrations for dryer and whole-house vacuum-cleaner vents, security lights, and range hoods. Other hidden trouble spots include changes in house geometry, such as shed and doghouse dormers, and built-up framing, such as inside and outside corners, ganged jack studs and king studs, headers, and double top plates.

Jim Bradley is a BPI-certified home-performance contractor, builder, and remodeler based in Vermont. He is currently a project developer and manager for Hayward Design Build in Colchester. Chris West is PHIUS/PHI Certified Passive House consultant/trainer and owner of Eco Houses of Vermont, a building science consultancy specializing in Passive House design for single family, multi-family, and commercial projects.



With the smoke test completed, the authors depressurized the home and performed a blower door test (6).



The authors used a new TEC DG-1000 manometer—here compared with an older DG 700 manometer—for the blower door test (7). The DG 1000 is much more intuitive, graphically showing where to connect red and green diagnostic tubing (8).

Building is not a rote sequence of steps. It is a quest rooted in design, craftsmanship, and the long-term performance of methods and materials.

Hanley Wood congratulates and thanks Feeney for its ongoing commitment to craftsmanship and performance.



BY FRANK WOESTE AND JOSEPH LOFERSKI

Ledger Strips and the Code

Before joist hangers became widely available, ledger strips were commonly used to help support toenailed joists, whether the joists were hung from an interior rim joist or flush beam or from an exterior deck ledger. But now builders commonly use joist hangers, and while ledger strips are still OK to use in interior applications, the 2018 edition of the IRC no longer permits their use on exterior decks (2018 IRC R507.6.1).

PRACTICAL ISSUES

As a practical matter, ledger strips used outdoors are required to be pressure treated, typically southern pine (SP) in the mid-Atlantic and Southeast. But according to information from three SP lumber inspection agencies—Southern Pine Inspection Bureau (spib.org), Timber Products (tpinspection.com), and RRA/Southeastern Lumber Manufacturer's Association (slma.org)—as well as our own observations at big-box lumber outlets, stress-rated nominal 2x2 pressure-treated (PT) lumber has not been available in the marketplace for a number of years. Thus, under the previous IRC editions, contractors were faced with a supply issue. One solution is to rip larger sizes of treated 2-by stress-rated

material (such as PT No. 2 SP) to the correct 2x2 dimension, but ripping creates two technical problems.

The first problem is that the grade of a piece of lumber, such as a 2x6 No. 2, does not carry over to the individual pieces that result from ripping. For example, if three 2x2 pieces are made from a 2x6 and regraded by an experienced grader, one 2x2 might be graded as "cull," the next as No. 2, and the third as No. 1. Stress-grading is more than just the number and size of the knots; it also takes into consideration other factors, such as slope of grain. As anyone who has ever shattered a baseball bat can tell you, localized grain deviations are hard to detect and can greatly impact strength.

The second problem is that ripping treated lumber exposes at least one and in some cases two largely untreated surfaces. While the 2015 IRC and earlier editions require field-cut ends, notches, and drilled holes of preservative-treated wood to be treated in the field in accordance with AWPA M4 (2015 IRC R317.1.1), the language does not cite "edges" for field treatment. Nonetheless, these untreated surfaces along the ripped edges are a durability concern and still may require treatment per the manufacturer's product warranty.

In a nutshell, a code requirement for a product that is not (apparently) available in at least one region of the country is not a good situation for DIYers and contractors. But our testing has shown even more compelling reasons to not permit 2x2 ledger strips outdoors.

LOAD-TESTING 2X2 LEDGER STRIPS

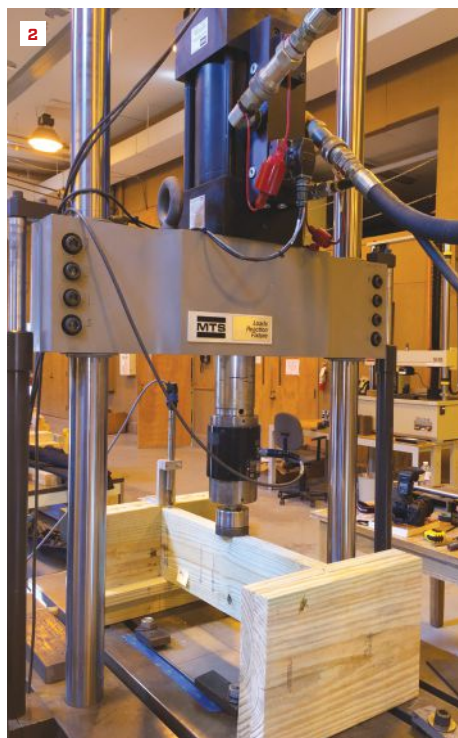
Recently, we load-tested 2x2 ledger strips to see how they might perform in service. The design of the test specimens was guided by nailing requirements in the 2015 IRC and by the availability of PT 2x2s in a local big-box store. We wanted to test PT ledger-strip connections that were in the wet condition (not kiln-dried after treatment), as might be used by a DIYer or contractor.

We went to our local big-box lumberyard and purchased dimensional PT framing lumber and 2x2x8s for our testing (1). When we measured the cross-section dimensions of the nominal 2x2s with a tape, they averaged 1³/₈ inches by 1³/₈ inches (1.375 by 1.375), while the treatment tags on the ends indicated that the 2x2s measured 1.3125 inches by 1.3125 inches. As such, neither the actual measured dimensions nor the dimensions on the



Typical of commercially available stress-rated pressure-treated 2x2 southern pine, this nominal 2x2 purchased at a lumberyard measures 1³/₈ inches by 1³/₈ inches, while the treatment tag reads 1.3125 inches by 1.3125 inches. Neither the measured nor the tag dimensions conform to the nominal dimensions of a 2x2 specified in the 2015 IRC.

Photos by Frank Woeste



To measure the load capacity and deflection of a 2x2 ledger connection per the 2015 IRC, the authors assembled this laboratory test. On one side of the assembly, a simulated 2x8 joist was supported by a 2x2 ledger strip nailed to a 2x12 with four 10D (3-in. x 0.148-in.) polymer-coated smooth-shank nails (2). On the other end of the assembly, the joist was supported by a Simpson Strong-Tie 316 stainless steel LUS28SS joist hanger and ring-shank 316 stainless steel nails (SSA10DD 3-in. x 0.148-in.) (3). Loads were applied by a hydraulic ram controlled by a uniform downward movement, allowing the load value to peak and then fall off to a much lower value.

treatment tag conformed to the requirements in the 2015 IRC, which specifies that a nominal 2x2 measure 51mm by 51mm, or 1¹/₂ inches by 1¹/₂ inches (2015 IRC R506.2).

Our test assembly consisted of a 2x8 joist fastened to two 2x12s to create two joist-to-framing connections, each sharing 50% of the total applied load from a hydraulic ram. On one end, the joist was supported by a 2x2 ledger nailed to the 2x12. For lateral support, three 10D toenails were installed, with two on one side of the 2x8 joist and one on the other side, per the 2015 IRC. On the other end, the joist was supported by a stainless steel joist hanger. An electronic device—called an LVDT, or linear variable differential transformer—was used to measure the vertical deflection of the end of the simulated 2x8 joist relative to the top of the simulated deck ledger (2, 3).

Our objective wasn't to test the capacity of the joist hanger connection. That said, it's important to note that within 300 feet of salt-water exposure, the 2018 IRC requires stainless steel connectors and fasteners (2018 IRC Table R507.2.3, footnote b: "Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel").

TESTING RESULTS AND OBSERVATIONS

As we applied a load to the test assembly (4–6), we were particularly interested to see the counterclockwise rotation of the 2x2 ledger strip, which created a pronounced "V" between the 2x2 and deck ledger (or support beam). We anticipated that this would happen, due to the fact that the depth of the nailed 2x2 ledger strip was only 1³/₈ inches, allowing it to rotate because it wasn't laterally restrained by other rows of nails. A more effective approach would be to support the joists with a much deeper member, such as a 2x6, nailed along both the top and bottom edges.

As the ledger-strip connection was configured, the polymer-coated steel nails were stressed in bending and subject to withdrawal. It should be noted that nail withdrawal design strengths are relatively low, and when smooth-shank nails are installed in green lumber (MC >19%) that subsequently dries, the design value is reduced to only one-fourth of the tabulated design value. Between the loss of nail withdrawal strength due to moisture cycling, and the combined bending and withdrawal of the nails allowed by the shallow depth of the 2x2, even a full-size (1¹/₂ inches by 1¹/₂ inches)



Before the vertical load was applied to the test assembly, the 2x2 ledger strip was snugly attached to the simulated 2x12 deck ledger (4). As the load on the joist increased, substantial rotation of the ledger strip was evident, as indicated by the angle (bottom right in photo) between the 2x2 and the deck ledger (5). As can be seen by the separation between the joist and the ledger after completion of the load test, a supported floor and ledger would have collapsed under a gravity-type loading, such as the load produced by deck occupants (6).

2x2 ledger-strip connection may not be reliable in a typical outdoor deck application. Based on the issues discussed and our observations, the 2018 IRC code change that prohibits the use of 2x2 ledger strips to support deck joists was a valuable change for property owners and public safety.

As an interesting aside, we did not observe any perceptible movement or deflection of the joist hanger used on the other end of the test assembly during and at the completion of each test. Clearly, the 10D ring-shank stainless steel nails (SSA10DD 3-in. x 0.148-in.) installed per manufacturer's instructions in an engineered hanger demonstrated a test safety factor well above the IRC-compliant connection. On the other hand, as photo 6 shows, when the hydraulic loading ram was lifted from the assembly, the ledger-strip connection had clearly failed.

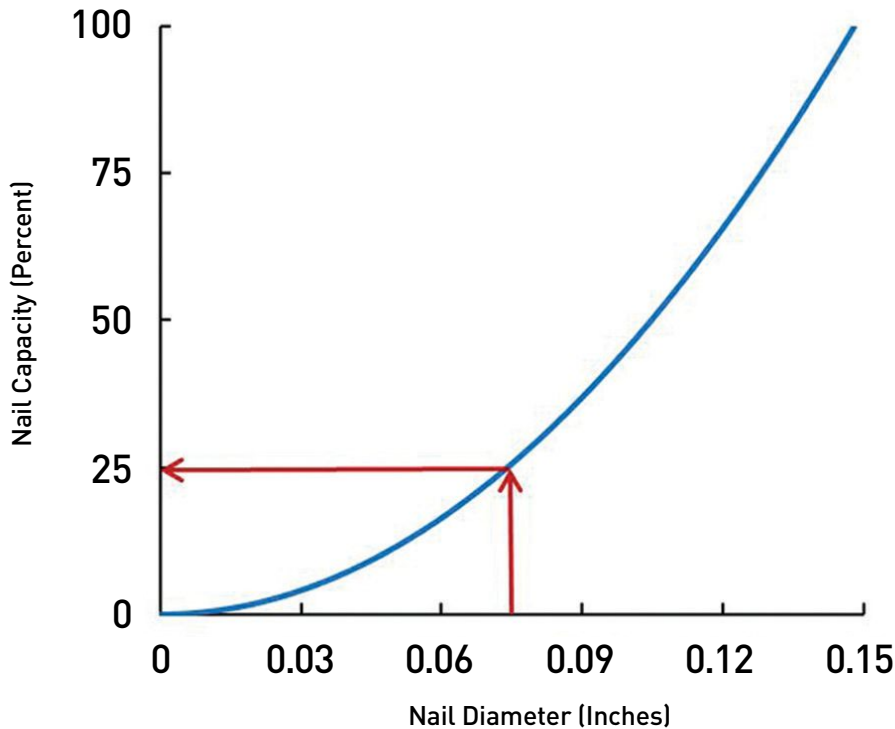
COASTAL DECK CONSIDERATIONS

Because of the impact of salt corrosion on commonly used galvanized nails, a major safety concern has been the use of 2x2 ledger strips in a salt-water environment. In some cases where a deck

collapsed, later investigations have shown that the shanks and heads of the nails had been totally consumed by oxidation. In many locations along a ledger strip, the nail shanks between the 2x2 ledger strips and the face of the beams or rim joists were totally red rust, indicating that the nail connections no longer provided load support for the joists bearing on them.

Even before a 2x2 ledger is loaded in-service, the connection creates a water-trapping joint between two pieces of PT lumber. This configuration alone creates an elevated risk of nail corrosion of a section of the nail shank at the face of the ledger/beam, which is the "business" section of a nail connection supporting a floor joist. In a coastal setting and under service loads, the water-trapping joint is transformed into a "V," creating a valley that traps both water and sea salts (in our example, of course, the width of the "V" is exaggerated due to our load testing; under more typical conditions, the rotation of the 2x2 is still present, but less pronounced). So it is not at all surprising that 2x2 ledger-strip nail connections to beams have a very limited useful lifetime in an exterior environment.

The practical question is, what is the useful lifetime of a 2x2



As red rust attacks the shank of a steel nail and effectively decreases its diameter, the design load capacity of the nail decreases accordingly. For example, if half the 0.148-inch diameter of a 10d common nail is lost due to red rust, the nail's design load capacity (90 pounds for wet use) would be reduced by 75%, with only 25% capacity remaining (22.5 pounds).

ledger-strip connection to a deck beam in a coastal environment? By not including the detrimental impact of 2x2 rotation on the nail connection load capacity, the residual strength of a nail connection can be calculated by assuming that the diameter of a steel nail shank at the 2x2-to-beam interface is reduced by a certain amount. For example, if the diameter of a 10D common nail is reduced by half due to red rust, the nail design load capacity is reduced to one quarter—or 25%—of the original value (see graph, above). Based on published nail design load values, a 10D (3-in. x 0.148-in.) nail load-rated for 90 pounds in southern pine in a deck application would be rated at 22.5 pounds when the nail shank diameter was reduced by half at the 2x2-to-beam interface.

Another way to view the impact of nail shank corrosion is by how it affects occupant design load. Since the typical total design load for a residential deck is 50 pounds per square foot (10-pound dead load plus 40-pound live load), the assumed 50% reduction in shank diameter reduces the total floor-design ledger-connection load to 12.5 pounds per square foot, meaning the weight of the dead floor plus occupant weight would be limited to 12.5 pounds per square foot. Clearly, when the shank diameters of the nails holding

a ledger strip in place are reduced by 50% due to red rust, the ledger-strip-to-joist connection is well beyond its useful lifetime.

DRY LOCATIONS?

We are not aware of issues with 2x2 ledgers used inside residences in dry conditions; however, a word of caution is warranted for the possibility of high moisture exposure for the ledger connections, such as in an improperly maintained crawlspace. High moisture conditions open the door to wood decay, and that outcome alone would weaken ledger-strip nail connections, thus lowering load capacity for occupant live loads.

Frank Woeste, P.E., is a professor emeritus at Virginia Tech. He frequently consults with the public, design professionals, contractors, and building code officials on various aspects of multifamily and residential construction, including decks and balconies.

Joseph Loferski, Ph.D., is a professor in the department of sustainable biomaterials at Virginia Tech in Blacksburg, Va. He teaches, conducts research, and consults on wood and wood-building components including decks, deck guardrails, and wood deterioration in structures.

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QUIETER KITCHENS START WITH THIS HIDDEN APPLIANCE

Next-gen garbage disposals are helping lead a quiet kitchen revolution

Have you noticed the growing

emphasis on kitchen acoustics? Appliance manufacturers are responding with quieter products, from dishwashers and refrigerators to microwaves and food processors.

It makes sense. Any family that entertains or has sleeping children know how disrupting a loud appliance is. The option of offering near-silent appliance upgrades could be a competitive advantage in owner discussions and bids.

Yes, even the garbage disposal.

Today some next-gen garbage disposal units operate at decibels so low you have to hear it to believe it. The technology is so quiet that one leading disposal manufacturer reports users can even carry on a conversation in the same room while the disposal is running.

That's the thing about garbage disposals. A stubborn mythology has grown up around the 90-year-old technology. Among our favorites: They're always loud and fussy.

3 MYTHS

What's the truth? What's fiction? Joe Maiale, vice president of wholesale sales for Racine, Wis.-based InSinkEerator, offers these insights:

- **Noise.** "A lot of money today is put into quiet kitchen upgrades," says Maiale. "The issue is, some contractors don't know there are quiet options for garbage disposals. Like many of us, they grew up with loud units. Our advanced disposals today are very, very quiet. You don't have to wait for the company to leave the house to use it."



- **Safety.** Hollywood loves to scare us with garbage disposals. It's all make-believe: All disposers are blade-free. "They're like a turntable with two lugs on the surface," Maiale explains. "The spinning turntable with the lugs throws the food waste against a circular cheese grater-like area lining the inside of the disposer, which is continuously flushed with water. It's very efficient."
- **Waste Items.** "If anything, garbage disposers are underused today.

You can put a whole turkey carcass down there. Our units can grind just about anything, even celery or corn husks because of the two- and three-stage grinding on advanced disposals," Maiale explains.

CONTRACTOR FRIENDLY

Not all garbage disposals are created the same. Contractors looking to minimize callbacks should double-check the warranty. For example, Maiale says InSinkEerator stands behind its products for up to 10 years with in-home parts and service. "The warranty isn't pro-rated, either," Maiale says.

Maiale says the companies making quality disposals can offer these warranties because they have done their research and tested the products. "During quality control testing," Maiale explains "we do our best to try to break our disposers by feeding randomly-selected units a steady diet of wood cubes and frozen rib bones. If it breaks, which it seldom does, we know there's a problem that needs addressing" Maiale says.

As you line-up your appliance partners, consider manufacturers that deliver both quieter operation and peace of mind.

To learn more about next-gen garbage disposals that reinvent quiet and performance, visit <https://insinkerator.emerson.com/en-us>

SAFETY



Respiratory Protection in the Age of Coronavirus We have the technology to keep hazardous contaminants out of the air we breathe

BY TOM O'BRIEN

When 2020 began, the sight of folks wearing face masks who weren't performing manual labor, treating patients, or robbing banks was inconceivable. As this dreadful year draws to a close, face coverings are ubiquitous but NIOSH-approved respirators are more elusive than an ivory billed woodpecker. COVID-19 is a hard reminder that good health cannot be taken for granted.

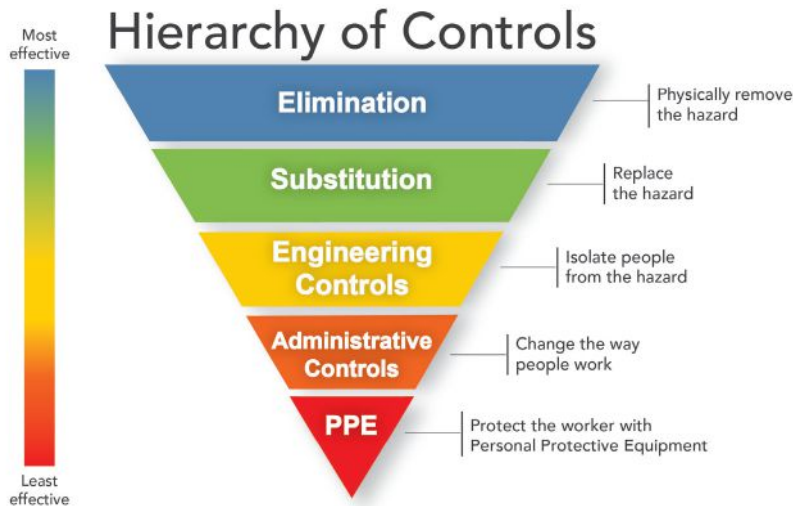
We've learned some valuable lessons this year: Jobsite hygiene is no laughing matter; airborne contaminants can be breathed out as well as in; an effective respiratory protection plan cannot solely depend on a filter over the face; and, perhaps most important, for people with compromised respiratory systems, some viruses can be lethal.

"This is the year of the lung, so to speak," says Michelle Kelly, spokesperson for Oneida Air Systems, a manufacturer of dust control systems for jobsites and woodworking shops. "Hopefully, people will be more aware of how much damage breathing in airborne hazards such as silica, and even sawdust, can do over the long haul."

CLEAR THE AIR

According to the American Industrial Hygiene Association (AIHA), 15.2% of construction workers over the age of 50 suffer from some form of lung disease, a rate that's almost twice as high as that for white-collar workers. Another disturbing statistic comes from

Photos by Tom O'Brien



Much like the Food Guide Pyramid that it resembles, NIOSH’s Hierarchy of Hazard Controls ranks health and safety controls in order of decreasing effectiveness. Like red meat, PPE should be used sparingly and in small portions.

CDC-NIOSH health communication specialist Nura Sadeghpour: “53,000 workers die annually from occupational diseases, almost 10 times the number who are killed by traumatic injuries.”

Airborne respiratory hazards are categorized as dusts, mists, fumes, gases, or vapors. The first three are particles—dusts are solid particles, mists and fumes are the liquid variety. All of these can be captured with particulate filters (HEPA being the most efficient option). Gases or vapors in the air require filtering elements tailored specifically to the nature of the contaminant. But no law says that those filters have to go on the face.

This year, every human being knows what it’s like to wear a face mask, if not a respirator, for an extended period of time: It’s uncomfortable, inefficient, and potentially harmful, especially when you’re doing strenuous labor in a dusty environment.

When employers make plans to address airborne health hazards, the U.S. Occupational Safety and Health Administration (OSHA) leaves no doubt in its Air Contaminants Standard [1910.1000(e)] that the respirator shall not be the first choice:

“To achieve compliance ... administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section.”

HIERARCHY OF CONTROLS

The National Institute for Occupational Safety and Health (NIOSH)—as well as AIHA, OSHA, and every other lettered organization that promotes health and safety—urges employers to

design their protection protocols using a rubric that ranks five categories of hazard control from most effective at risk reduction to least (see “The Hierarchy of Hazard Controls,” left).

Here are some examples of jobsite procedures that fit the categories in this hierarchy:

Elimination: Encapsulate asbestos or leaded paint instead of removing it.

Substitution: Remove paint using non-toxic liquid stripper.

Engineering Controls:

- Use wet saws and drills when cutting masonry products.
- Use shrouded power tools connected to HEPA vacs to capture dust at the source.
- Use air scrubbers to capture whatever gets away, and provide good separation between the work area and occupied areas of the building to ensure air between them does not mix.

Administrative Controls:

- Keep the jobsite clean.
- Set up the cutting station outside.
- Train all employees on proper procedures for dust control practices.
- Inspect and maintain equipment to prevent malfunctions that might allow contaminants to escape.
- Coordinate with subcontractors to minimize demolition and do all of it at the same time.
- Schedule hazardous work practices for times when no other workers are present.

Personal Protection Equipment: Use respirators (specifically “filtering facepiece respirators,” as we shall describe in detail below).

Generally speaking, PPE is the least effective means of providing health and safety protections, because it does not eliminate the hazard and leaves the wearer exposed to it if the equipment is damaged or poorly maintained.

That’s not to say that all forms of PPE should be done away with. “Eye and hand protection can never be minimized,” says Ken Tucker, director of the Connecticut Department of Labor Division of Occupational Safety and Health (CONN-OSHA), “but we try to avoid the need for respirators as much as possible.”

Rob Robillard, owner of A Concord Carpenter, follows an all-of-the-above approach to keeping the air clean. “We’re using air scrubbers when it makes sense, we’re using ZipWalls when it makes sense, we’re collecting dust at the source, and we’re vacuuming with HEPA vacs, sometimes multiple times a day, to keep the dust down.”



Manufacturers have a burgeoning array of attachments that enable workers to work safely at almost every dirty job (even paint-scraping). Shown above (clockwise, from upper left): Festool Drilling Dust Nozzle D 27-BSD, Oneida Air Systems Viper Vacuum Scraper, Oneida Air Systems Dust-Free Router Hood, Bosch HDC200 Universal Dust Collection Attachment.

LEAD PAINT AND SILICA RULES PAVE THE WAY

Not long ago, dust extraction was a two-person job: One would operate the saw, drill, or whatever, and the other would hold a vacuum hose close enough to the cutter to suck up the dust. By the mid-1990s, innovations such as tool-operated vacs and dust shrouds were catching on. But it took the government to goose the market.

Demand for dust controls got a kick in the pants in 2008 when EPA's Renovation, Repair and Painting (RRP) regulations went into effect, and a shot in the arm in 2017 when OSHA instituted the Respirable Crystalline Silica Standard (1926.1153). Although plenty of contractors grumbled about the onerousness of these rules, the swelling demand for dust-control solutions spurred toolmakers to flood the market with innovative methods to capture dust at the source and filter the breathable air. Highlights include:

- Almost all power tools are factory-equipped for dust collection.
- Third-party manufacturers such as Oneida Air Systems (oneida-air.com) and Dustless Tools (dustlesstools.com) have come out with dust-capturing hand tools, as well as shrouds that enable older power tools to work dust-free.
- Reasonably priced tool-operated HEPA vacs are commonplace (some feature Bluetooth capability for pairing with cordless tools).
- Cyclonic dust collectors (staples in woodworking shops) have arrived on the jobsite, both in the form of standalone units, and as pre-sorters for HEPA vacs—to separate out the larger dust particles so they don't clog the filter.
- Air scrubbers (aka "negative air machines") have gotten more portable and more affordable.

TABLE 1 FROM THE OSHA SILICA STANDARD

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
Hand-held power saws (any blade diameter)	Use saw equipped with integrated water-delivery system that continuously feeds water to the blade.		
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		
	When used outdoors:	None	APF 10
	When used indoors or in an enclosed area:	APF 10	APF 10

In this example, if a worker uses a saw outdoors for four hours or less per day, no respirator would be needed. If a worker uses a saw for more than four hours per day or any time indoors, he or she would need to use a respirator with an assigned protection factor (APF) of at least 10. A NIOSH-certified filtering facepiece respirator would provide this.

PERMISSIBLE EXPOSURE LIMITS

The aim of engineering controls such as these is to keep airborne contaminants out of a worker's "breathing zone" (within 10 inches of a worker's face). Unless the concentration of respirable hazards exceeds the Permissible Exposure Limit (PEL), respiratory protection is not required. PEL is expressed in terms of micrograms (µg) of airborne contaminant per cubic meter (m³) of breathable air over the duration of an eight-hour workday. Prior to 2017, the PEL for quartz, cristobalite, or tridymite (the three most common forms of crystalline silica) was 250 µg/m³. OSHA's silica rule slashed it to 50 µg/m³.

In years past, employers were on their own when they used the Hierarchy of Controls to design safety protocols that protected workers without forcing them to suit up like HazMat teams; they had to come up with their own dust-containment plan and be prepared to provide evidence—such as air-sampling testing data—to prove its effectiveness. That's not the case with the silica rule.

"It's a massive step forward. One of the best things that OSHA could have done to help the employer comply with a mandate," says Ken Tucker of CONN-OSHA. What he's specifically referring to is



Cyclonic dust extractors can suck up large volumes of dust without clogging filters. Large stationary units are common in woodworking shops, but there are several portable types available now, as well. At left is an “add-on” version, which requires you to use your own vacuum; at right is an all-in-one unit.

Table 1, a chart that zeros in on 18 common work practices that involve silica and specifies procedures to be followed and what (if any) PPE is required for the task (see sample, previous page; for the complete Table 1, search online for “OSHA Table 1 silica”). Employers who adhere to the general mandates of the silica rule and follow the methods prescribed in Table 1 have no further obligation to prove the effectiveness of their silica safety plans. “If you follow the script, use the wet methods, use the dust collection systems, or whatever it may be, there’s no need for air monitoring,” says Tucker.

OSHA IS NOT YOUR FRENEMY

Although the silica standard applies to only one type of hazardous dust, the practices and controls specified in Table 1 attest to the effectiveness of capturing dust at the source. For proof, look at the number of situations where respiratory protection is not mandated. For instance, if a contracting firm upgraded its arsenal of dust collection devices and reconfigured its safety protocols to align with the Hierarchy of Controls, how would it determine under what situations respiratory PPE might still be needed?

The quantitative solution is to hire an industrial hygienist, or other specialist, to test the concentration of hazardous particles in a worker’s breathing zone as they’re performing potentially haz-

ardous tasks. Air monitoring of this type is relatively easy to do in a shop or a factory, but significantly more complicated when the environment changes from job to job.

For budget reasons, home builders and remodelers might be better advised to seek a qualitative solution to the question. If they can get over their (understandable) hesitation to invite an OSHA representative onto their jobsite, help is just a phone call away.

The On-Site Consultation Program ([osha.gov/consultation](https://www.osha.gov/consultation)) is designed to provide advice, consulting services, and training (all free of charge) to small businesses that do hazardous work. Although it’s federally funded, this program is administered at the state level. Consultants who visit jobsites are not empowered to issue citations or report safety violations.

“We don’t share any information with the Feds,” says Ken Tucker, who oversees Connecticut’s On-Site Consultation Program. “We go out at an employer’s request, and limit our investigation to what’s asked of us. After evaluating the work practices and exposures, we write up a report that goes to the employer and no one else. It’s 100% anonymous.”

Air sampling is among the free services offered by the consultation program, but Tucker has rarely seen the need for it on residential construction sites. “Monitoring may be done, but we try to look



“Air scrubbers” are designed to sit in the middle of a work area and pull air through a cyclonic extractor (as in the Vortex Duct One unit, at left) or through HEPA filters (as in the Pullman-Ermator A1000, above). When the exhaust is ducted outdoors, an air scrubber can create negative pressure in the work area that can help keep contaminants out of other areas in a building.

at what we can do to use engineering controls and administrative controls to reduce exposures,” he says.

RESPIRATORS 101

A well-thought-out safety protocol should reduce the need for wearable respiratory protection to a handful of dirty jobs—demolition, insulation, paint preparation, and spray painting, for example—wherein airborne contaminants are not easily contained. When respiratory protection is mandatory, it’s because the concentration of airborne contaminants swirling around a worker’s face constitutes a serious health threat. Choosing proper protective devices cannot be taken lightly.

There is no such thing as a dust mask. Every NIOSH-approved wearable device that filters the air is a respirator, whether it’s disposable or reusable. The technical term for a disposable one is “filtering facepiece respirator” (FFR); that means that the entire mask, apart from the straps, is a filter, and, just like a cartridge filter, when it has outlived its usefulness, it must be discarded.

Reusable respirators fall into two categories: air purifying and air supplying. Air-purifying reusable respirators function the same as FFRs, except that they rely on replaceable cartridges for filtration; they’re also more versatile because they can be fitted with

a variety of filter cartridges to protect the wearer from different categories of airborne contaminants. Air-supplying respirators rely on fresh air being pumped into the mask, like a scuba diving set-up. These devices are expensive and are rarely seen in residential construction.

In order to choose the proper air-purifying respirator for a particular job, you may need three pieces of information:

1. Assigned protection factor (APF).
2. Nomenclature (for FFRs).
3. Nature of airborne contaminant.

APF refers to the level of protection. An APF of 10 means that the respirator (if properly fitted) can safely be worn in an environment where the airborne contamination is as much as 10 times the PEL. NIOSH-approved FFRs and reusable half-mask respirators both have an APF of 10. A full-face reusable respirator (the kind that looks like a gas mask) can achieve an APF of 50. Although APFs range as high as 10,000, anything over 50 requires battery power or supplied air.

FFRs are only suitable to filter particles (dusts, mists, or fumes). They are classified by a letter, which refers to oil-resistance, followed by a number, which designates filtration capability. The N95 that we hear so much about these days is not oil-proof, and is designed to filter 95% of airborne particulates. An R95 is oil-resistant; a P95 is oil-proof. An N, R, or P100 can filter 99.7% of particulates and qualifies as HEPA.

Contaminants other than particulates require a reusable respirator with replaceable cartridge filters, which are color-coded by the hazard they protect against (see table on next page, bottom left).



A NIOSH-approved disposable filtering facepiece respirator (FFR), such as an N95 (above left) or N100 (above right) can be used for protecting workers from particulates, but not vapors and gases. These models have double head straps, which provide a better seal than the ear loops found on KN95s.



A reusable half-mask respirator (above) with the right color-coded filter (below) can protect workers from particles as well as hazardous vapors or gases.

Filter Color	Hazard
Magenta	Particulates (HEPA)
Black	Organic vapor
White	Acid gas
Green	Ammonia and methylamine
Yellow	Organic vapor and acid gas

FITTING

Everyone who needs a respirator on the job must be cleared by a doctor and fit-tested annually to ensure that the mask seals tightly to the face. FFRs are one-size-fits-all, but reusables are manufactured in small, medium, and large. Beards are not permissible unless the facial hair is entirely within the seal. For more information about an employer's responsibilities under OSHA's Respiratory Protection Standard, search online for "OSHA 29 CFR 1910.134."

MAINTENANCE

As they fill up with debris, particulate filters become more effective, but less comfortable; a good rule of thumb is to replace a particulate filter when you notice an increase in breathing difficulty. Gas and vapor filters are more problematic, because they soak up contaminants like a sponge but lose their effectiveness when saturated. The only way that workers can become aware that one of these filters needs to be changed is if they smell the contaminant, but by that time they've already been exposed. To make sure that never happens, contractors can set up a cartridge change schedule, based on the nature of the contaminant, airborne concentration, and duration of exposure. Fortunately, there's an app for that: Visit the NIOSH website (cdc.gov/niosh), and enter "multivapor" in the search box.

After you have worn a respirator for hours in a sweaty, dusty environment, you will have created a Petri dish. To prevent lung infections or facial dermatitis, a reusable respirator must be cleaned at the end of every workday. Best practice is to take it apart and thoroughly scrub it with soap and water. Second best is to use wet wipes that are specifically designed to clean respirators without damaging the silicon.

COVID-19 CONCERNS

Almost a full year has elapsed since bells first rang out in warning about a previously unknown, highly contagious respiratory virus, yet severe shortages of vital PPE such as NIOSH-approved N95s persist to this day. One bright spot (perhaps) is that countries that have successfully contained the pandemic are shipping their surplus FFRs to us. Shelves in supply houses that once held N95s are now filling up with KN95s. What's the difference? Besides cost (demand has driven up costs of FFRs), the short answer is that a KN95 respirator is the Chinese equivalent of an N95. The filtering element is equally effective, but one area of concern is that most KN95s have ear loops, rather than adjustable head straps, which make achieving a tight fit to the face more difficult. For more information about which makes of imported PPE might be safe to use, visit the NIOSH website (cdc.gov/niosh).

Until medical professionals and first responders are stocked up, builders would do well to focus their safety plan on the Hierarchy of Controls and lessen their reliance on PPE. With proper planning and diligence, it's conceivable that the only place a construction worker might be required to strap on a face mask is at the grocery store.

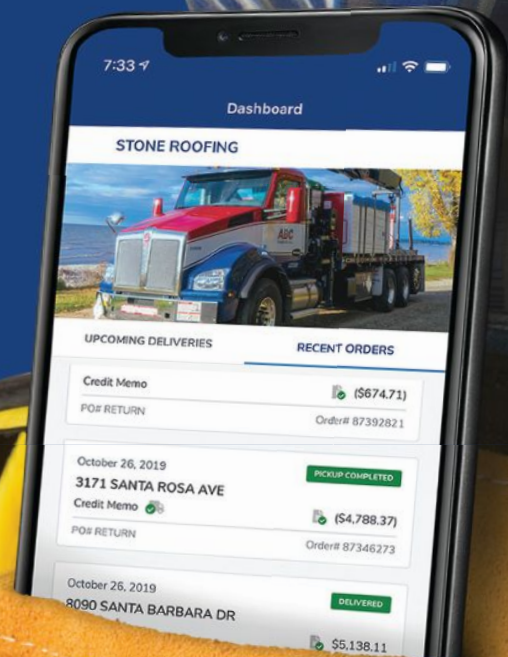
Tom O'Brien is a freelance writer and carpenter in New Milford, Conn.

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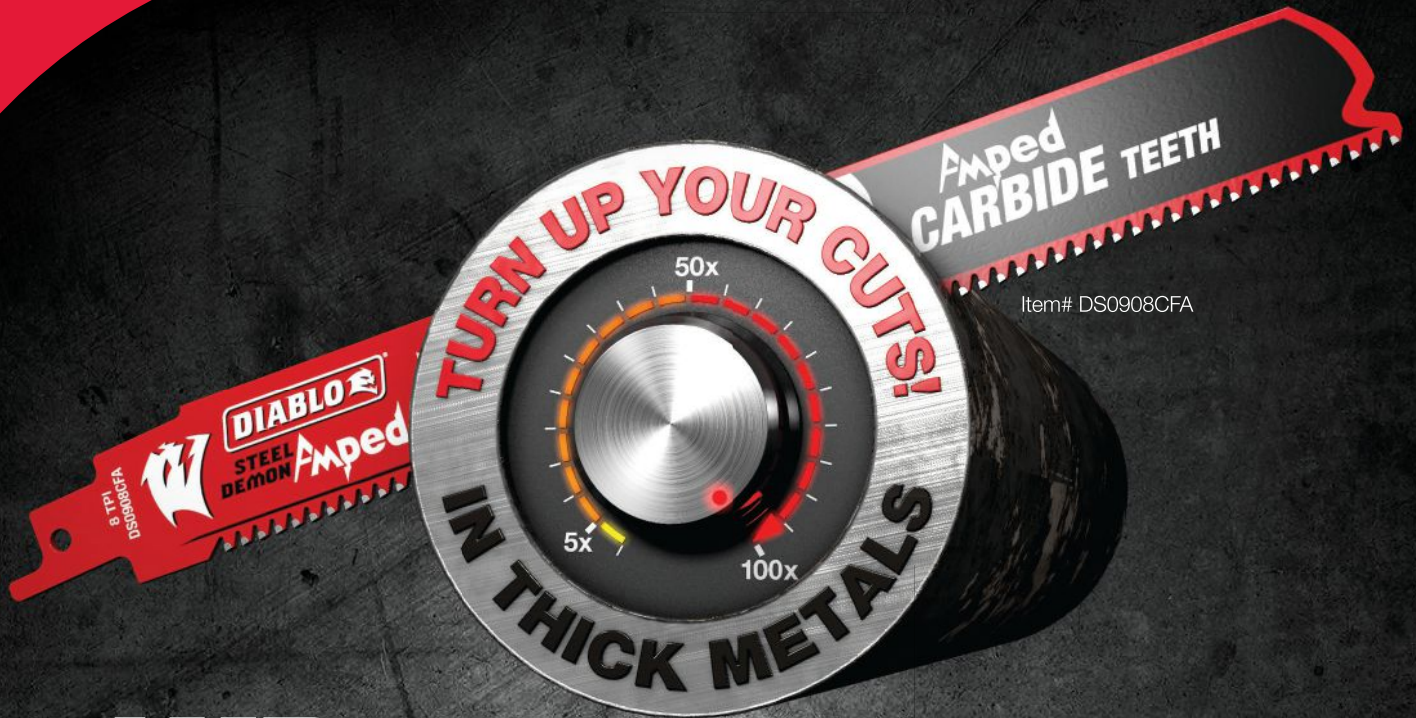
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ROOFING



A Versatile Fluid-Applied Roofing Solution Acrylabs is a paint-like coating that can solve tricky flashing details

BY KYLE DIAMOND

Most of the time, we sub out the roof work on our projects, but not always. Occasionally—because of scheduling issues or some unique aspect of the job—we tackle the roofing ourselves. That was the case for a renovation project we recently completed, which included two 15-square, low-slope roofs with planned solar arrays. Because of the numerous roof-to-deck anchors needed to support the PV panel stanchions, we decided to install Acrylabs, a seamless, fluid-applied acrylic elastomeric roof system, rather than an EPDM or other single-ply membrane.

Acrylabs is a versatile product that we've successfully used over the past 15 years or so on all types of jobs, from large roofs like the one in the photo above to small deck-over-living-space projects. To fix

leaks, we've also applied it as a re-roof material over a number of different types of roofing. The system is easy to install, doesn't require respirators or other special equipment, and doesn't require a big investment in tools: basically, just a roller, paintbrushes, and a good pair of scissors to cut the reinforcing fabric that gets embedded in the elastomeric coating. Some contractors spray-apply the material for a smoother appearance, but we haven't invested in that equipment.

Our cost for materials is about \$2.50 to \$3 per square foot with shipping; for estimates, pricing with materials can range anywhere from \$5 to \$15 per square foot, depending on the size of the roof and whether it's a new roof or a roof-over.

In this article, I'll lay out how we install the system, with a focus

A VERSATILE FLUID-APPLIED ROOFING SOLUTION



Instead of sealing the sheathing joints on this small upper-story deck with Zip tape, which would telegraph through the Acrylabs coating, workers troweled on a smooth layer of Sikaflex sealant (1). Before applying the Acrylabs tack coat, the reinforcing fabric was carefully cut to fit (2), then rolled up for later application. The coating can be applied by brush (3, 4) or “squeegee-style” with a 1/2-inch nap slit foam roller (5).

on three different types of projects: a small rooftop deck with some tricky flashing details; the large roof referred to above, with the solar array; and an aging flat-seam metal roof with a built-in gutter.

WATERPROOF DECK OVER LIVING SPACE

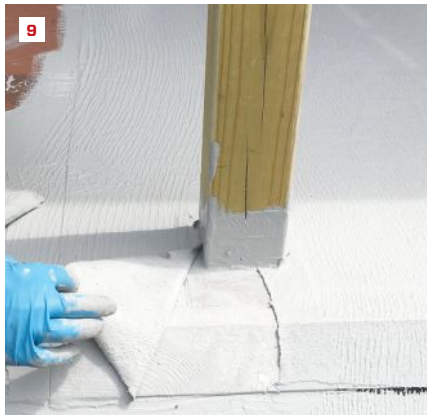
A few years ago, we remediated a walkout deck that served as a fire egress for a third-floor apartment. Because of some faulty flashing details, water had been leaking into the apartment and the living space below, both through the door opening and around the perimeter of the small roof deck, following severe weather events. Wind was driving rain up behind the siding and into the wall and floor framing, so we needed to repair the deck and reflash the deck-to-wall joint to stop the leaks. The project also included a new railing system with new posts.

We started by removing the old railing, siding, and roof deck down to the framing. Then we installed new 4x4 pressure treated posts and 5/8-inch Zip System floor sheathing. Normally, we would

apply Zip tape to weatherproof the joints in the sheathing, but we’ve found that taped joints telegraph through the Acrylabs coating, which also sometimes causes the tape adhesive to bubble. Instead, we troweled Sikaflex sealant into the joints and nail holes, taking care to smooth out the sealant.

Next, we cut and folded custom aluminum flashing to fit around the deck perimeter, up into the door opening, and out over the edge of the deck. It’s a kind of belt-and-suspenders approach, with the flashing providing a smooth and durable substrate for the Acrylabs waterproofing layer that will cover it.

Reinforcing fabric. Mesh 2000 stitchbonded reinforcing fabric comes in various widths up to 40 inches. We use narrow widths to flash joints and seams, and wider widths to cover larger areas. On a small roof like this with a lot of corners and edges, we use full-width fabric but cut the corners to fit prior to applying the elastomeric coating. It’s not critical that the corners are perfectly cut to form “pig ear”-type folded inside corners, because the fabric only



The fabric is embedded in the tack coat smooth side up; workers used the red line woven into the fabric to note where the upturned leg of the fabric at the wall should be (6). After the fabric has been carefully worked into the tack coat to smooth it out and remove air bubbles (7), the saturation coat is roller-applied (8). Workers cut the field fabric around the posts (which had already been flashed with copper) (9), then wrapped the upturned legs of the fabric with another narrower strip of fabric, which was pre-cut at 3 1/2-inch intervals so that the legs would extend out over the field fabric (10). Additional base coat material was then brushed over the post flashing (11). Later, excess Acrylabs can be sanded smooth prior to painting.

reinforces the coating; instead, the goal is to make sure each corner is smooth and fully reinforced with embedded fabric.

The fabric has a smooth side and a fuzzy side; we orient the fabric with the smooth side up, and so that it will lap up over the aluminum corner flashing by at least 2 inches. At the door, we left plenty of material to completely cover the threshold. At the edge of the deck where the aluminum flashing extends out over the asphalt shingles, we let the fabric run long and slipped some felt paper under the flashing to protect the shingles from the coating.

Base coat. The only difference between the Acrylabs 2100B base coat and 2100 finish coat is that the finish coating contains a mildewcide (both have UV inhibitors); you can use finish coat as the base material, but you can't use base material as the finish coat. The base material is applied in two coats, for total coverage of about 2 1/2 gallons per 100 square feet.

We start by pouring some material onto the roof, then use a 4-inch brush to spread a fairly thick tack coat around the perimeter over the flashing, into corners, and around posts. To apply the material to bigger areas, we switch to a 9-inch roller fitted with a Foam Pro slit foam roller cover, which leaves just enough coating thickness without creating puddles of material that take much longer to dry.

Because embedding fabric with pre-cut corners in the tack coat can be a little tricky, we stopped applying base coat at the edge of the deck when the layer was about 16 inches wide. Then we carefully rolled out the fabric, using our hands to push the cuts and folds into the edges and corners. It's a good idea to wear latex gloves to protect your hands while doing this, but when we don't expect quite as much close contact with the coating, we simply use lots of suntan lotion on our hands, which makes cleanup afterwards much easier.

After embedding the edges, we rolled the remaining fabric back

A VERSATILE FLUID-APPLIED ROOFING SOLUTION



To dry-in the large solar roof project, workers applied base coat and fabric to the Zip System sheathing seams (12). Zip tape was used to seal a roof-to-wall intersection (13). After spreading out the tack coat with a roller (14), workers bedded fabric in the coating (15), then applied the saturation coat (16), taking care to smooth out wrinkles in the fabric (17) as they squeezeed the coating to the desired 25-mil thickness.

and finished applying the tack coat. Then we finished embedding the first fabric layer into the tack coat, making sure that there was plenty of coating material between each fabric layer at the folds. Sometimes leaves or insects land in the coating, so we take care to remove those as we go; any bump or wrinkle in the fabric and initial coating layer will show up in the finished surface.

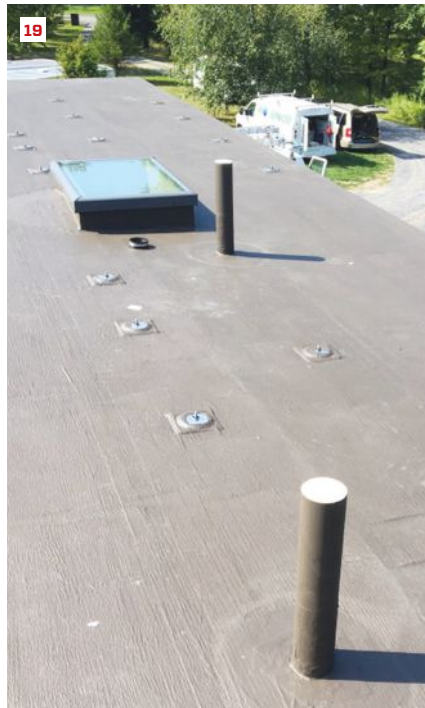
Next, we apply the saturation coating. This has to be done while the tack coat is still wet, so on a big job it's important to have enough workers to maintain a wet edge during the process. At the corners and edges where there are small flaps of fabric, working with a very wet brush will help to avoid pulling the fabric away from the tack coat. We use both the brush and our hands to press the fabric into the corners to ensure there are no voids or air bubbles. Then, we roll out the rest of the saturation coating so that the total thickness of the base coat is consistent—about 25 mils—and smooth, keeping in mind that the surface appearance of the coating after this step will be reflected in the appearance of the final finish. On subsequent courses, we overlap the fabric by 3 inches.

Posts and other roof penetrations. When we installed the PT

railing posts, we flashed them with reglet cut copper, which was covered by the base coat and reinforcing fabric. We also lapped the base coat up a few inches on all four sides of each post, and then embedded a piece of fabric that wrapped all the way around the post and was pre-cut at 3 1/2-inch intervals so that it extended an inch or so out over the roof deck. Each layer of fabric was embedded in the coating material.

Finish coats. Depending on the temperature, humidity, and sun exposure, it can take up to eight hours or more before the base coat is dry enough to apply the first finish coat. We apply two finish coats, with the drying time between these coats typically much shorter, usually one to two hours. Each coat uses about 1 1/4 gallons per 100 square feet. After we're done, the total dry film thickness of the system should be about 45 mils.

One strong selling point of this system is the large number of colors—at least 24—that the material is available in. The finish coats can be roughed up with sand broadcast by hand between coats to give the surface more traction. In addition, for frequently used rooftop decks that see a lot of foot traffic, a high-strength (2100 HT) finish coating material is available.



Installing the fabric in weatherboard fashion is not critical. On this large roof, workers started the base-coat application in the center and worked toward the eaves in sections (18), allowing each section to dry before applying the adjacent one and lapping the fabric by 3 inches. Solar mounts and other roof penetrations are easily flashed and integrated into the Acrylabs base coat with additional fabric and coating material prior to application of the two colored finish coats (19). Where drip edge was required, workers plowed a shallow 3-inch-wide dado in the sheathing with a power planer to avoid creating a “speed bump” of material that could cause ponding along the edge of the low-slope roof; shown here are the eaves of one of the home’s small mansard roofs (20). New copper counterflashing was let in to an existing brick chimney, which was then flashed with Acrylabs (21).

BIG LOW-SLOPE SOLAR ROOF

Technically a hip roof, the 30-square roof (an upper and lower roof, each measuring about 15 squares) that we recently completed for a renovation project demonstrates how versatile the Acrylabs system is. As on the smaller roof deck, we used 5/8-inch Zip System panels to sheathe the roof, but instead of using tape or sealant on the joints, we used narrow strips of Acrylabs reinforcing fabric embedded in base-coat material. That way, we were able to quickly dry in the roof while we waited on delivery of the solar panels and their supporting hardware. We also had to wait for a stretch of good weather.

Weather window. One of the main limitations of the Acrylabs system is that installation requires dry, seasonable weather both prior to installation and afterwards. It can’t be installed over a wet surface, so even morning dew is problematic. And if it rains while the coating is wet, the coating will wash away, though the product becomes “rain ready” after a few hours, with the outer layer skinning up. If it’s hot and sunny, the coating may dry too quickly, while it dries extremely slowly in cool, humid conditions. We won’t install it when temperatures dip below 40°F or when a freeze is expected

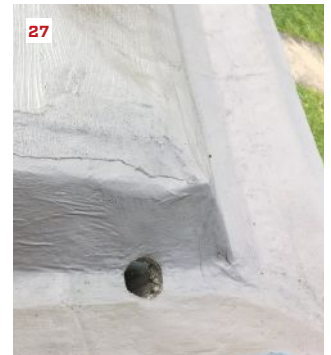
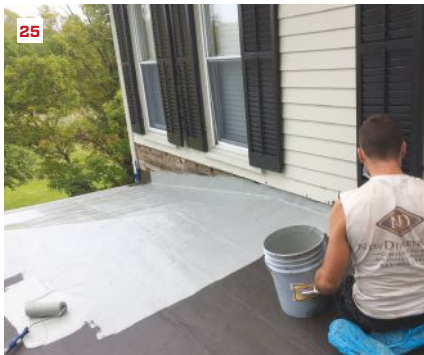
within 24 hours. Wind, too, can be a problem, as it can blow leaves and other debris into the wet surface.

While a small roof can be installed by one or two workers, a large roof requires a crew of four or five, especially on a warm, sunny day, when the material dries quickly. To spread the coats rapidly, we use double-headed roller cages that accept two 9-inch-wide roller covers, and fit them with long, heavy-duty extensions. To make sure that the tack and saturation coats don’t dry prematurely while we embed the fabric, we set up our workers so that each is performing a dedicated function, like taking care of the coating bucket, rolling out the fabric, or using a roller to spread the material.

Solar mounts. After allowing the base coat to cure, we worked with the solar sub to lay out the locations for the 160 EcoFasten Solar SimpleGrip-SQ mounts. After the sub mounted the base plates to the roof deck, we flashed the compression plates that fit over them to the base coat with additional 12-inch squares of fabric, each with a hole cut out of the middle, and additional coating material.

Drip edge. On low-slope roofs, we’ve found that water tends to pond along the edge of the roof where the Acrylabs coating laps over

A VERSATILE FLUID-APPLIED ROOFING SOLUTION



To repair an existing flat-seam metal roof with a built-in gutter (22), workers first power-washed the roof and scraped it clean. Starting with the L-flashing at the wall (23), workers applied the base coat (leftover colored finish coat from another project) reinforced with fabric. The fabric reinforcement was used with the base coat over the entire roof, including the built-in gutters (24). Here, a worker is applying the first of two silver-colored finish coats (25). After completing the finish coats (26), workers cut out the hole for the gutter's downspout, flashing the cut edge with additional fabric and coating material to avoid delamination of the membrane (27).

the drip edge. To provide a smooth transition from the roof membrane over the drip edge that allows water to drain off the roofing material unimpeded, we use a power planer to rout a 3-inch-wide by 1/8-inch-deep dado along the edge of the sheathing to receive the drip edge.

Finally, once we finished flashing the roof vents, skylights, and other roof penetrations with Acrylabs, we came back and applied two finish coats.

ACRYLABS OVER AN EXISTING ROOF

We've recoated a number of different types of roofing materials with Acrylabs, including both flat- and standing-seam metal roofs, BUR asphalt roofs, and EPDM. Recently, for example, we used Acrylabs to fix a troublesome flat-seam terne metal roof with built-in gutters. While the material tenaciously adheres to almost anything (I still have some on a belt that I wore for a project seven years ago), thorough prep work of the existing roofing is the key to success.

On a metal roof, the process starts with pressure-washing the roofing, followed by scraping to remove patches and other repairs. The idea is to make the final project visually pleasing, keeping in

mind that surface irregularities will telegraph through the Acrylabs.

Once the existing roofing was prepped, we applied the base coat, following the same protocol as on other projects (tack coat, reinforcing fabric, and saturation coat). On sloped standing-seam roofs, it isn't necessary to use the reinforcing fabric when applying the base coat. In this case, the base coat is finish coat left over from another project, which explains the dark bronze color in the photos above.

This roof had an integrated gutter, which is one of the reasons why Acrylabs was such a good choice for the repair. The material conforms to complex shapes and is self-flashing, so we simply coated over the downspout opening for the gutter when we applied the base coat and cut it out later after the base coat had dried. Then, to cover the cut edges that could lead to delamination of the roof over time, we flashed around the drain opening with additional reinforcing fabric and coating. Finally, we applied two colored finish coats to complete the repair.

Kyle Diamond co-owns New Dimension Construction, in Millbrook, N.Y., with his father, Dale Diamond.

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JLC
FIELD GUIDE

BY VINCENT SALANDRO



1. Stone-Look Luxury Vinyl Tile

Tarkett has introduced nine stone-inspired designs to its ProGen rigid-core luxury vinyl tile (LVT) collection. The manufacturer says that ProGen flooring is dimensionally stable and that it resists indentations from drops, high heels, and furniture. An acoustical backing absorbs sound, helping the flooring earn its IIC rating of 60. The 12-by-24-inch tiles, which can be cut with a utility knife, click together for easy installation. Pricing ranges from \$5.50 to \$6.50 per square foot, depending on location. tarkett.com



2. Economical Composite Decking

Deckorators Trailhead decking is an economical wood-plastic composite product offering a 25-year structural, 25-year stain-and-fade, and 25-year removal-and-replacement limited warranty. The 7/8-by-5-inch boards are available in 12-, 16-, and 20-foot solid and grooved-edge profiles. According to Deckorators, the decking has a highly compressed core and a durable and scratch-resistant polyethylene cap, and it can be installed on 16-inch-on-center joist spans. Trailhead is expected to retail in the low \$2-per-lineal-foot range and will be available in early January 2021. deckorators.com



3. Energy-Efficient Dryer Exhaust Duct Ventilator

Fantech's DEDPV-705 dryer exhaust duct power ventilator is designed to provide safe laundry exhaust, reduce drying time, and save energy. The manufacturer claims that the UL-listed fan maintains exhaust velocity ideal for keeping lint entrained in the flow of air to minimize the risk of fires due to lint buildup. The ventilator continues to operate briefly after the dryer stops, cooling clothes and removing humid air. A panel informs users of problems such as a locked rotor or duct blockage. The DEDPV-705 costs \$450. fantech.net



4. FlexTemp Acrylic Paint

FlexTemp Exterior Acrylic Paint from Sherwin-Williams can be applied in temperatures from 35°F to 120°F, providing professionals a longer painting season and helping prevent schedule delays caused by unexpectedly high or low temperatures. The 100% acrylic paint is available in flat, satin, and gloss sheens and can be tinted in VinylSafe paint colors. One gallon of FlexTemp is \$75.50. www.sherwin-williams.com

Products

5. Stone Wool Insulation

Rockwool has added R-13, R-21, and R-38 batts to its Comfortbatt line, and introduced dimensions for wood-stud applications to its AFB (acoustical fire batt) line, previously sized only for steel-stud applications. Comfortbatt is a semi-rigid stone-wool batt insulation for exterior wood- and steel-stud walls, ceilings, and floors that features a flexible edge designed to expand the batt to completely fill a stud cavity. AFB is a lightweight stone-wool insulation for interior walls, ceilings, and floors that the maker says provides greater sound reduction and fire protection than Comfortbatt. Both products are non-combustible and resist temperatures up to 2,150°F. Contact local distributors for pricing. rockwool.com

6. Stainless Steel Pulldown Faucet

Made with 316 marine-grade stainless steel to resist rust, pitting, corrosion, and staining, Waterstone's Contemporary Positive Lock Pulldown (PLP) Faucet is suitable for both indoor and outdoor kitchen applications, according to the manufacturer. The faucet is offered in standard, extended, or prep sizes. Pricing for the PLP starts at \$3,000. waterstoneco.com

7. Residential Hot Water Boiler

Weil-McLain's Eco Tec high-efficiency boiler is available in combi versions with response time and domestic hot water output designed for residential replacement applications. The boiler, which features a long-lasting firetube heat exchanger, is easy to install, use, and service, the manufacturer claims, and operates quietly, with a 95% AFUE rating. The combi versions are available in 110, 150, and 199 MBH with hot water output up to 5.4 gallons per minute. The product includes built-in zone control and connects up to four thermostat inputs. Pricing varies by distributor. weil-mclain.com

8. Deflector Screw Fasteners

Strong-Drive SDPW Deflector screws from Simpson Strong-Tie are designed to connect nonbearing, full-height partition wall top plates to trusses or joists. Simpson says the fasteners help provide lateral resistance and allow walls to deflect with the truss or joist, while the screw's polymer sleeve helps eliminate squeaks from metal-on-metal connections. The screws, available in 3 1/2-, 5-, and 6-inch lengths, allow contractors to manage up to a 1 1/2-inch gap between the top plate assembly and the joist or truss. Contact a local distributor for pricing. strongtie.com





9

9. DCS Grill Attachments

DCS launched new attachments for its built-in and freestanding outdoor kitchens. The Power Burner provides precise temperature control ranging from 70,000 to 1,300 Btu, and features a cast brass burner, two illuminated dials, and grates designed to provide stability for pots. The Grid-dle attachment offers a large surface area with precise temperature control, two independent temperature zones, and even heat distribution, according to DCS. Contact local distributors for pricing. dcsappliances.com



10

10. No-Weld Aluminum Railing

Superior Aluminum Products' Series 9000 aluminum railing features a no-weld design with simple, cast aluminum fittings for no-hassle installation, and has machined post openings that eliminate the need for brackets, according to the manufacturer. A screw cover conceals picket screws on the top and bottom rails. The railing is available in any height and is built custom to project requirements. Superior Aluminum says the railing is maintenance-free and meets OSHA, ADA, and ICC safety criteria. Pricing varies by region. superioraluminum.com



11

11. Mono-Finish Lavatory Faucets

Sonoma Forge expanded the finish options for its Strap lavatory collection of deck-mount and wall-mount widespread lavatory faucets and tub fillers to include five solid finishes in addition to two split finishes. The manufacturer says the mono finishes have a softer look while the split finishes provide a more robust aesthetic. The spouts can be adapted to become hands-free sensor faucets. Pricing for mono finishes starts at \$975 for the deck-mounted faucet and \$1,350 for the wall-mounted faucet. sonomaforge.com



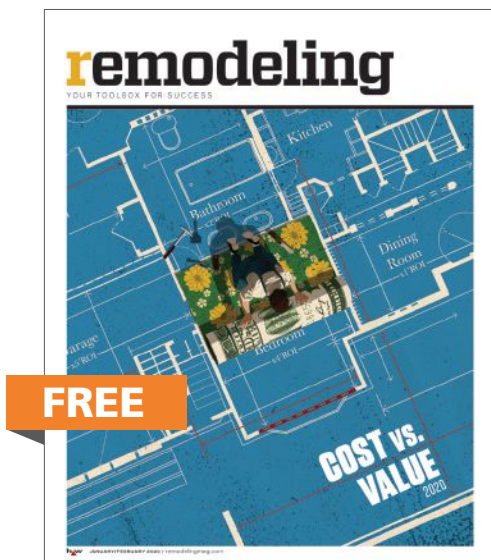
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12. Acoustical Underlayment System

Laticrete's high-performance acoustical underlayment system, the 170.5 Sound & Crack Isolation Mat, muffles noises through hard surfacing materials. The 5mm-thick, rubberized membrane, comprised of 88.5% post-consumer recycled materials, helps prevent substrate cracks of up to 1/8 inch from transferring to the finished floor, according to Laticrete. For interior use only, the Greenguard-certified underlayment applies quickly and easily to concrete, mortar beds, exterior glue plywood, cement backer board, cement terrazzo, cement tile, and stone, the manufacturer claims. Contact local distributors for pricing. laticrete.com

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TOOLS OF THE TRADE

Cordless Coil Roofing Nailer

BY TONY BLUE

Every roofer worth their weight in scrap copper will tell you how many square of asphalt shingles he or she can put down in a day. Just like that fish caught when no one was looking, the size gets bigger every year. With that said, I recently put down 10 square (30 bundles) of architectural shingles on a 90°F day, and I did it cordless, because I had my hands on DeWalt's new 20V Max 15-degree coil roofing nailer.

If DeWalt had a specific job in mind when it designed this tool, I think this was the one: A boat house on beautiful Lake George in upstate New York's Adirondack Park. Who wants to lug a compressor and hoses down through the woods and over boulders to shingle a 1,000-square-foot roof over the water? Not this guy. So away I went: Step out of the truck, grab the DeWalt bag, head down the trail, climb up on the roof, hold down the trigger, and bump fire four nails into each shingle. Pop-pop-pop---pop. It did the job, and I would never want to do a boathouse again without it.

After about four hours of shingling, I switched from 1¹/₄-inch coil nails to 1³/₄-inch nails for the ridge caps. Again, it performed well. Had I used my trusty old pneumatic Hitachi nailer, I would have shaved about 30 minutes off my shingle install. But then I would have added more than that much time in loading the compressor at the shop, unloading at the job, setting it up, taking it down, and lugging it back to the shop.

The nailer came with a 2.0-Ah battery, which lasted through almost two square (six bundles) installed. With a larger, 5.0-Ah battery, I installed about five square. With the 2.0-Ah battery and

no nails, it weighs about 7.4 pounds (for comparison, my Hitachi pneumatic nailer weighs 6.2 pounds); the size and balance make it feel a little awkward in the hand.

The nailer was reliable in shooting and setting nails consistently. Over a span of four days, we shot approximately 7,000 nails, and I only had a problem with about 20 of them. I wasn't able to pinpoint the cause, but I believe it was due to a slightly bent nail coil that resisted a proper feed into the chamber.

With no hoses to trip over, no need for a compressor (or the power to run it), no gas to fill, no breakers being tripped in the house, this tool is a no-brainer for the average carpenter who may shoot on a couple of roofs a year. And while it won't replace a pneumatic gun for the full-time roofer, it will have a useful place for him almost every day for repairs, skylights, drip edge, nailing caps, shooting on a small roof, and other tasks. It does require a slight ramp-up period before firing the first nail, but that's a minor quibble.

Roofing is harsh on tools; in just four days of use, we had worn through a small portion of rubber buffer on the side, starting to expose the plastic underneath. Therefore, this nailer will need a little more TLC than an aluminum-body pneumatic nailer. Even so, I am ordering another one. It's about \$400 in a kit with a charger and 2.0-Ah battery; \$340 for the bare tool. dewalt.com

Tony Blue owns @SquaredAwayContracting in Greenwich, N.Y. He is a general contractor who enjoys nerdy energy efficiency and moisture management details.



With no hose and no compressor, the DeWalt DCN45RNB 20V Max 15-degree coil roofing nailer is a good choice for smaller jobs and repairs, or where power is unavailable (far left). It is powered by a brushless motor that requires no gas canisters, and it accepts ³/₄-inch to 1 ³/₄-inch-long fasteners.

Photos by Tony Blue

A Pair of Rebar Tying Guns

BY TIM UHLER

When our engineer makes site visits, he stresses how important it is to tie bar in a clean way, exactly per his specifications. But often, it's the lowest-paid guy who is tying the rebar (which is how I started), so I know from experience that it may not end up being the straightest or best job. A rebar tying gun makes it much easier to get it right. This past summer, we had a young guy working with us who had never been on a jobsite before, but with this tool, he could tie three times faster than I could on his second day of work.

I became familiar with rebar tying guns in 2012, when I reviewed the Max RB397. Work was slow then, but we had landed a foundation and framing job for another builder, so I asked to review the rebar tying gun because I thought it would help us out. I sent the gun back after a week (which was the stipulation from the rep) but never stopped pining for it, because I was right:



The Makita LXT rebar tier uses #3 wire and has a plastic cover to keep moisture and dirt out of the tying mechanism.

It had drastically lowered the number of hours we spent tying rebar. When the market rebounded a couple of years later, we decided to buy that Max gun. We self-perform foundation work, framing, siding, and some flatwork here at Pioneer Builders, and the rebar tying gun turned out to be a very good investment for our two-person crew, especially since we ended up building a series of steel-intensive foundations.

Max introduced a new version of the gun earlier this year, the RB441T TwinTier gun, which we had the opportunity to try out recently. We also have been using Makita's 18-volt rebar tying gun for more than a year, giving us a chance to compare the two guns.

MAKITA XRT01ZK 18V LXT

The Makita can make three ties in less than one second using #3 wire. You can tie two #5 bar or four #4 bar, so this gun is perfect for residential construction. There are two modes for tying: single or continuous. We leave it in single mode unless we are tying a mat of bar; then, in continuous mode, about as fast as you can step on, around, or



The Max TwinTier is about twice as fast as the Makita and has a larger jaw, allowing it to tie up to #7 x #7 rebar.

between bar, you can tie. The 18-volt tool has a handy belt clip and weighs less than 6 pounds with a 5.0-Ah battery.

If it gets damp at all (which happens often here in the Pacific Northwest), we make sure to blow out the gears. Taking this a step further, Makita uses a transparent cover over the wire wheel to protect it from the weather and dirt. The Makita gun has been good to us over the last year and a half (though at one point, it showed an error code, and I had to send it in to have it fixed). On Amazon, the gun costs \$2,000. makitatools.com

MAX RB441T TWINTIER

Max has been producing rebar tying guns since 1993, with the TwinTier being the latest iteration. I was blown away by how fast and compact this new gun was when I saw it at the International Builders' Show last year, and recently had the chance to use it on a basement foundation we were forming. It definitely proved to be faster than previous versions of the Max gun and about twice as fast as the Makita.

The TwinTier uses a special wire because of its "dual feeding" mechanism, so it's essentially tying two wires simultaneously. And while it seems counterintuitive, the gun uses less wire to tie the same amount of rebar as the earlier Max gun and the Makita gun—about 120 more ties with this gun per roll compared with the other two. The rolls for the TwinTier cost about \$8.39/roll (\$0.033 per tie), and for the other guns, \$5.59/roll (\$0.043 per tie), so it is a bit less money per tie and faster. The larger jaw will tie up to a #7 x #7 (7/8 inch x 7/8 inch) rebar, and will work just fine with #4 x #4 rebar.

One of the big improvements Max made to this gun is that it is better sealed than the older RB397 we bought in 2014, so the wire rolls aren't open to the elements. The tool is light and compact, weighing just 5.6 pounds. You can buy the TwinTier online for \$2,700. maxusacorp.com

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

Photos by Tim Uhler

Bosch Flexiclick 5-in-1 Drill/Driver

BY ANDREW WORMER

I own a number of tools that are powered by Bosch's 18V battery platform, thanks in large part to "show specials" the company used to offer out of its large booth at JLC Live/Providence. This includes a few different drill/drivers and impact drivers, so I was curious about the new "Chameleon" Flexiclick 5-in-1 GSR18V-535FC 18V drill/driver system when Bosch first announced it last spring, and asked the company to send me one to try out.

The kit came with a 4.0-Ah battery and charger, a nylon tool bag, and three different attachments: a standard 1/2-inch keyless metal chuck; a right-angle attachment, also with a keyless chuck; and an offset-angle attachment, which has a 1/4-inch hex bit holder with quick release. Also available is an optional rotary hammer adapter that accepts SDS-plus bits for drilling into masonry. That's four optional attachments; so what's option number five? The drill/driver is designed with an integral 1/4-inch hex bit holder, and in tight spaces can be operated like an impact driver, without any of the attachments. Keep in mind, though, that it is a drill, not an impact driver, though it does have an adjustable clutch mechanism that seems to operate a little more precisely than the clutches on my other drills.

The drill also has what the company calls Kickback Control, which is a built-in acceleration sensor that shuts down the motor when it detects sudden movement, limiting tool rotation. I learned about this feature when I first started using the drill (who reads op-

erating instructions?) and was both relieved and a little freaked out when I bound up a bit while drilling through a 1/4-inch metal plate and the tool simply stopped. I was thankful that I hadn't scraped any skin off my knuckles, but feared that I had burned the motor out. But, no worries—after a brief pause, I was able to back the bit out of the hole.

Is 535 inch-pounds of torque a lot? I don't know, but that's what Bosch claims the brushless motor delivers, and it feels like the drill has more power than my older ones. It doesn't have any trouble powering a 2 1/2-inch-diameter hole saw through a 2-by, and while it doesn't have the brute strength of a Hole Hawg, it also won't slap you up against a stud or sprain your wrist if it binds up—partly because of its Kickback Control system.

For you tech nerds, the drill can be connected to Bosch's free Tool-box app via Bluetooth, as long as you've installed one of the company's GCY42 Bluehound modules (about a \$20 item). Apparently, this will allow you to "customize your tool" and check battery status, though more important to me is the fact that the drill comes with a toolbelt clip, a bit holder, and a built-in LED light. A kit with a Core 18V 4.0-Ah battery costs about \$300 online; adding the SDS attachment to the kit boosts the price to \$400 on Amazon. boschtools.com

Andrew Wormer is JLC's executive editor.



Photos by Willem Wormer

Bosch's Flexiclick drill/driver comes with three attachments, including an offset-angle attachment for driving fasteners close to an adjacent surface (left, right). Its integral 1/4-inch hex bit allows it to be operated without any attachment (center).

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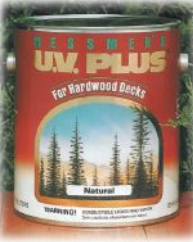
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BY CLAYTON DEKORNE

‘The Poetics of Space’

When I was a young carpenter, *The Poetics of Space* by Gaston Bachelard helped fuel my inspiration for building houses. It offered an unusual perspective on space as a sort of elemental substance, like water or air, only not entirely rooted in a physical world. For Bachelard, space, and in particular the space inside a home, is a metaphysical substance, inhabiting both the outer natural world and our interior selves. This idea, which I will venture to explain here, still inspires me whenever I come into a space infused with light and a sense of atmosphere. Creating such intimate and uplifting spaces within a home is what inspired me most to pursue building, and Bachelard’s book helped me understand a little how to think about doing that.

To be clear, Bachelard’s book is more about poetry—an intensely philosophical exploration of poetry—than it is about the design or craft of building homes. And I think for Bachelard, it is not strictly about poetry but about imagination and memory—phenomenological elements that poetry reveals and we inhabit when we read or write poetry. For me, though, poetry and houses are alike. The word “stanza,” the building block of a poem, is derived from the Italian word meaning “room,” and it’s not a stretch to think of a well-built house as a series of stanzas that evoke different essences and, as a whole, have a sense of completeness, a poetic beauty. And the Greek “poiesis” means to make, which is exactly what we do when building. If we embrace Bachelard’s phenomenological approach when we build, we aren’t just standing up walls. There’s more than just physics, materials, and motion. Rather, by turning deliberately towards the poetic nature of our craft, we are leaning on inner experiences as well as physical skills to create the essence of home.

Phenomenology is the philosophical study of meaning and value that comes through the lived experience of human beings. Bachelard takes up this lens to examine the house, with the goal of finding the “intimate values of inside space.” His chief concern is “an intimate, concrete essence” found in houses, especially the houses we were born into and grew up in, places that foster images that we carry inside of us and call “home” or identify as “praiseworthy spaces.” To understand this essence, we have to dive into what we mean by phenomenological experience, which is not simply an experience of physical reality, but an experience in which our memories and imaginations are

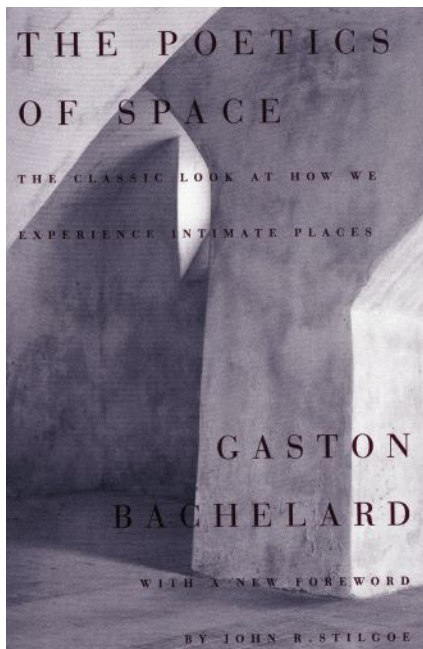
always interrupting our point of view, always being infused with observations and actions in the physical world. It is in this actual, comingled experience that our inner world and outer reality coexist.

“The house is not experienced from day to day only,” Bachelard writes. “Through dreams, the various dwelling places in our lives co-penetrate and retain the treasures of former days ... We comfort ourselves by reliving memories of protection.” Memories of intimate spaces we have inhabited in the past, Bachelard argues, are infused with a sense of solace, for these are the places we have felt free to dream and imagine our highest hopes. This daydreaming of possibility becomes part of the world we long for and establishes a template for what we call home. “Memories of the outside world will never have the same tonality as those of home,” he writes. “And by recalling these memories, we add to our store of dreams; we are never real historians, but always near poets, and our emotion is perhaps nothing but an expression of a poetry that was lost.”

The Poetics of Space feels like a dream. Reading it, I am drawn deeper into a space of thought tinged with emotion from the many passages of poems he cites. And from those thoughts, my own dreams and memories emerge—images of light-filled patches of floor, patterns of light and shadow that reveal the shifting geometries of doorways and stairways and balconies, windows with views that hold me spellbound, an alcove near a wood stove, light reflecting

off walls at certain times of day, shadows of trees appearing on a floor, moving, and then slowly disappearing from the wall. These memories of place melt my anxiety and fill me with comfort.

Certainly, this feeling makes reading Bachelard’s *Poetics* enjoyable, but what I find most fascinating is the idea that space is not just an emptiness; it is a substance that gives meaning and value to architectural form. Architectural space, as poetic space, has both outer dimensions and inner ones, and the interplay between those dimensions is what allows us to “read” a space using a language of images and knowledge that transcends quantitative science. Bachelard gives me words to describe this transcendent reading, helping convince me that houses are reflections of what we call soul, or heart. It’s not an easy argument to make, but perhaps that is the point. Poetics provides what rationalism and physics cannot: an understanding of why we are driven to create.





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