

KNOW THE CODE: PLANNING FOR SOLAR PANELS

Fine Homebuilding

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Upgrade to Engineered Wood Siding

Man-made siding is durable, inexpensive, and easy to install **PAGE 34**

Stronger deck-railing connections

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Right-sizing an HVAC system

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Compact retirement home

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FIRST THERE WAS AN EVOLUTION.

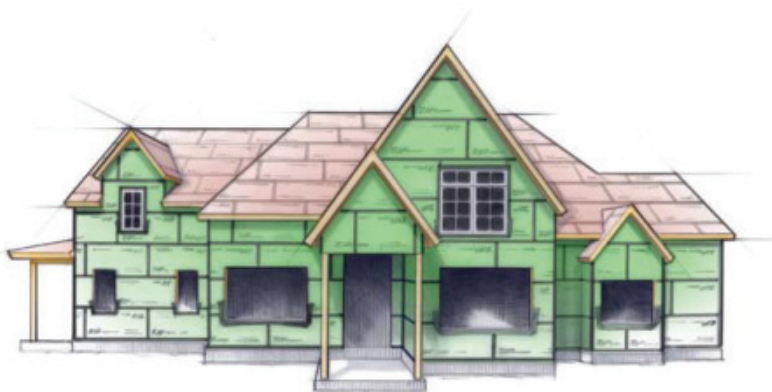


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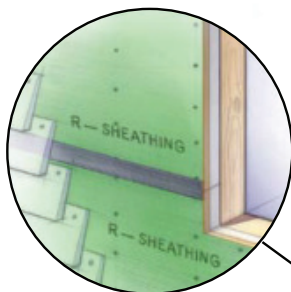
1970

THEN CAME THE REVOLUTION.



TODAY

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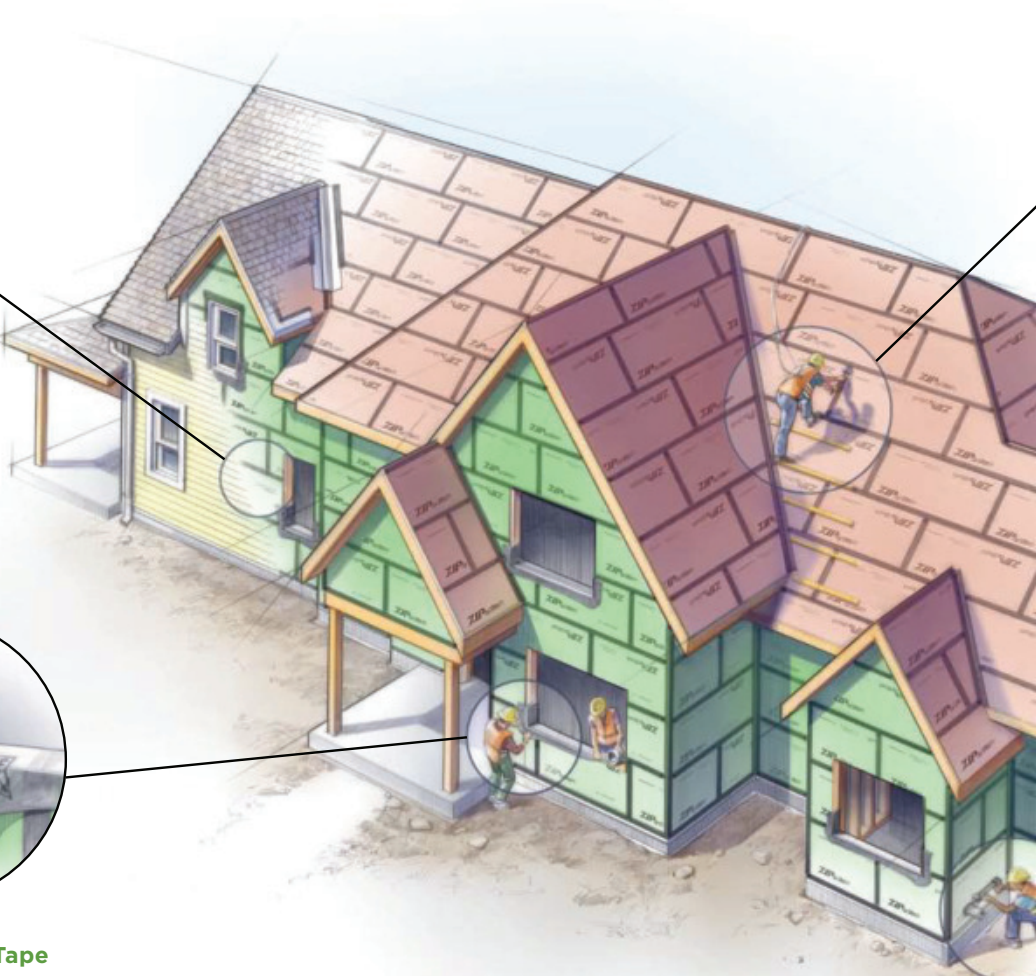
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BUILDING ENCLOSURES

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WINDOWS

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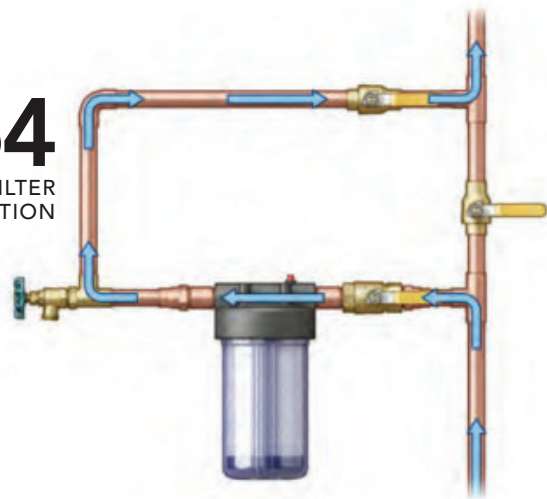
European-style windows sit within the rough opening and require a face-sealed approach to water and air management
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RETIREMENT
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Cover photo by Matthew Millham

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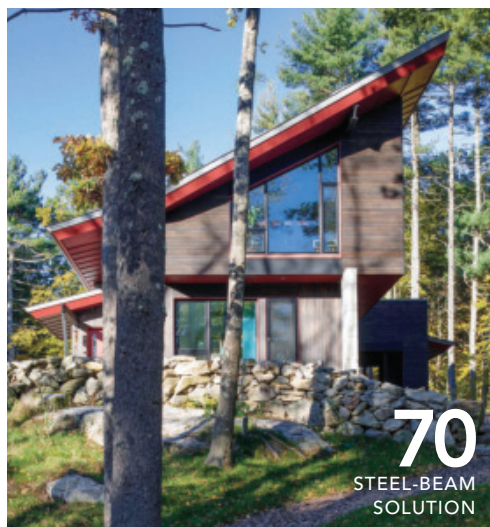
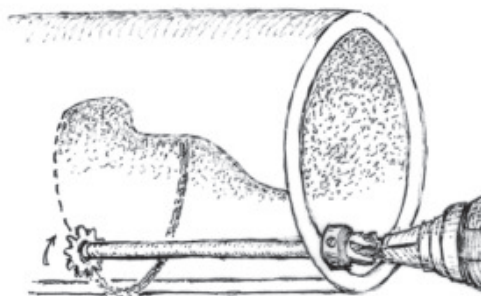
A revolution in building

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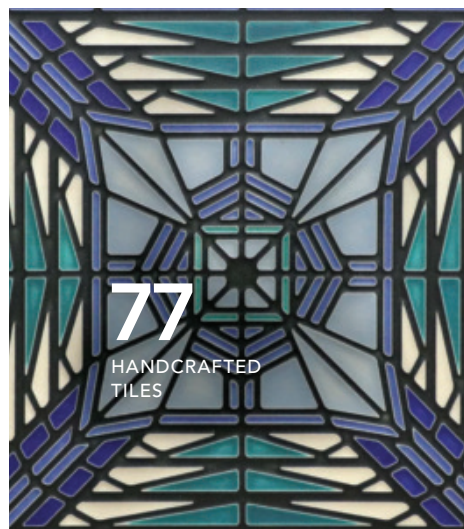
Ben Bogie, building production manager

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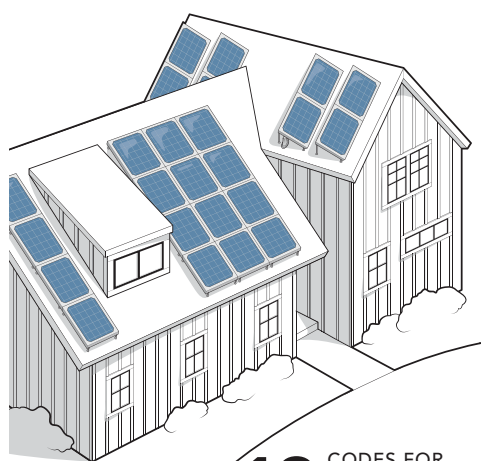


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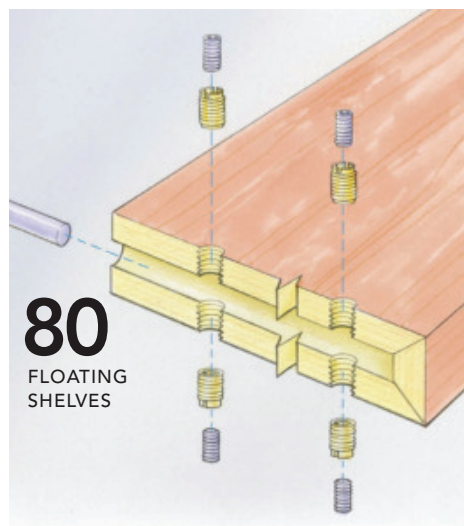


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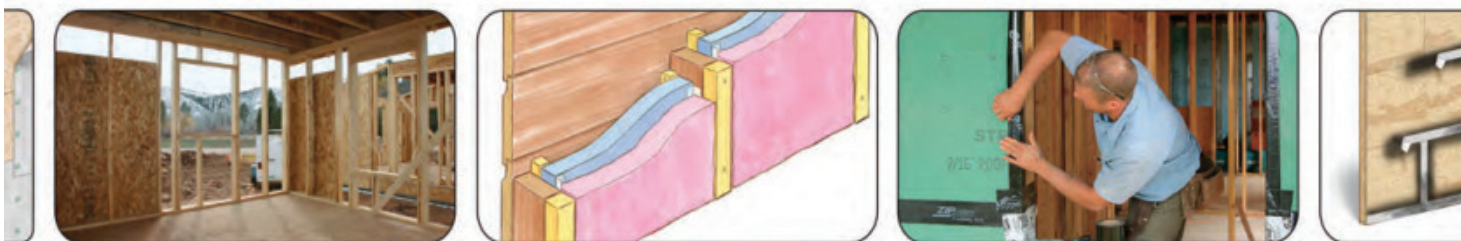
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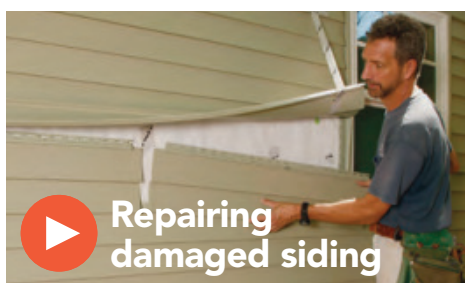


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- Making Sense of Deck Stains
- A Crash Course in Control Layers
- On-Site Spray Finishing
- Double-Stud Wall Construction
- Stormproofing a Roof



Builder Mike Guertin demonstrates simple fixes for a few of the most popular types of siding in this eight-part series. Visit FineHomebuilding.com/videoseries.



Ep. 218: Architect Steve Baczek

Steve joins the *FHB* crew to talk about building materials, building science, and sharing knowledge within the building community.



What makes for good design?

Take a look at the qualities that separate masterfully designed homes from those that are mediocre. Read more at FineHomebuilding.com/design.



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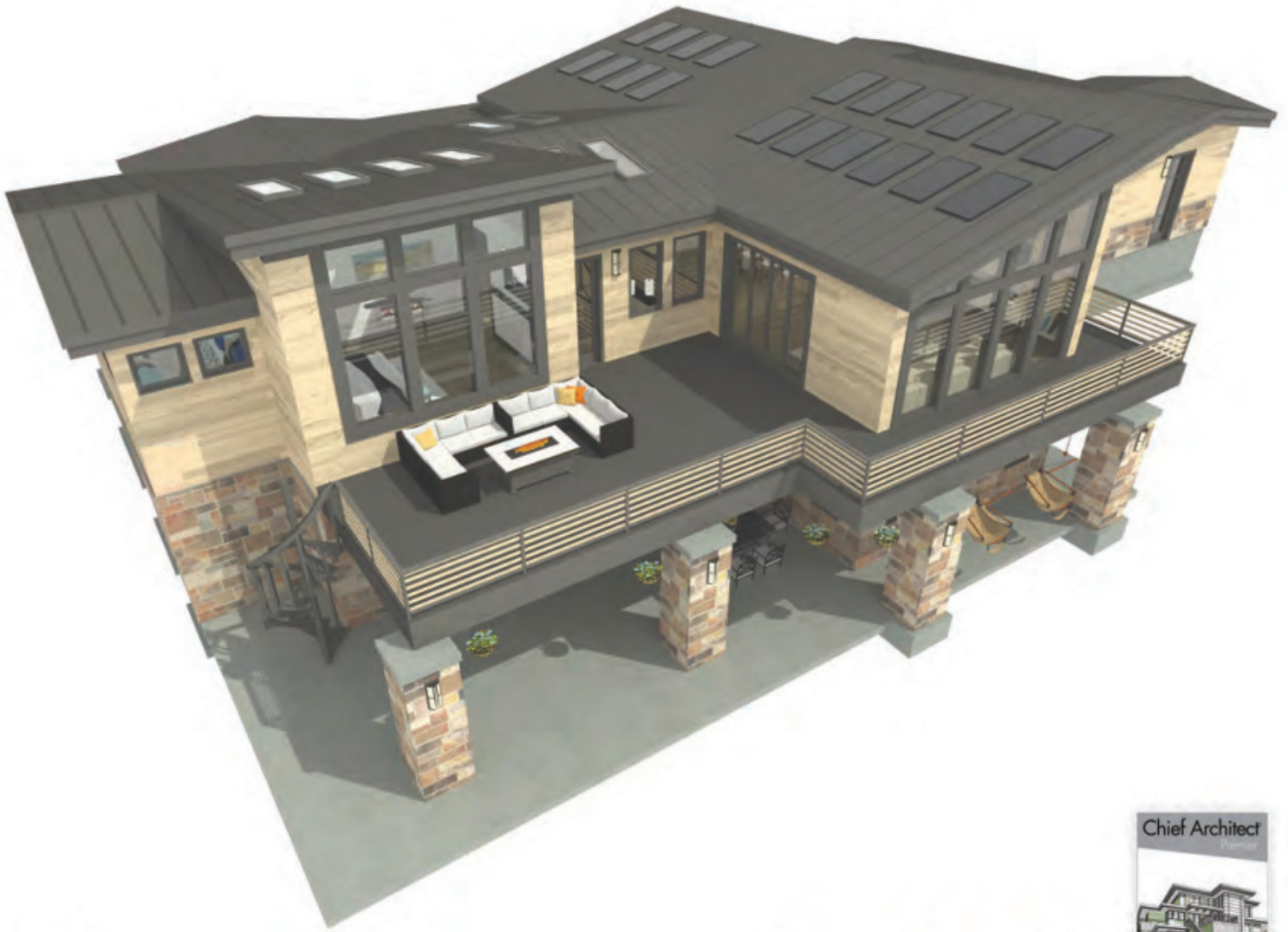
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THE VOICES OF EXPERIENCE



BEN BOGIE is a second-generation high-performance builder working as a lead carpenter in Portland, Maine. Ben is passionate about historical renovation and creating high-performance homes, and is an active member of the Northeast Sustainable Energy Association. He specializes in building science, low-energy designs, and high-end custom finishes. In this issue, he writes about lap siding (pp. 34-39), siding tools (p. 23), and flashing products (p. 78). He is also featured in this issue's Keep Craft Alive on page 90.

PETER POLCYN ("Build a Sturdy Shop Table," pp. 64-69) is the owner-operator of Rail and Stile Custom Woodworks, a one-man cabinet and furniture shop located just east of San Antonio in Seguin, Texas. Peter has been working in the construction industry in various aspects and roles for the past 18 years. In his teens, Peter spent summers working with his father, who owned a remodeling business. He spent countless hours in his dad's shop, where he learned the joy of creating things with his hands—a passion that still burns strong today.



Builder and remodeler **JAKE BRUTON** ("Installing Flangeless Windows," pp. 58-63) is the owner of Aarow Building in Columbia, Mo. Jake works to help ensure that all the company's houses are built to last and are energy efficient. Jake believes that project development should be a collaboration between the builder, the architect, and the client to help ensure that the final product is a home that will not only look good, but feel good to live in and stand the test of time.

write an article

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Making the best of a tough situation

As I write this, the staff at *Fine Homebuilding*, like many of you, is hunkered down in our homes, riding out this serious pandemic. But we remain committed to not just limping along during this global crisis, but instead doubling our efforts to continue production of the magazine you're reading and to provide even more of the design, building, and remodeling information you have come to trust and appreciate from our brand.

One of the things we set in motion at the end of March is a series of webinars, which allow us to present complex building topics in real time, in a conversational manner, and with the participation of a live internet audience. So far, in a joint effort between *Fine Homebuilding* and Green Building Advisor, we have done multiple sessions each week, with topics including deck building and maintenance, painting, roofing, building science, framing, and designing with the help of SketchUp. The webinars are free to join, and are also recorded and archived at FineHomebuilding.com/webinars.

In our continuing efforts to Keep Craft Alive, we have begun to offer displaced trade-school students free access to all of *Fine Homebuilding's* digital content, and are working with teachers across the country to set up packages of content to fit their needs. If you are currently enrolled in school to study residential construction, I encourage you to visit FineHomebuilding.com/student.

Finally, I urge everybody in the *FHB* family to use this time to reinvest in the craft. Call it a distraction, a release, or just making the best of a tough situation by crossing some things off our home maintenance and improvement to-do lists, but at some point it's time to turn off the non-stop news coverage and turn on the lights in our shops. Now, in times of hardship, is when it's most important to pour ourselves into passionate pursuits and encourage others to do the same. Hopefully these efforts will provide some comfort, focus, and semblance of routine, and remind us all that the bonds of this craft are unbreakable.

Happy building,



—JUSTIN FINK, editorial director



A pandemic workshoffice.

Senior editor Patrick McCombe's home workshop pulls double-duty as a site for home-improvement projects and a desk for writing magazine articles.

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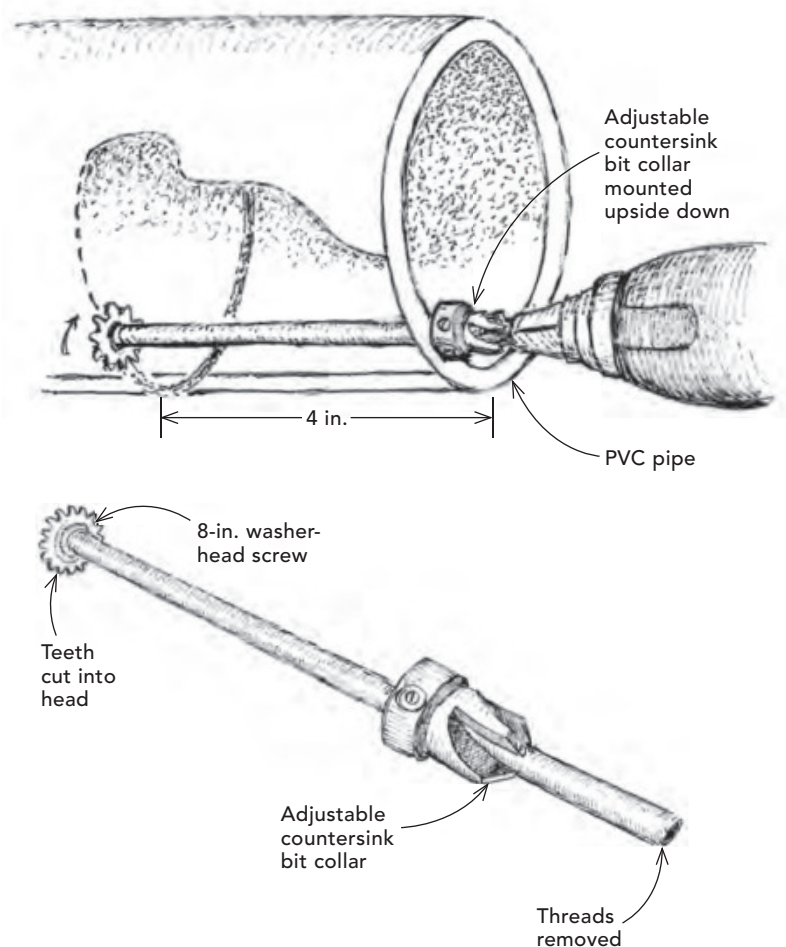


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Cut pipes from the inside

I was recently faced with moving a plastic soil stack so it could be hidden within framing. I needed to shorten the waste line's horizontal leg by about 4 in. Unfortunately, the pipe was surrounded by obstructions, so the only way to make the cut was through the open end. When I went looking for something to cut it, I found an 8-in. washer-head structural screw, and I used my angle grinder to modify it.

First, I ground it slightly thinner, and used a cutting disc to make teeth around its circumference. Then I cut off the threaded end so it would fit securely in my drill's chuck. Finally, I put an adjustable countersink bit collar 4 in. up the shaft as an improvised depth stop, using its set screw to hold it in place. I chucked the whole thing into my trusty drill and made the cut without a problem.

—JAIME WARD
Frome, Somerset, England

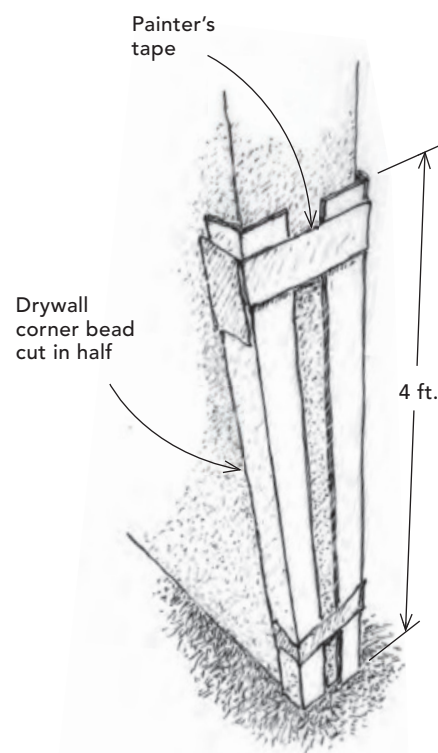
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Protect corners

The corners of cabinets and trim take a beating during the construction process, so recently I bought two-dozen strips of CertainTeed No-Coat corner bead, made for drywall corners, to protect the corners of cabinets, casing, and door jambs. I cut the 8-ft. corner strips into two 4-ft. pieces—you can cut multiples at once on a miter saw—and tape them to the vulnerable corner with blue painter's tape. The tape is easy to remove, so the make-shift protectors can be reused on the next project.

—JARRETT KRAVITZ
Clinton, Conn.



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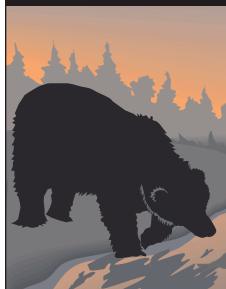
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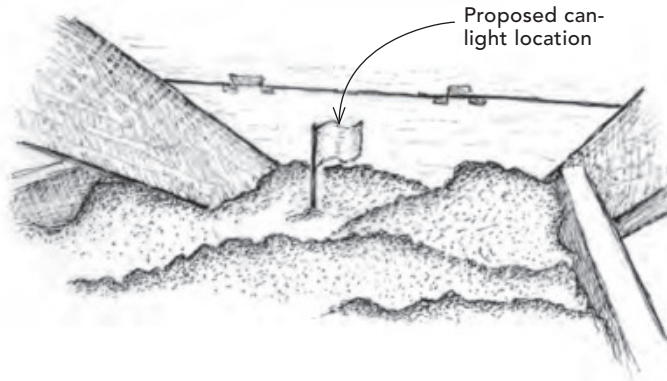
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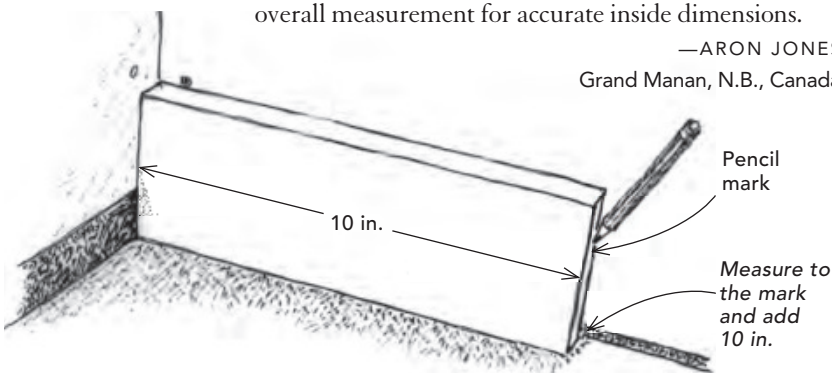
When we install a recessed can light in an existing ceiling with cellulose insulation above, we need to dig out the insulation before cutting the hole for the light. We start by drilling a $\frac{9}{64}$ -in. hole in the ceiling at the center of the proposed location. Then we take one of the little flags sold at the hardware store for marking underground utilities. We cut off the majority of the flag, leaving about a 1-in. piece. We roll the flag up around its metal rod, poke it through the hole, and push the rod up through the insulation. To keep it from falling back down, we bend the last inch of the rod 90° and tape it to the ceiling. In the attic, it's easy to spot the flag marking the proposed location. We can dig out the insulation and inspect for obstructions, and if the spot doesn't work, the small hole is easy to patch.

—MARCH COOVER
Dallas, Texas

Take better measurements

It's tough to accurately read a tape measure when it's curled up inside a corner. I find it especially problematic when measuring from one inside corner to another inside corner. These awkward locations include closet walls, drawer boxes, and the backs of cabinets. To take these measurements more accurately, I make a 10-in. block (any size will work, but 10 in. allows for easy math), set it into one of the two corners, and mark the wall on the opposite end of the block. Measure from the opposite corner to your mark, and add 10 in. to the overall measurement for accurate inside dimensions.

—ARON JONES
Grand Manan, N.B., Canada



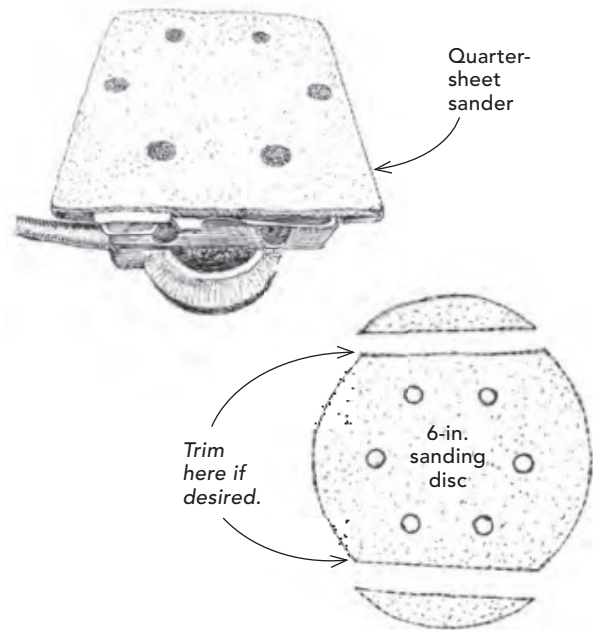
Stay-tight miters

Finish carpentry relies heavily on glued miter joints, which means you're gluing end grain. The problem is end grain sucks up wet glue more readily than edge grain, leaving little glue for bonding the two sides of the miter. But you can get a better bond with glue sizing. Here's how to do it: Apply a thin layer of glue to both sides of the miter joint and then immediately wipe the glue off so the pieces look dry. Set them aside for the remaining glue to dry fully—usually about 2 minutes—then reapply glue and assemble the joint as normal. The thin layer of glue sizing prevents the end grain from taking up all the glue, resulting in a much stronger bond.

—JON PRONIEWSKI
Menomonee Falls, Wis.

Square sander, round paper

We were out of standard sandpaper for our quarter-sheet sander, but we had plenty of 6-in. discs for the random-orbit sander. I found that the 6-in. discs fit quite well in the quarter-sheet sander. I trimmed the



disc's unclamped edges to make them flush with the pad, but this isn't necessary. The sturdy hook-and-loop backing on the disc makes it incredibly durable, and because it's a little thicker than normal sandpaper, the sander's clamps hold the disc tenaciously.

—ED HOSTETTER
Pleasant Valley, N.Y.

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Rules for rooftop solar

Big changes usually happen slowly, and often it takes time for society to catch up to the implications that result. Consider how ride-sharing apps started as an off-the-wall idea, but now there are entire parking-garage levels at major international airports dedicated to the services. I think similar things have happened with rooftop solar.

The Uniform Solar Energy Code was published in the 1970s. Back then, it was all about solar-thermal systems that heat water for space heating and domestic hot water. Though those systems are still available and used and mentioned in codes, the idea never really took off in the U.S. Meanwhile, solar photovoltaics (PV), which turn sunlight into electricity, have grown into a leading technology.

Rooftop PV was still pretty niche a couple decades ago, though it was growing and becoming more established. While the technology was rapidly changing, installation practices were just that—"practice"—and many hazards and failures were yet to be revealed and addressed in building codes and standards. Now, solar PV has a solid foothold in the residential market. On Colorado's front range, for example, roofs with solar arrays

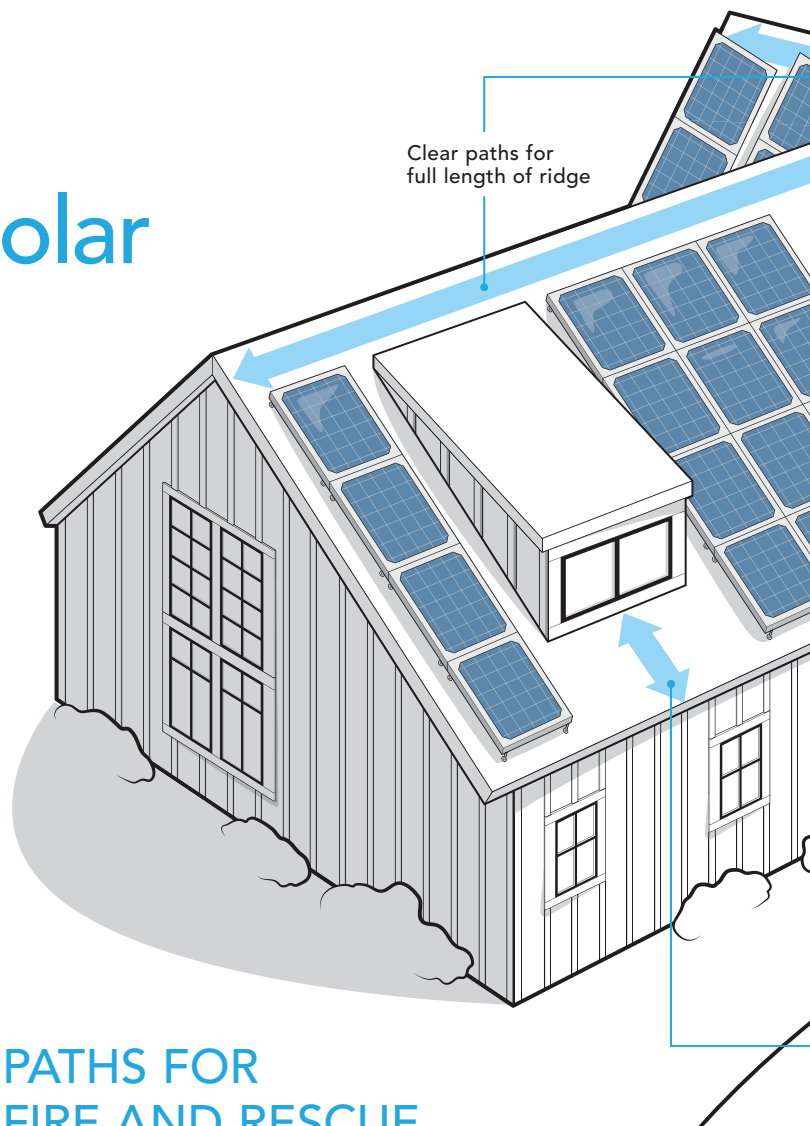
are scattered everywhere. And the codes have caught up.

The International Code Council, partnered with other stakeholders, now publishes a volume titled International Solar Energy Provisions, which combines the requirements from various code publications into one book. Unlike other codes, it was not developed independently. It is simply a conglomeration of the various solar provisions scattered in other code volumes. Electrical and solar contractors know the electrical provisions of the solar code well. It's the nonelectrical provisions—the ones contained in the Building Planning chapter of the International Residential Code (IRC)—that get overlooked the most.

For installations on houses, Section 324 of the IRC is where the majority, but not all, of the nonelectrical solar provisions are found. These provisions were recently developed, and there's a lot of new stuff. I'm going to focus on the most commonly encountered issues, though there are numerous exceptions I encourage you to check out on your own.

Firefighter access to the ridge

Though firefighting practices differ from district to district, the concept of venting and



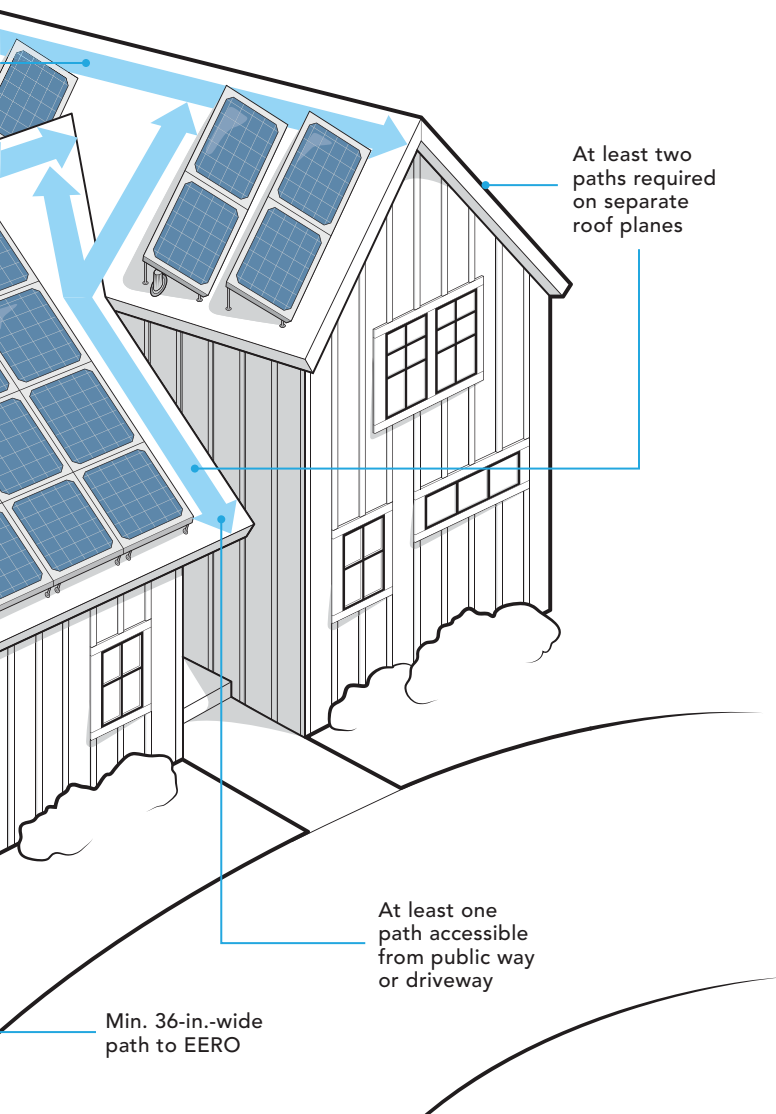
PATHS FOR FIRE AND RESCUE

Placing PV panels on residential roofs is a balancing act between getting the most possible wattage and creating safe pathways for first responders who may have to climb the roof in an emergency.

controlling the smoke and heat of a structure fire is universal. Fighting fire requires managing smoke and air, and that means controlling and creating openings. Often firefighters will ascend to the ridge of a roof to cut a hole and vent the smoke. Doing so provides a way for the smoke to exit a room and allow for a rescue operation. It takes

enough bravery to scale the roof of a burning home, and putting solar panels in the way just increases the danger.

On the other side of the discussion is the science of solar and the difficulty of efficiently placing panels to provide the most watts. Not all surfaces of a roof are solar-friendly; in the northern hemisphere, south-



facing, unshaded exposures are the prime real estate for solar-panel installations.

To provide the most effective panel arrangement possible, while still providing a path for firefighters, the code gets a little complicated and specific:

- At least two 36-in. or wider paths must be provided on separate roof planes from the lowest roof edge to the ridge.
- At least one of the paths must be accessible from a public way or driveway.

- Each roof plane with a PV array on it must have a 36-in. or wider pathway on that roof plane, an adjacent roof plane, or straddling that plane and an adjacent one—for example, a valley or hip. Where a path straddles roof planes, it counts as one path, but can be attributed to either roof plane to meet the requirements of the first bullet.

- Pathways must be over areas capable of supporting firefighters accessing the roof.

- These pathways must be in areas with minimal obstructions (such as vent pipes and mechanical equipment).

Once at the ridge, the path must continue along its length to provide access to cut vents at any place along the ridge. The size of the path along the ridge depends on how much of the roof is covered in PV panels. For roofs where PV panels cover up to 33% of the total area in plan view (essentially, as seen from above), the panels must be at least 18 in. away from a horizontal ridge on both sides to create the 36-in.-wide path. Where panels cover more than 33% of the roof, a 36-in.-wide path is required on both sides of the ridge.

Clearances to EEROs

Windows used for emergency escape—often colloquially referred to as “egress windows” but described in the code as “emergency escape and rescue openings” (EEROs for short)—need clear getaway routes to serve their purpose. A quick slide down a bank of solar panels and off the roof is likely just as deadly as braving the smoke-filled path through the house. To remove the chances of encountering such a dilemma, there has to be a safe path from the EERO to the edge of the roof. For any EERO that opens to a roof, a clear 36-in.-wide path must be provided from the window to the eave.

Plumbing vents in the way

Another thorn in the side of effective solar-panel arrangement on roofs is all the other stuff up there—namely, plumbing vents. The drain, waste, and vent (DWV) system in a house is pretty incredible, but rarely honored as such. It transports the most filthy stuff through and out of our homes,

cleans itself, and seals itself from the air we breathe using nothing but gravity, water, and atmospheric pressure. But to work properly, the vents that terminate on the roof have to breathe. Though there may be gas vents and dryer vents on roofs, there are usually many more plumbing vents, and often they are scattered around. Even my small 1950s ranch has three plumbing vents through the roof. Solar contractors have had to dance panels around these vents as their industry grew—but not anymore.

The code now recognizes that plumbing vents may be in the way, but they can actually share the space with solar panels. A complete rewrite of IRC section P3103.1 regarding rooftop DWV terminations now specifically allows solar panels to be placed over the top of plumbing vents. Of course, there are limitations, but they speak directly to the issue—air getting in and out of the vent. The vent, when protected from snow closure by the panel design, can be cut down from the minimum height of 6 in. to a height of only 2 in. above the roof.

The vent opening must communicate with outside air over an area no less than the area of the vent pipe, measured on the inside. For a 2-in. pipe (1-in. radius), that area is 3.14 sq. in. Assuming the pipe is clear around all sides, a panel could be as close as ½ in. above the vent and still provide the minimum 3.14 sq. in. of communication with the outside air.

The spaces under PV panels, however, create a cozy place for birds and rodents to nest. Such nesting now has a higher likelihood of blocking a vent, and since it would be concealed under the panel, it wouldn't be obvious to the occupants, who might realize their drains aren't working right but wouldn't

know why. To address this, the new provisions require vent terminations under solar panels and solar collectors be protected using a “method” that prevents birds and rodents from entering or blocking the vent-pipe opening.

These new provisions speak to the issues of air movement, snow, and nuisance animals, but don’t specify exactly how to design for them. Installing a screen over the vent is probably not a good idea, as that may cre-

hold, so section R324.4.1 makes a statement that the roof “shall be designed and constructed to support the loads imposed by such system in accordance with Chapter 8.” Chapter 8 provides prescriptive roof construction methods from the code, so this statement is not directly requiring “engineering” of the roof structure. Subsections clarify that the roof must support the dead load of the roof including the weight of the panels plus the local snow load. Alternatively,

the roof itself is not specified as part of the analysis. The PV system is looked at essentially like cladding, and thus the wind-load table for cladding is what is used to determine the load the panel system must resist depending on factors such as exposure, windspeed, roof area, roof slope, and where the panels are located on the roof, such as near an edge or in the center. Though not directed by code, it is clearly a good idea to be sure the rafter connection

out, and R904.1 requires you install materials according the manufacturer’s installation instructions. There’s not much more to it.

While “more codes” can be viewed as negative, I think that’s a limited view. Model building codes are designed to respond to society, and society is ever-changing. When new technologies become commonplace, they become a larger hazard to communities and yet are simultaneously more accepted by the people of those communities. Codes step in as these common techniques, hazards, and products are established.

As can be seen with solar, these new things often bump up against old things, and decisions must be made. With emerging trends, these decisions are made locale by locale, frustrating the new industry. Standardizing solutions to new problems provides manufacturers, retailers, and installers consistency in the government regulation of their work. Existing industries are also forced to revisit their own standards. No one thought much about clearances to plumbing vents until they began installing solar panels. Nor did firefighters have to question the minimum path necessary to get to the ridge until roofs were covered in PV.

The new nonelectrical solar provisions are a welcome upgrade to the code and provide a good balance between the freedom of design for a growing industry and the minimum performance and requirements of the existing systems they affect.

Glenn Mathewson is a consultant and educator with buildingcodecollege.com.

A quick slide down a bank of solar panels and off the roof is likely just as deadly as braving the smoke-filled path through the house.

ate a foundation to encourage nest-building or other debris to settle in place. More commonly, the entire perimeter of the array is screened. A nonspecific code provision allows for freedom of design, but it can also allow more varied interpretation among building authorities.

Structural loads on the roof

Since panels first were placed on roofs, many building departments have asked about the sufficiency of the existing roof to carry the new loads, and this is a very valid question. U.S. housing stock was built over more than two centuries of trial and error and renovation. There is no shortage of surprises that can be found in the attics of homes, and I’m not talking about what’s in the dusty boxes. There is no guarantee of what the roof can

where the snow load is less than the minimum required roof live load (12 psf to 20 psf depending on size and slope), the roof must support the dead load of the roof and the live load.

When panels are to be installed, the existing roof must be verified to either meet the current prescriptive roof design requirements in Chapter 8 or be analyzed and approved by an engineer. When structural upgrades are required, it’s often not due to the weight of the panels—it’s because the old and often modified roof can’t be proven to support even the minimum design snow load. The prospect of adding PV panels essentially brings forth the sins of the past.

Wind loads are addressed in section R324.4.1.2, but they only apply to the panels, the modules, and their supports. Unlike dead and snow loads,

to the ridge is sound, and/or there are ridge straps or collar ties installed.

Penetrations and connections

Rooftop PV requires a lot of connections to the roof, and each of these is a penetration through the roof covering. A huge variety of mounting systems have been tried as the industry has grown, and all these systems have various methods of sealing to the shingles or other roof covering. Section 324.4.3 simply states that penetrations of the roof covering “shall be flashed and sealed in accordance with Chapter 9.” This chapter covers roof assemblies (roof coverings), but doesn’t provide specific details for how exactly to seal and flash these mounting systems. Rather, R903.2 simply requires you keep the moisture

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² BUILDER magazine Brand Use Study, 2002-2018, OSB Category.

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CAPABLE CORDLESS BRAD NAILER

Over the last four months, my crew and I have used Milwaukee's 18v, 18-ga. cordless brad nailer for trim and finish work both inside and out. In that period, there were only four nails (yes, I counted) that I had to finish with a nailset, and in the same time frame the nailer only misfired twice. And we haven't gone easy on it—we've used it with some challenging materials, including fly ash, composite decking, pressure-treated yellow pine, LVL, and hardwoods like red oak and maple. It has proved to be a great combination of power and consistency. It leaves very small holes, has no ramp-up time, and accepts brads from 5/8 in. to 2 1/8 in. long. Other features include a 110-nail magazine, dry-fire lockout, and a belt hook. The battery life with a



The nailer's driver leaves a small hole and the compact nosepiece fits in tight spots.



Electronic controls allow you to switch between contact and sequential firing.

**Milwaukee
M18 Fuel
18 Gauge
Brad Nailer
(2746-20)**
\$280 (tool only)

3-amp-hour battery is amazing. My guess is that it drives hundreds of nails on a single charge.

This may be the first battery-powered nailer on the market that could replace its air-powered counterpart. It can certainly keep up and doesn't require the hassle of a hose or expensive gas fuel. The

rest of my crew likes the nailer, too. In fact, I frequently have to track it down because one of the other carpenters has made off with it. In short, this is the best cordless brad nailer I've ever used.

Aaron Butt, a carpenter in Salem, Mass.

Better nitrile gloves

Typical blue nitrile gloves are not up to the rigors of construction. I use them when I'm working with finishes, solvents, and greasy engines, but their durability leaves a lot to be desired. Lately I've been using Rip Resistant Industrial Nitrile Gloves from Venom Steel. They're way tougher than the typical blue ones. The large size works for my medium-size hands, but many tradespeople will need the extra-large option.

Patrick McCombe, senior editor



Thick skin. Made from two nitrile layers, Venom Steel gloves are 6-mil thick and much tougher than ordinary nitrile gloves. A box of 100 sells for \$20.

Smart siding tool

Fiber-cement siding gauges work great, but they're limited in the thickness of siding they work with. The SoloSider Pro (about \$120 for a pair) eliminates that issue because it works with material from $\frac{5}{16}$ in. to $\frac{5}{8}$ in. thick. In use, the tool's metal clamp on the base holds the bottom edge of the previous course of siding, and a large lever on the face locks the clamp. The support arms are adjustable for the siding exposure, and "flippers" at the top of the arms open easily so the siding can be dropped into position. The arms also have a white ruler across the back where you can mark reveals. The SoloSider Pro is well-built, and functions exactly as one would hope, maintaining consistent reveals that are easy to adjust and supporting long pieces (16-ft. pieces of 8-in. LP SmartSide) with no issues. I expect we'll be using these gauges for years.

Ben Bogie, a lead carpenter for Kolbert Building in Portland, Maine.



Rolling kneeler

I dread working on my knees, even with good knee pads.

When I first saw a tilesetter gliding around the floor on a Racatac, alternating between kneeling and sitting and propelling himself with his feet, it was a revelation. I thought a similar setup might be good for measuring and installing baseboard and shoe molding, so I ordered one for \$135. The Racatac isn't only good for baseboard; I use it for installing wainscoting, assembling balustrades, and low-down caulking and painting. It's one of those tools that makes me wonder how I ever got along without it. The tool tray allows you to take a break from wearing a tool belt and it's large enough to hold a gallon of paint. My only regret is not getting the chest-support option (an additional \$80), which is worthwhile even if you use it only occasionally. One caution: It's important to keep the wheels and floor clean where you're working, or the Racatac can scratch the floor. I inspect both the wheels and the floor each time I use it and I have not scratched a finished floor yet, but a grain of sand could easily mess up my track record.

Brian Campbell, a carpenter in Minneapolis.



High-value blades

My European track saws and beam saws see a lot of use because their performance is unmatched. The only problem is the ridiculously high price of metric blades. As my dad would say, "That's how they get you." Searching for an affordable alternative, I found Oshlun blades on Amazon. The company makes blades in many of the hard-to-find arbor and blade diameters for boutique saws. They have especially wide offerings in the 160-mm and 210-mm sizes, both common diameters for track saws. I ordered the Oshlun SBFT-210052 210mm 52 Tooth FesPro Crosscut ATB Saw Blade for my Festool TS 75 for a whopping \$37. By comparison, a similar



Festool-brand blade is \$135.

I was expecting the Oshlun blade to be a low-quality knockoff that at best would be half as good as the Festool version. I was totally wrong. This is a great blade. The cut quality is on par with Festool blades, and it stayed sharp for just



as long. I have since tried a few different 210-mm blades with total satisfaction as well as a 10-in., 12-in., and even a 16 $\frac{5}{16}$ -in. beam-saw blade with the same results. If you need a great blade at an extraordinary value, try Oshlun.

Andrew Grace, a contractor in Ligonier, Pa.

Divided-lite solution

Around here, 15-lite doors and 6-over-6 windows are all the rage. But masking or hand-brushing anything with divided lites takes forever. To streamline the process, I picked up a gallon of Masking Liquid H2O from Associated Paint. This masking liquid is a water-based, acrylic-modified clear coating that sticks to wood but can be peeled from glass. You can spray, roll, or brush it on. I sprayed three 15-lite doors with the masking liquid using my Graco Ultra cordless sprayer. After the specified six-hour cure time, I followed up with a water-based primer and two coats of latex paint, completely covering the glass with each coat.

Once the paint was dry, I scored around each lite with a dulled razor blade, picked a corner loose with my fingernail, and all four layers of finish pulled off in one sheet. I think it would take me two to three hours to either mask-off or hand-brush each door; I applied the masking liquid to all three doors in 25 minutes including setup and cleaning the sprayer. At just over \$60 a gallon, Masking Liquid H2O is a steal for the amount of time (and boredom) it saves.

A.G.



Photo: Rodney Diaz


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THE FUTURE OF Tile IS BIG

Full-wall porcelain panels offer the seamless look of stone with less cost and maintenance

BY JOSHUA ODUIN

Supertough and virtually stainproof and waterproof, porcelain tile is the undisputed champion of the modern bathroom. The latest development—and a logical extension of the big-tile trend—is full-wall porcelain panels, which nearly eliminate grout lines, delivering the rich look of marble with much less maintenance. Better yet, big-slab porcelain tile has an installed cost that's 30% to 40% less than thick stone slabs.

Porcelain-slab basics

Large porcelain slabs are known formally as gauged porcelain tile panels (GPTP), with “gauged” referring to their precise

thicknesses. The most common thicknesses are 6 mm (roughly ¼ in.), the bread-and-butter choice for residential builders, and 12 mm (½ in.). The 6-mm panels are much lighter—160 lb. for a 10-ft. by 5-ft. slab vs. 320 lb. for the same size 12-mm panel—they're easier to snap and cut, and their edges are quicker to polish.

The 6-mm slabs also make it easier to avoid lippage and misalignment, a notable perk because these huge panels are often bowed by the manufacturing process, and a thinner, more flexible slab makes that much easier to deal with.

While much lighter than quarried stone, big porcelain panels are still far heavier





GAME CHANGER With porcelain-tile slabs measuring up to 5 ft. by 10 ft., skilled tilesetters can create the look of solid stone with very few grout lines and very low maintenance.

than other tile formats, and less forgiving of inconsistencies in the flatness of walls and substrates. So the learning curve is significant, even for experienced tilesetters. At prices up to \$1000 per panel, you can't afford to damage one or make a slight mistake in layout or cutting. You'll need to make an initial investment in specialized tools and gear, and a three-person crew is the minimum for safe handling.

The new tools and challenges are why I strongly recommend that anyone seriously interested in large porcelain slabs take one of the excellent training courses conducted by regional retailers and wholesalers such as MSI, Daltile, Crossville, and Bedrosians. Even after 16 years of tilesetting, I jumped at the chance to practice using these new tools and techniques on the manufacturer's material and not my clients'. The investment paid off quickly, and today big-slab work is both fun and rewarding for me, my crew, and my customers.

Designing and planning for slabs

Before anything else, you'll want to plan how the panels will fit into the space you are



FRAMES AND SUCTION CUPS

Similar to transporting countertops or glass, slab tiles must be supported by an A-frame for the drive to the job site. The extra bodies, suction-cup handles, and stiffening bar are also critical.

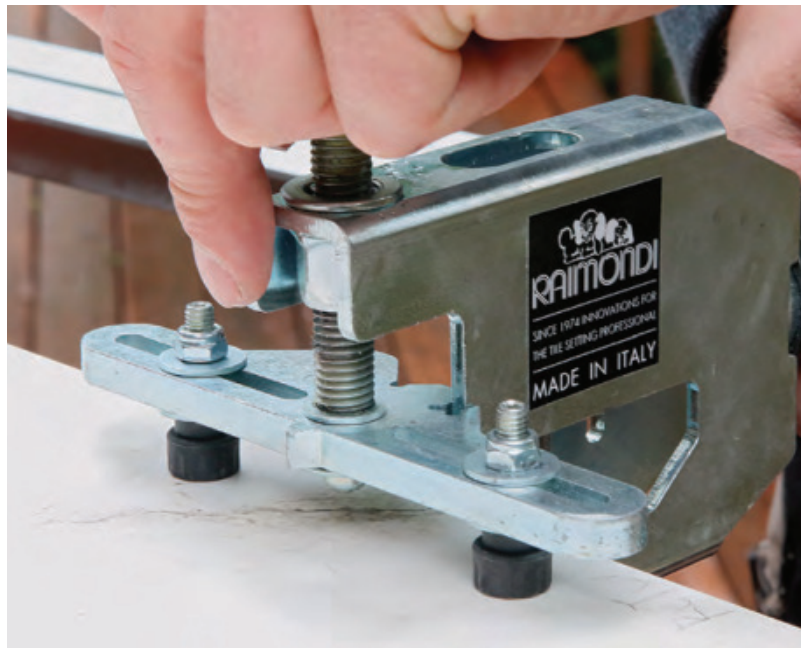


SCORING AND SNAPPING

For edge-to-edge cuts, or butt-joined inside-corner cuts, tile slabs can be scored and snapped like glass using some specialty tools. But when joining panels on an outside corner I prefer to snap and then miter both pieces for a cleaner, more convincing finished look.



SCORE FIRST The Raimondi Raizor cutting system includes two rails that span just beyond 10 ft., and using it is as simple as lining up the scoring unit with your marks, locking down the suction cups, and scoring a line with firm hand pressure.



FRACTURE THE ENDS Specialty pliers are used to bend the panel at the score line, causing an audible crack. Do that at both ends and the panel is ready to snap. A slight push may be needed, but often the weight of the overhang is enough to send the fracture down the score line, so be ready to catch the heavy offcut.



POLISH THE EDGE The snapped slab edges will need to be cleaned up before installation. For square edges I use a 5-in. dry polishing pad with a stiff aluminum backer to smooth the cuts.



OUTSIDE CORNERS BY HAND Don't be intimidated by creating mitered edges with a grinder—only the very point of the miter will be visible. The angle of the cut doesn't have to be exact, so bevel it beyond 45° and leave 1/16 in. or so of flat material at the edge.



BREAK THE EDGES

The last step on all cuts is to take a quick pass with a 120-grit diamond pad, smoothing out any imperfections left by the polishing pad and putting a slight curve on any sharp edges.



JIG UP FOR HOLES When drilling holes in the field of a tile slab, like this one for a showerhead, I use a diamond hole saw, which I cool and lubricate using water squeezed from a sponge. These bits are not self-centering, so I use a couple of wood scraps to establish the X and Y positioning of the hole, with one piece bored (slightly wider than the diamond hole saw) so there's no chance of the bit wandering.

finishing. Wall widths, ceiling heights, and access are all factors, and some slabs can be ordered in only one size. If a wall is bigger than a single slab, you need to decide where the seams should go.

Because the lifelike veining patterns are manufactured, porcelain slabs can be offered in matched sets of up to four, allowing a skilled tilesetter to “roll the grain” around corners, creating shower curbs and pony walls that look like solid stone, and walls that flow into each other.

To ensure a dead-flat substrate, I frame my own walls whenever possible, power-planing and shimming studs as needed. Other tricks include wet-setting the backer board—putting thinset on studs and joists to fill and support lows—or creating the shower floor with a full mud bed.

The floor tile goes in after the wall tile, but I build the shower pan and complete the waterproofing ahead of time, of course, before any tile goes in. In showers, I go with a mud bed instead of a foam-based pan because the mortar is much stronger and more rigid, with no chance of compressing or deflecting over time.

As for the floor profile in a shower, I either angle the whole surface in one plane toward a linear drain, or angle multiple planes toward a center drain, templating the finished pan to create an “envelope” array of tile.

Tips and tools for safe handling

The first challenge in working with porcelain slabs is transporting the thin, heavy panels. Like glass companies do, I use a wood A-frame setup, which is bolted onto a standard trailer. For the rest of the process—carrying, cutting, and setting the slabs—you'll need a handful of specialized tools developed in Europe, where the trend started, available from industry leaders Raimondi, Sigma, Montolit, Omni Cubed, and ETM (European Tile Masters).

Two initial tools are critical for moving the thin panels safely on and off the trailer and fabrication table, and moving them carefully through the house and precisely into place. These are suction-cup handles and a stabilizer frame that stiffens the panel for transport, and also attaches with suction cups.

You'll also need a big, flat, portable cutting table, which is the first thing you'll set up on the job site. Some installers get away with sawhorses and a big slab door of some kind, but I prefer my light, flat, modular work-

SETTING SLABS

Large, thin slabs require tighter tolerances for the substrate. I only allow substrate flatness to vary by $\frac{1}{8}$ in. or less overall so the thinset bonds properly. I also apply notched coats of medium-bed thinset mortar, including an initial scratch coat to ensure a strong bond, to both the substrate and the panel. A thicker coat of thinset helps fill the gaps caused by slightly bowed panels (almost all of them are) and any minor inconsistencies in the substrate.



WALLS FIRST To avoid damage to floor tiles, it's best to install the walls first. Start with a scratch coat of medium-body thinset, using the flat side of the trowel, and then apply a notched coat ($\frac{1}{2}$ -in. notches in this case).



BACK-BUTTER

Before applying thinset to the back of the slab, it's critical to remove any manufacturing dust with a damp rag or sponge. Holding the slab upright and near the substrate about to receive it, apply a scratch coat and $\frac{1}{4}$ -in.-notched coat of thinset across the back of the slab.



WIGGLE AND LEVEL

Use the suction-cup handles to wrestle the slab safely into place, and then slide it back and forth to start collapsing the ridges in the thinset. It's critical that each part of every installation goes in square and level, so we use plastic wedges as necessary.



THUMP OUT THE AIR POCKETS

Heavy, rubber-faced “beating blocks” are used to remove air pockets.

The blocks are used by touching down one end and then thumping the whole block against the tile. To allow the air to escape, start down along one edge of the slab and then move across it.

KEEP IT PLUMB

Always check each slab with a level after placing it on the wall. If the substrate is flat and plumb, and the tile is too, you know you’ve got an even layer of thinset without major air pockets.



MATCHED EDGES Matched slab sets have continuous veining at their long edges for creating a seamless look. To ensure a clean transition, we scrape away any thinset squeeze-out from the edge of the first slab and set 1/16-in. spacers (part of the leveling system we use) before placing the second slab on top.

table from Raimondi, which is made for the job and folds up for transport and storage.

Be ready for a variety of cuts

For straight cuts and straightforward cut-outs, I trust my tape, knowing I can make slight adjustments when installing parts and panels. For anything trickier, I make a template using 1/8-in. plywood (see p. 32).

Accuracy is key—you need every edge to come out plumb, level, and square. I use a self-adjusting laser level for this, plus large squares. For end-to-end cuts across an entire panel (or stopped cuts, which end at a cut already made) you can snap porcelain slabs like glass. The first step is scoring, which is done with a tool that rides on a rail that attaches to the tile with more suction cups, the big-slab tilesetter’s best friend. You just line up the scoring point with your layout marks, lock down the cups, and scratch a line across the slab. One thing I learned early on is to wet the suction cups slightly before switching them on, so there’s no chance they’ll shift.

After scoring the slab, fracture it at each end of the score lines using small pliers designed for the job. Apply pressure until you hear or see a faint crack (you’ll almost always hear it). The overhanging offcut usually breaks as you snap the second end, so be sure someone is supporting it. Sometimes I have to return to the first end to use the snap pliers there again, but once the score line snaps, the break usually happens all at once simply from the weight of the tile or with a light push downward.

For inside corners and cutouts, with cuts that need to stop at a precise mark, I use the Raimondi Power Raizor plunge saw, which rides on the same rails the scoring system uses. It uses a diamond wheel to make cuts in a single, slow pass.

I like to miter outside joints, wrapping the marble veining around the corners for a seamless look. While the Power Raizor can tilt to 45°, I find that it’s quicker and cleaner to cut miters by making a square snap cut or plunge cut first, and then creating the miter freehand with a grinder and diamond wheel, using the square edge as my guide and cutting the miter a bit beyond 45° to ensure the joint comes together tight on the show side.

A big payoff

As with any large-format tile, a leveling system is required when installing porcelain slabs. For flat walls, I like the broad pressure



TEMPLATE BASICS I build slab-tile templates the same way countertop installers do, using thin plywood strips, with a dab of hot glue attaching each to the substrate and a glob attaching each strip to its mates. At outside corners, where I miter the slabs, the template extends past the substrate by a bit more than the thickness of the tile, leaving room for thinset behind the adjacent piece.

TEMPLATES AND PLUNGE CUTS

For complex layouts like this bathroom-fireplace surround, it's best to make templates, just like when preparing to install countertops. But unlike cutting to length and width, cuts in the center of a slab require a different procedure.



TRACE THE PATTERN After snap-cutting the panel to the right overall size, I align the template on it and trace inside the perimeter of the cutout with a pencil.



DRILLED HOLES RELIEVE PRESSURE To prevent cracking at the corners of a center-slab cutout, drill a hole at each corner before making any cuts. I use diamond-core bits—between 1/4 in. and 1/2 in. in diameter—which I keep on track using a simple wood jig, and keep lubricated with water squeezed from a sponge.



SPECIAL SAW FOR PLUNGE CUTS

The Raimondi Power Raizer plunge-cutting attachment rides the same rails the scoring unit does. Plunge cuts are made slowly, in a single pass.



CLEAN UP THE CORNERS

Working from both the show side and underside of the slab, use a 4-in. grinder to square the rounded corners left by the drill bit.



CUTOUT COMES FREE Use suction cups to carefully lift and remove the waste, exposing the cut edges for the usual mitering and cleanup prior to installation.



TIP IT IN For small panels like these, I find it easiest to set the bottom edge in place and then tip the slab against the wall.



TIGHT MITERS FOOL THE EYE Tight miters and matched veining make this fireplace surround look like a thick marble slab. After attaching the return with thinset, I wrap blue tape across the miters to draw them tight, and later fill the grout line with color-matched silicone to allow the framing to move slightly.

of a clip-and-wedge system, like Acufloor leveling spacers. When the floor has a number of angled planes, I prefer the spinner type, which have a smaller footprint.

Panel manufacturers recommend $\frac{1}{8}$ -in. grout lines between slab tiles in the field, and a $\frac{1}{8}$ -in. space where they meet adjacent surfaces, such as inside corners. In my experience, $\frac{1}{16}$ in. is enough between panels, but I stick with the recommended gap at the adjacent edges to allow the framing to expand and contract, especially in a humid bathroom. Those corners get silicone caulk for the same reason, color-matched to the grout used in the field—but avoid silicone sealant between panels, as it tends to hold dirt. Epoxy grout is a better choice for field joints.

I can do a standard porcelain-tile installation for about \$25 to \$35 per sq. ft., including all necessary materials, backer and water-

proofing systems, and installation. Large-format porcelain tile, with pieces 2 ft. by 4 ft. in size, will land somewhere around \$35 to \$55 per sq. ft., altogether. The porcelain slabs we're talking about here will be in the neighborhood of \$65 to \$80 per sq. ft.—a significant jump in price, but still less than I need in the budget to install quarried stone, which typically lands at about \$100 to \$125 per sq. ft. here in the Pacific Northwest.

And once I tell my clients that they can say goodbye to cleaning miles of grout joints, have the look of true marble at a fraction of the cost and maintenance, and be kinder to the planet in the process, big-slab tile is an easy sell. □

Joshua Oduin is a builder, remodeler, and tilesetter in Portland, Ore. Photos by Asa Christiana.





High-Strength, Long-Life Lap Siding

A carpenter's guide to accurately laying out, cutting, gapping, and fitting engineered-wood clapboards

BY BEN BOGIE

In the United States, there's probably no more quintessential siding material than clapboards. Once hewn from logs and later sawn, clapboards were one of the earliest things used to clad American homes. Also known as lap or beveled siding, clapboards have pretty much always been a higher-end cladding. In the colonial era, if a homeowner couldn't afford to cover the whole house in claps, they'd at least try to cover the front, and then clad the back and sides in cheaper cedar shingles. The size of the clapboards also said something about the wealth of the owners—the bigger the exposure, the more expensive the material.

The look is so archetypal that it has been simulated in nearly every kind of cladding that has come since, from aluminum and vinyl to fiber cement and fly ash. One of the better ones to show up—both in terms of its durability and ability to mimic the real thing—is lap siding made from engineered wood.

This isn't to say engineered wood siding has always been great—an early version, LP's Inner Seal, had issues that led to a class-action lawsuit. Their follow-up version, SmartSide, was launched in 1997, and has been on the market and on homes long enough now that we can be confident in its longevity. And with that confidence comes popularity—at least among the builders I speak to.

The lap version of SmartSide is a lot stronger than its fly-ash and fiber-cement rivals—a single person can carry a board or bundle over their shoulder without worrying about whether it'll snap in half. Because it's wood—basically a high-grade OSB with resins, waxes, and treatments to fend off water and rot—it cuts with standard wood blades, and you don't need to take additional precautions for silica dust.

If there's a downside to its strength, it's that it can be incredibly hard to hand-nail. To ensure pieces stay where they're supposed to while fastening, a nailer is pretty much necessary. Pay special attention to the nails—LP requires a minimum .113-in. shank, 8d



**PARTY IN THE FRONT,
BUSINESS IN THE BACK**

Resins, waxes, zinc borate, and a water-resistant overlay protect the strand substrate of LP SmartSide from water and decay.

INSTALLATION BASICS



Saw setup. Use a dialed-in miter saw with a finish blade and long extension tables to make crosscuts. The extension tables double as surfaces for rip cuts made with a track saw.



Start and gap. Before installing the first course, and above windows and other long horizontals that break up siding courses, install a starter strip of siding material roughly equal to the height of the overlap between courses. Use $\frac{3}{16}$ -in. spacers at the ends to keep the courses spaced evenly from the corner boards, and install the first course $\frac{3}{8}$ in. above the water table (if present).



Keep it down. Nail at least $\frac{3}{8}$ in. from the ends and at least $\frac{3}{4}$ in. down from the top edge of the siding, but not so far down that the next course won't cover the nail head. An offset attachment for the nailer, like this EZi-Gauge, makes it easy to get the spacing consistently right. Siding gauges keep the course exposure even.

Avoid math. Pull measurements using spacers that account for the gaps at both ends of the siding, and read the tape where it crosses the spacer rather than the trim. For accuracy across the crew, use composite shims, which have an even thickness along their length (save for the tips), as spacers. Here a $\frac{1}{4}$ -in. and $\frac{1}{8}$ -in. shim are taped together.



hot-dipped galvanized nail with a .297-in.-diameter head, which is a special-order item in my neck of the woods.

Unlike original clapboards (or fiber-cement or fly-ash versions), SmartSide isn't beveled across its width. There is an obvious face and back, but no top or bottom—both edges are essentially the same. That means if one edge gets a ding, you can just flip it around and hang it with the good edge down. But it also means that the bottoms of courses get kicked out more than with traditional claps. You need to use minimum $\frac{5}{4}$ trim to prevent the bottom edge of the siding from sticking out past it. To keep the kickout angle constant, a starter strip under the first course is essential.

Another difference between this and solid-wood siding is the way you have to gap it. Because this is made from strands of wood, it has

the potential to shrink and expand in all directions, while solid wood tends to move most tangential to the grain. While it's best practice to gap solid-sawn claps at the ends and around penetrations to provide a space for sealant, SmartSide requires $\frac{3}{16}$ -in. gaps anywhere it butts into something—including butt joints between pieces of siding. As with any horizontal siding application, we stagger butt seams at least two studs away from each other and avoid creating a pattern with the seams.

A lot of what can make or break a lap-siding job is done long before any trim goes on. On a blank wall, it might not be obvious to the eye that windows are set at different heights. But if it's clad in lap siding—or any other material that runs horizontally—even minor inconsistencies will be highlighted. We want the placement



Leveled out. Check for level periodically to ensure everything stays on track. The siding gauges should keep everything parallel, but slight mistakes can easily compound if not caught.



Mind the gap. Use $\frac{3}{16}$ -in. shims to check the gap on both ends before nailing. Use the same shims to gap butt joints between pieces of siding.



Nailing cutouts. Where siding is cut to fit under windows, face-nail 8 in. o.c. using the same 8d nails used for blind-nailing. Flush nails can be painted; overdriven nails need sealant.

of electrical-outlet boxes, sconces, hose bibs, and other penetrations to look intentional, so we make sure that they appear in the same siding course.

The SmartSide installed in this article is the 76 Series Smooth Finish Lap (8 in.). The standard version comes preprimed, but we had it custom-painted as well (LP also has prefinished options).

Set the course

There are two major schools of thought when it comes to laying out lap siding. The first is to lay out the courses on each wall so that they line up with the door and window trim, which usually requires adjusting the exposure of courses as you go up the wall. The eye typically has a hard time picking up these differences. On old New Eng-

land houses, which usually started out as rectangles with no inside corners to speak of, this approach was long considered the “right way” of doing things.

But with more complicated buildings, especially ones with varying window and door sizes, this is next to impossible to achieve while maintaining the continuity of courses around corners. Unless things were planned to a T, it’s unlikely that the courses on one wall will wrap neatly around to the neighboring wall while falling perfectly in line with windows and doors. Corner trim can disguise minor discrepancies at outside corners, but inside corners are another story—trim there is usually narrow, so it’s obvious when the courses don’t line up.

For these more complicated situations, the approach I use is what I call “set it and forget it.” The most basic example of how this works

MARKING IN PLACE



Gap penetrations. To accurately mark for penetrations, position the piece of siding, then align a $\frac{3}{16}$ -in. spacer flush with the penetrating obstacle, and mark on both sides with a knife.

Mark for cutouts. For penetration cutouts in the center of a piece, position the panel, then mark the sides. Measure up from the bottom of the course's reveal to the penetration, subtract $\frac{3}{16}$ in. from the measurement, and mark it on the siding. Measure the height of the penetrating obstacle, add $\frac{3}{16}$ in., and make a mark for the top cut. Connect the lines with a straightedge, drill a relief hole to allow access for a fine-tooth jigsaw blade, and make the cutout.



is this: Simply measure the distance from the bottom of the wall to the bottom of the frieze or soffit and divide this measurement by your desired exposure. You're likely left with a fraction. You can either round the number you get up or down. If the fraction is under $\frac{1}{2}$ in., I usually round down. If it's $\frac{1}{2}$ in. or greater, I round up. This rounded number is the number of actual courses you'll install. To get the actual exposure, divide the height measurement by the number of courses.

Here's an example: Say you have 8 ft. from the top of the water table to the bottom of your frieze. You have 8-in. lap siding, and the manufacturer requires at least 1 in. of overlap. So 7 in. is the maximum exposure. Divide 8 ft. by 7 in., and you get 13.714 courses. Round that up to 14. Then just divide the wall height by 14, and voila, you have your exposure—in this case $6\frac{7}{8}$ in. when rounded to the nearest $\frac{1}{16}$ th

of an inch. Use the same exposure all the way around the house, and all corners will match up.

This method sounds easy, but it can be time consuming because pieces have to be cut to fit around door and window openings rather than simply adjusted up or down.

Installation basics

We use a laser level to establish control lines early on in the build, and use them to ensure the soffit is set level around the building. The control lines later get buried behind the peel-and-stick water-resistive barrier, so they aren't visible here, but the soffit is. The soffit becomes the reference point for everything else that sits level, including the water table, which goes up before the siding. Corner trim—both



Rip and jig. Use a track saw for long stopped cuts, but finish them up with a jigsaw to avoid overcutting. Use a square to guide the jigsaw for crosscuts to finish the cutout.



Mark for trim. When marking siding for cutouts around window aprons, simply hook composite shims over the siding and mark the siding on both sides of the window. To get the depth of the cutout (or, rather, how much of the siding remains after making the cutout), set a scrap of siding into a pair of siding gauges, mark the bottom of the apron on the scrap (again, using a spacer), then measure up to the mark. (Alternatively, put a siding gauge in place under the trim, hold a shim against the trim, and measure from the shim to the seat of the gauge.)



Cut, then mark. When fitting pieces between oddly shaped obstacles or trim, cut the piece to its longest dimension first, then use gauges to hold it in place while marking the cutout. The same trick can be used to mark both ends.



inside and outside—needs to be plumbed in both directions, and also gets installed before the siding.

We snap level lines as reference for the top of the first two courses, but from there on, we use siding gauges to help keep everything on track. The ones used here, from SoloSider, are adjustable in $\frac{1}{16}$ -in. increments and hold pieces of siding in place at the correct exposure while marking for cutouts and nailing (for more, see p. 23).

SmartSide should always be blind-nailed into studs with each course lapping the previous by at least 1 in. Maximum nail spacing generally depends on the thickness of the siding—for $\frac{3}{8}$ -in. siding, it's 16 in. o.c.; for $\frac{7}{16}$ -in. it's 24 in. o.c. It can't be used in contact with masonry, and must be at least 6 in. above grade, but only has to sit 1 in. above the roofline, which makes for a clean transition at sidewall terminations.

Sealant is another big consideration. Anything that exposes the wood-strand core needs to be sealed. LP makes moldings that seal butt seams, but otherwise, all gaps, cuts, and exposed overdriven nails need to be sealed with an exterior elastomeric sealant. LP requires sealants that meet ASTM C920 and are a minimum of class 25—meaning they can stretch or compress one-quarter of the joint width. Higher classes can stretch and compress even more. We did this installation in late winter, but when it's warmed up enough, we'll come back and fill all of these joints and cover exposed nail heads under windows with color-matched OSI Quad Max. □

Ben Bogie is a lead carpenter with Kolbert Building in Portland, Maine. Photos by Matthew Millham, except where noted.

Set for Life

A compact new build takes cues from boat design to create a long-term, low-maintenance home

BY KILEY JACQUES

With an eye toward retirement, the owners of this quirky, Craftsman-inspired abode on Orcas Island, Wash., visualized a getaway cabin that would ultimately become their year-round residence. Accustomed to sailing, they are at ease in efficient, compact spaces, and they wanted their new house to be similarly organized. The empty-nesters worked with Stoltz Kau Architects to plan a long-term, low-maintenance, and highly livable home with lots of personality.

Finding adequate space for guest accommodations and storage in the 1585-sq.-ft. envelope topped the list of priorities. “They were looking to us for guidance on downsizing,” says principal Susan Stoltz. “They wanted to be comfortable just the two of them, but they also wanted to be able to invite their kids and guests—essentially they wanted to have room to absorb people. That was a fun challenge for us because we enjoy maximizing every square inch of a project.”

Strategies and opportunities

Believing built-ins are “the classic space saver,” Susan and her partner, David Kau, incorporated them throughout the house. There are single built-in bunks in the living room and bedroom, plus a double in the library. The design makes use of the space beneath the library—a half-level up—where a storage area is tucked behind a swinging door that also serves as a bookcase. In the study, waist-height bookshelves add storage space without overpowering the room, and there are trundle drawers beneath the built-in beds. Rolling barn doors at the top stair landing convert the open-concept library into a private space, and there’s an outdoor platform designed for a tent to be set up during warm months. In sum, the house can sleep six extra people.

Of course, all of these built-ins needed to be custom-made. They are the result of a collaboration between Steve Diepenbrock of Morningstar Builders and Mark Padbury, a cabinetmaker and former boat builder. Steve describes the main room’s built-in as a tight-squeeze scenario. Along the western wall, which measures just 16½ ft., they included a media cabinet, a 6-ft. daybed, and a woodstove. To compress these features, they needed to locate the woodstove as close as possible to the corner of the room. However, International Mechanical Code 308.6 prohibits installing a woodstove within 36 in. of a combustible surface. To skirt the issue, they surrounded the stove

SPECS

Bedrooms: 1

Bathrooms: 1

Size: 1585 sq. ft.

Location: Orcas Island, Wash.

Architect: Stoltz Kau Architects,
stoltzkau.com

Builder: Steve Diepenbrock,
Morningstar Builders

Cabinetmaker: Mark Padbury





Creating character. The design incorporates items salvaged by the homeowners, including antique windows, a wood column, and a porthole.

with fieldstone with a 1-in. air gap behind it. To vent the air gap at the wood mantel, they split it into two pieces. Where the stove pipe required minimal clearances, they swapped out portions of wood with a steel detail.

So that someone sitting in the daybed would feel connected to the outdoors, the team aligned the windowsill with the height of the daybed and dropped the level of the finished floor closer to grade. To do that, they hung the floor joists off ledgers attached to the foundation, which made it tricky to bring plumbing and electrical from the crawlspace into the perimeter walls. The issue was addressed using chases in the concrete and by taking advantage of the toekick space to snake wiring up and over the stem walls.

Of the three-feature built-in, Steve says, “Keeping track of it dimensionally and tying it all together with trim details was pretty specific. The tighter the space, the less room for transitions. Things land on each other very quickly.” He also notes the large number of windows in the house meant that many of the seismic shear walls required extra layers of plywood, as well as a thicker 3x sill plate to allow for shear nailing.

Delineating the house

“The house is an assemblage of components that were built for specific purposes,” says David. The architects stacked multiple volumes in a small footprint, each of which relates to the site. “Every dormer and window you see is a response to something outside,” Susan explains. For instance, one dormer looks out at Glacier Peak, part of the Cascade Mountains, while another is aligned to view a cove. “It was designed from the inside out,” she says, noting that the form was of less concern. “The design was driven by the function of the spaces and the overall site. We let the form evolve organically.”

Contributing to the unusual form is the wide variety of Loewen windows. Each was chosen to maximize the views. The decision to leave them void of trim was a way to smooth out the differences. The designers used contrasting materials on the exterior to differentiate the skin of each volume—a move that prevented it from becoming a “blob of a home.”

Some materials were chosen with maintenance in mind. The great room’s exterior, for example, is clad in Hardie board, which is easier to access and repaint. “When it comes to downsizing for retirement, we are always



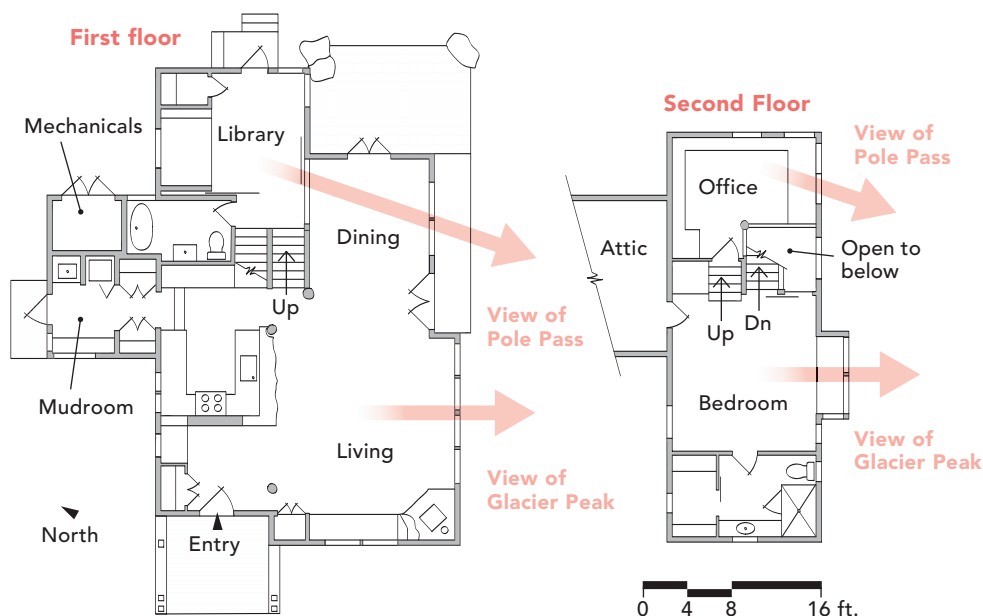
Three-feature unit. The entertainment center, full-length daybed, and fireplace come together in compressed style.



Finding space. Built-in bookshelves open to reveal extra storage space beneath the stairwell, which leads to the library/private guest room.

BUILT-INS AND BEAUTIFUL VIEWS

Rooms are oriented and organized to capitalize on the spectacular Orcas Island views. Each space is constructed to work on multiple levels, and maximized storage options keep the small house from feeling cluttered.





Double duty. The bedroom built-in features a clever venting system that can be opened or closed to either allow or block heat from the woodstove below.



“While an empty nest needs to feel comfortable for just one or two people most of the time, families hate the idea of not having a place for kids and friends to stay.”

—Susan Stoltz, Stoltz Kau Architects

thinking about maintenance and how we don’t want people on ladders,” says Susan. To that end, they used untreated cedar shingles for the main volume’s upper-level exteriors. “You don’t have to do anything to cedar shingles for 40 years, and then you can take them off and compost them.”

In the same vein, a large percentage of the building materials are recycled and recyclable. This is in keeping with the island population’s commitment to environmental stewardship. Additionally, the European woodstove is the primary heat source and meets Washington State’s strict emissions code. Plus, only native wood species were used—cedar and Douglas-fir logs were salvaged from the site; local western maple was spec’d for the floors despite eastern maple being a harder wood; the kitchen cabinets are alder, a common Northwestern tree; and the kitchen countertop was made from a wind-felled elm tree salvaged from nearby Woodland Park Zoo.

Showcasing unique details

To personalize their home, the clients wanted to incorporate things they had collected over the years into the structure. The wood column in the office, for example, is made from a log the owner found while boating; it was a Herculean effort getting it to the island. The two leaded interior windows between the master bedroom and the office are another pair of finds. They bring in light for the light collector that runs through the house. The original intent was to use salvaged interior doors, but the challenge of hanging them led to the decision to use barn-style and pocket doors, which are also valuable space savers.

In historical boats, it’s common for stair treads to double as drawers. Similarly, in the bedroom built-in, each tread is aligned with a dresser drawer, which makes them read as one unit. Other boat-inspired details include the bookshelf wainscot in the office and the turned-wood finger holds and drawer pulls.

Of note, too, is the vent beneath the bedroom built-in, which was designed to let in heat from the woodstove below.

In addition to weaving in many custom details, Susan and David found ways to belie the home’s small stature. They used corner windows and a corner barn door to direct the eye along the diagonal, which makes a room feel longer and wider. Likewise, they went with white trim around the windows, which makes each room look bigger than if they had used a contrasting wood trim. “Your eye stops around a wood frame,” explains Susan, “whereas if it’s white and blends in with the wall, your eye goes out the window.”

All told, this house is set to serve its occupants on multiple levels—as a getaway, as a writer’s studio, and as an eventual retirement destination. □

Kiley Jacques is design editor. Photos by Taj Howe, courtesy of Stoltz Kau Architects, except where noted.

Site-Built Deck Railings

Stout connections and a simple design turn decking and 2x4s into a safe, handsome feature

BY MIKE GUERTIN

A custom, site-built railing sets your work apart, and it doesn't take much more effort or materials than an ordinary one. The design I worked up for this small deck uses #1 western red cedar for the 4x4 posts, and #2 western red cedar for the 2x4 horizontal rails and the 5/4 decking for the cap rail and balusters. Clustered in groups of four, the balusters have about 1 in. between them. The wider space between the baluster groups adds interest and is just under 4 in. to comply with the building code. (The maximum opening in a railing must be smaller than 4 in., and the railing must be at least 36 in. above the decking surface.) The horizontal space between the upper rails adds character without requiring many additional materials.

When tested at Virginia Tech about 15 years ago, a lot of common ways of attaching railing posts to deck frames failed to meet the 200-lb.-load code requirement with the 250% safety factor included in some codes. Consequently, when I mount posts, I integrate blocking carefully and fasten it correctly. The FlatLok and ThruLok screws used here are made by FastenMaster. The company also publishes the post details, which it claims meet the IRC's load requirement.

Finally, because water is the enemy of any wood railing, I implement several details to help minimize its effects. □

Mike Guertin is a remodeler and custom-home builder in East Greenwich, R.I., and an editorial adviser to *Fine Homebuilding*. Photos by Andy Engel, except where noted.



POSTS ON A CORNER

FastenMaster's post-connection details require screws or bolts to be installed in specific spots, typically 2 in. from the top and bottom of the joists and 1 in. from the edge of the post. (The company has additional fastening information on its website.) I often make simple plywood templates with fastener locations on them to streamline the layout. When fasteners enter from perpendicular sides, the templates also help to place them at different levels so that they don't meet in the middle. A plywood box (shown here), built about $\frac{1}{8}$ in. wider than the posts and clamped in place, holds the post at the right height during installation.



Secure the rim joist. Screw the rim joist into the ends of the joists on each side of a post position with 6-in.-long FlatLok screws. Normally these fasteners don't require pilot holes, but I use them at these end locations to keep the rim joist from splitting.



Slope the tops of the posts. To give the cap railing a slight pitch while keeping it level enough to put a drink on, bevel the tops of the posts 3°.



Add 4x4 blocking. Bolting into a block rather than just into the post places the bolts farther back along the joist. This reduces the chance that levering on the post will make the bolts split the end of the joist and cause a railing failure. Fasten 4x4 blocks cut the same height as the joists with two ThruLoks in each, driven 2 in. from the top and bottom edges of the framing. Then drive longer ThruLoks through the end and rim joists, post, and blocking.

POSTS ON AN END JOIST

To securely mount a post to an end joist, use blocking to tie the end joist to the first joist inboard. As with the corner post, a 4x4 block is bolted behind the post, in this case to reduce the chances of the bolts splitting the 2x blocking if the post is subjected to a heavy load.



Tie the joists together with blocks. Spaced with a scrap of post material, screw two blocks of joist material between the outer pair of joists using 6-in. FlatLoks.

Back up the post with a 4x4 block. Cut to the height of the joists and positioned between the 2x blocks behind the post, the block is secured to the end joist and post with ThruLoks.



Tie the assembly together. A pair of ThruLok bolts locks the 4x4 block between the 2x blocking to reinforce the post.

POSTS ON A RIM JOIST

This post could be placed anywhere between two joists. The rim joist is attached to these two joists with two 6-in. FlatLok screws in each. Blocking behind the post and parallel to the rim is reinforced with more blocking screwed to the joists themselves with 3-in. decking screws.



Tie the joists together. Using 6-in. FlatLok screws, secure a piece of blocking to give the post lateral stability.



Screw the post to the rim joist. A pair of 8-in. ThruLoks tie the rim, post, and blocking together.



Add backup. Fasten 16-in.-long 2x blocks behind the blocking sandwiching the post to resist outward forces. Here, a block is marked for notches to clear the ThruLok nuts.



No-drill bolts

FastenMaster's ThruLok bolts can substitute for 1/2-in. galvanized bolts in many deck-building applications. They're pricier than common bolts but far faster to use. Simply drive the ThruLok through the framing members like a screw. No pilot holes are required. When the fastener protrudes from the far side but is not fully driven, thread on the special nut, and finish driving the fastener. The nut will pull tight as the screw is driven.

ASSEMBLING THE RAIL SECTIONS



To ease matching the baluster spacing between sections, the posts on the outside of the deck are spaced equally, as are the posts along the end of the deck. But the distance between the outside posts differs from that between the end posts by about 2 in., so there are two different baluster layouts. The first step in laying out the balusters is calculating the

spacing for the longer railing sections. This involves approximating the spacing and then fiddling with the numbers until they work out evenly.

To avoid a noticeable difference in baluster spacing between the railing sections, the spaces between the balusters are microadjusted to hide the 2-in. difference. To do this, I used a template made from 1-in.-wide ribbed nonroll elastic bought for \$3 at a fabric store. Because elastic stretches equally along its length, it can be used to lay out baluster patterns on rail sections of different lengths. It changes the spacing proportionately, growing or shrinking depending on the length of the piece being laid out, with no math required.



Mark the template. With one end pinned, stretch the elastic about 1 ft. longer than the longest rail. Relax it about 10 in., and pin the other end. Snap it a couple of times to equalize the stretch, then mark the ends of the longest rail and the baluster spacing.

MAKE THE BALUSTERS



Rip 5/4x6 decking in half. Since the balusters are only 25 in. long, they can be made from scraps and full boards too twisted for decking but fine when cut into short pieces. Ease the balusters' cut edges with a roundover bit in a small router.



Cutting 70 balusters calls for precision. A stop block on a miter saw helps to make repeated cuts quickly and accurately. Seal the end grain with Anchorseal (ucoatings.com), a wax-based coating that reduces water wicking and discoloration.





Transfer the layout. Pin the elastic to the shorter rail so that the end marks align with the end of the rail. Snap it a couple of times to equalize it, then transfer the baluster position marks.



Use a template made from aluminum coil stock to drill the rail sections. The two holes in the template are half the baluster thickness in from the edge. Align the template edge with the baluster-edge marks on the rails to center the holes in the balusters.



Assembly bench doubles as a jig. Spaced 24 in. apart, strips of 1/2-in. plywood raise the 2 1/2-in.-deep balusters 1/2 in. off the bench, aligning them perfectly on the 2x4 rails. Two 2 1/2-in. stainless-steel trim-head screws hold each baluster to each rail.

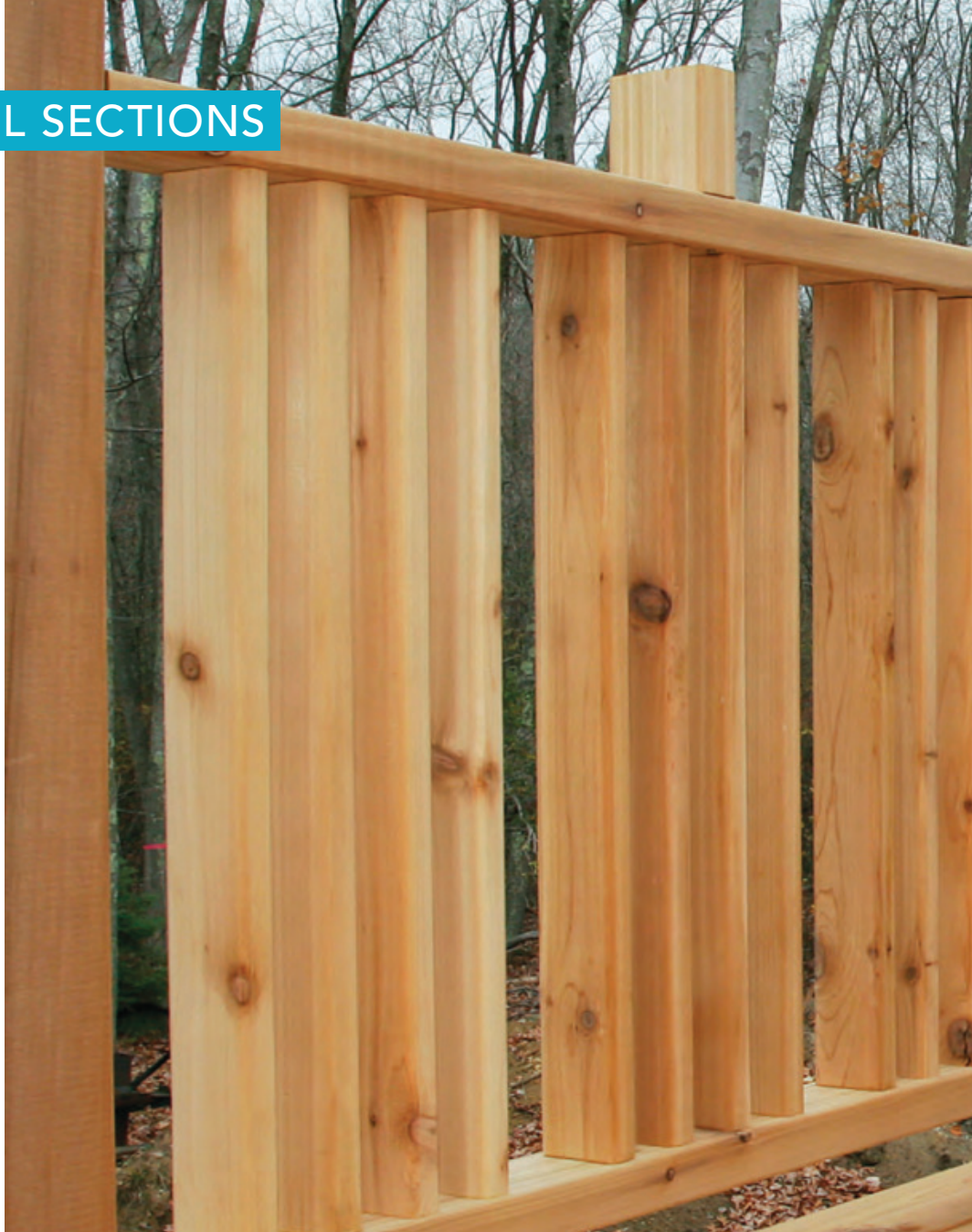
INSTALLING THE RAIL SECTIONS

I like to fasten the preassembled rail sections to the posts from below, hiding the fasteners and making it so that the screw holes won't collect moisture.

The 5/4x6-decking cap rail runs the length of each side of the deck and is screwed to the posts. Additional 2x4 blocking supports the cap rail between the posts and ensures that the railing height and the space between the cap and the rail below remain code-compliant. All the fasteners are stainless steel to prevent corrosion from weakening the connections and staining the cedar.



Drill the rails for toe-screws. The rails are screwed to the 4x4 posts from the bottom to hide the 2½-in. stainless-steel screws. Drill the pilot holes at about a 60° angle through the bottom ends of the rails.



Fasten the bottom. After removing the blocks spacing the rail off the deck surface, drive the lower screws. The clearance is tight, but a right-angle drill attachment helps to set them.



Screw the center blocks. To maintain the 4-in. spacing between the cap rail and the railing section below, fasten 2x4 blocks with 2½-in. stainless-steel screws. Like the posts, the tops pitch 3° for drainage.



Make the cap rail from straight decking boards. Because the tops of the posts are pitched slightly, the cap rail slopes outward to shed water. Screw the cap rail down with stainless-steel trim-head screws.



Fasten the top first. Spacer blocks hold the railing the correct height off the decking. A long extension helps to set the screws without the spinning driver marring the balusters.

Testing post connections

About 15 years ago, Virginia Tech's Frank Woeste tested common post connections, all of which failed before they reached the IRC's 200-lb. load requirement (plus the standard safety factor of 250%, which loaded the assemblies to 500 lb.). I approximated his methods to test my connections with FastenMaster's hardware and with 1/2-in. bolts. In my tests, all of the connections shown here met the 500-lb. load requirement.

I have not tested the railing-to-post connection, but smaller single screws resisted 1400 lb., and each section of rail is held in place by eight such screws.





Install a Whole-House Sediment Filter

Sturdy mounts
and a filter bypass
prevent problems
down the road

BY TOM CARDILLO

One of the most important parts of a home's plumbing system is also one of its most under-appreciated: the sediment filter. Optimally placed near the point the water service line enters the house, the filter prevents particles suspended in the water from reaching downstream appliances and fixtures, where sediment can clog and damage everything from showerheads and faucets to boilers and water heaters.

Unfortunately, many well drillers and plumbers skimp on sediment filters and their installation—if they install one at all. Putting

a filter in a spot where it's hard to service, or using a flimsy mounting system that flexes during filter changes, can lead to leaks. I've seen all of these problems in my service work, so I take extra care to make sure my whole-house filter installations are rock solid. I'm careful to match the filter system to the diameter of the main line so there's minimal loss of pressure and water volume, and I mount the filter at a convenient height so it's easier to maintain. Finally, I include a bypass so the water can be temporarily routed around the filter during maintenance and if the filter housing starts leaking. A leaky housing

PREP THE HOUSING

A trouble-free water-filter installation requires that the filter housing be rock-solid to prevent leaks when swapping filters. The process starts with installing a piece of $\frac{3}{4}$ -in. plywood large enough that you can secure the filter, filter loop or bypass branch, shutoff valves, and adjacent piping onto it.



LAY OUT THE LOCATION The filter must be installed so the inlet and outlet are horizontal, otherwise water will spill on the floor during cartridge changes, so for vertical water lines I use a horizontal loop. Mark the location of the filter housing, and lay out the loop about 12 in. to 16 in. above it.



USE NIPPLES, NOT ADAPTERS

To connect to the piping, use 3-in. brass nipples on both sides of the filter housing, and be careful not to overtighten because the housing can crack. Don't use male adapters, which have fewer threads than nipples and can bottom out before they're tight.



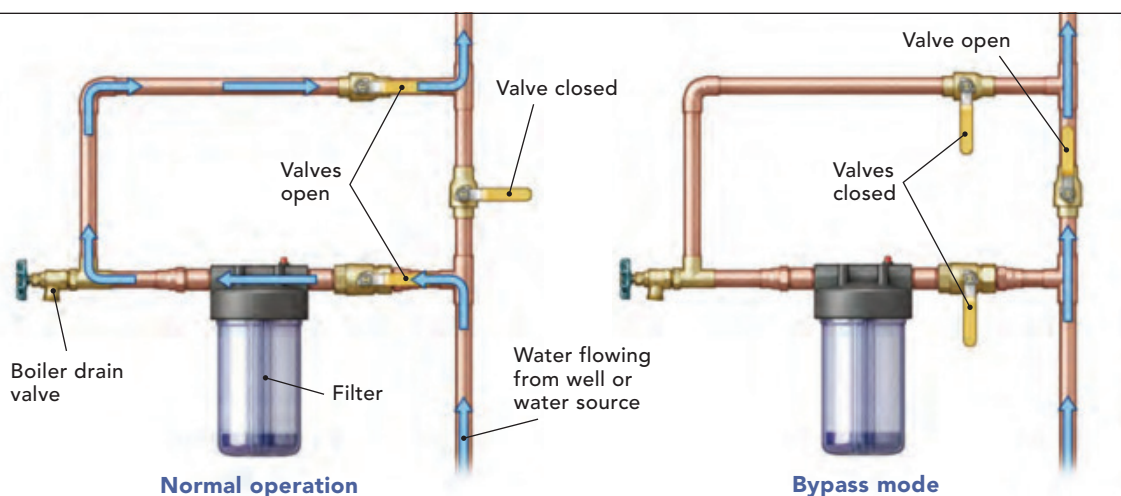
SWITCH TO COPPER Install a full-flow shutoff just before the brass inlet nipple. Use the same-size shutoff as the line coming in from the well or municipal supply to maintain volume and pressure. Though I use PEX in many other plumbing installations, I prefer the sturdiness of copper pipe for filter installations.



MAKE THE MOUNTS For a secure installation, use split-ring clamps and standoffs—made from threaded rod connected to two-hole mounting flanges—rather than the stamped-steel bracket sold by filter-housing manufacturers. Measure the filter housing and fabricate the standoffs to leave about $\frac{1}{2}$ in. between the widest part of the housing and the wall.

A BYPASS SYSTEM CUTS OFF PROBLEMS

When the unit needs maintenance or repair—to replace the cartridge or fix a leaky housing, for example—the water will have to be shut off. The filter can be bypassed by closing a shutoff valve upstream of the housing, keeping water flowing to the rest of the house.



BUILD THE LOOP

Once the filter is mounted, connect the filter piping inlet to the main line coming from the well or municipal service and then connect the outlet to the rest of the house's water system.



MOUNT THE INLET PIPING

Once the standoff length is determined, install the riser tubing on the inlet side of the filter housing. At the top of the riser, install a tee. One branch of the tee goes to the filter and the other branch is for the bypass. Bypassing the filter is reserved for problems, because the water will be unfiltered while the bypass branch is in use.



CHECK FOR LEVEL Level the housing in both directions before tightening the standoffs and the clamps that secure the housing. Once the inlet side of the filter piping is established and the fittings are soldered, move on to completing the rest of the filter loop and connecting to the rest of the home's water-system piping.



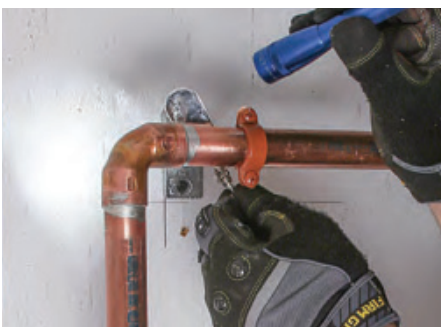
SWEAT THE CONNECTIONS

Sweat the filter outlet's female adapter to a short length of tubing before threading it onto the male nipple to protect the plastic housing from the torch's heat. Then dry-fit the rest of the filter loop before soldering the connections. The threaded elbow will get a drain valve later.



CHECK THE CLAMPS

After soldering all fittings, double-check that the split rings and mounting plates are fully tightened. Then make sure the assembly doesn't move when you tug on the filter basket with its special wrench.



CHECK EVERY JOINT Look around the entire circumference of every soldered connection to ensure the solder made it throughout the joint. An inspection mirror helps you see the back side of the fitting.



ADD A DRAIN The lower corner of the filter loop has a 3/4-in. female fitting for a boiler drain valve. The drain allows you to relieve the pressure and drain off some of the water before changing the filter.



LOW FLOW AT FIRST With the inlet valve just barely open, start filling the filter loop while listening for the gentle hiss of air that would indicate a leak. Increase the pressure as the housing and pipes fill with water.



HANG THE WRENCH Most filter housings come with a matching wrench to unscrew the filter basket. If your filter kit doesn't include a wrench, get one anyway—it's very difficult to change the filter without it. Hang the wrench above the filter so it's easy to find when it comes time to change filters.

is surprisingly common because the O-ring that seals the filter basket to the housing can be damaged when the cartridge is changed.

What kind of housing and filter?

Here I'm installing a Sterling HJ10-Clear filter housing. Its translucent basket allows homeowners to see a buildup of trapped sediment, indicating it's time to change the filter. I've found them to be very reliable, and local plumbing suppliers stock matching filters and O-rings. There are also multistage filters for capturing multiple particle sizes and for reverse-osmosis, as well as other types of filters for water with hard-to-remove contaminants. The only way to know exactly what you need is to have the water tested. Your local health department can usually offer suggestions for nearby environmental labs that test drinking water. You can also experiment with different micron ratings (for more, see sidebar, right).

This filter and most others have optional steel mounting brackets that screw to the top of the filter housing. The "L"-shaped bracket, which costs a few bucks, saves installation time, but it flexes when you have to remove a stubborn screw-on basket.

I've seen this flexing cause leaks where the threaded fittings screw into the housing. I've found that split rings and threaded standoffs commonly used in commercial plumbing are a stronger way to mount the filter.

Choose the right spot

As mentioned earlier, the filter should be mounted after the main shutoff and before any downstream fixtures or appliances. The exception to this is if you have an exterior hydrant or sillcock that will be used for irrigation or car washing.

The filter should also be mounted at waist level so it's easy to see and change. I've seen filter housings mounted on the sides of the floor joists because it's easier to put there than on a concrete foundation wall, but homeowners are less likely to change a filter if they have to get on a step ladder to reach it.

It costs a little more money to install a filter my way, but I think it's worth it to avoid the stress of leaks or turned-off water because of a problem filter. □

Tom Cardillo is a plumber in Coventry, R.I. Photos by Patrick McCombe, except where noted.

Which filter do you need?

The best way to know what kind of water filter you need is to have your water tested. Filters are rated by the size of particles they're designed to capture, so a 50-micron filter catches particles 50 microns and larger. Filters that trap smaller particles won't last as long as filters with a higher micron rating. Pleated-, string-, and carbon-filter cartridges each have pros and cons (see below). Most residential filter housings are either 2½ in. or 4½ in. in diameter and 10 in. or 20 in. long. Larger filter elements last longer (and cost more) than smaller ones, but some sizes are hard to find locally.

Pleated

Pleated filters have more surface area than string-wound or spun cartridges, so they can hold more sediment. They are commonly available in versions that filter particles from 5 to 50 microns. These filters work best with sediment particles of the same size. If the particles vary in size, smaller particles will slip through the filter and larger particles will clog the surface.



String

String-wound and string-spun cartridges are also commonly available in 5- to 50-micron versions and use two layers of filtration to catch sediment. The outer layer catches larger particles, and the inner layer catches smaller particles that slip through the outer layer. While better at filtering out a wide range of particles, these cartridges tend to have a shorter life.



Carbon

In addition to sediment, carbon filters trap odors, VOCs, and chlorine. They can also remove some unpleasant tastes. These cartridges are more expensive than sediment-only filters. Sometimes carbon filters are used in combination with an upstream sediment filter. The sediment filter catches the majority of the larger particles, so the more-expensive carbon filter isn't clogged prematurely.



Flangeless Windows Done Right

European-style windows sit within the rough opening and require a face-sealed approach to water and air management

BY JAKE BRUTON



Some of you may have taken the time to watch my video series with *Fine Homebuilding* about properly installing flanged windows in multiple assemblies. Those methods apply to most windows installed in the United States, but they don't apply to flangeless "European-style" windows, including the triple-glazed, tilt/turn windows preferred by many high-performance builders. This type of install is known as a "face-sealed system".

Of course, some of the fundamental principles are the same; shingle-style lapping, for example, is the right way to detail any window flashing, as well as using a back dam and creating a slope at the sill of the rough opening. Your walls may vary, but these principles will provide a solid starting point so that you can adapt the installation to suit your situation. The windows on the project shown here are from Schüco, though many European-style windows install similarly.

Locating the window in the opening

Over the past five years I have not built a home with walls that were less than 7½ in. thick. Most of the time that assembly includes 2x6 framing (5½ in.) plus ½ in. of drywall inside and 1½ in. of Zip System R-sheathing outside. Having this thick wall gives us an opportunity to make choices about how our Euro-style, flangeless windows are installed.

One option is to push the window outward in the assembly, but this presents more challenges for water management because the window is closer to the weather. Moving the unit to the interior face of the wall better protects the unit from the elements, but in doing so, also moves the unit away from the sunlight and the breeze—two reasons why we have windows in our houses in the first place.

The other factor that must be considered when positioning a window unit is the potential for creating a microclimate. If the window is placed all the way to one side within a deep wall (in this case, likely deeper than 7½ in.), you limit airflow in the window well on the opposite side, and this raises the risk of creating a zone that is different than the surrounding areas. This microclimate can create the right conditions for moisture accumulation in areas where you don't want it. For this reason, I typically locate the window in the middle. This limits the microclimate effect and maximizes the connection to the light, breeze, and views, all while limiting the window's exposure to the elements—

FLASH THE OPENING



DISCOURAGE WATER ENTRY AT THE SILL

Use a piece of ¾-in. stock to create a back dam and a rip of beveled siding to create a pitch toward the outside edge of the sill.



USE STRETCH TAPE

On the rough-opening sill, lap one continuous piece of stretch tape over the beveled siding and onto the back dam, extending about 6 in. up the sides of the rough opening.



WORK YOUR WAY UP For the sides and top of the opening, I use two parallel, overlapped rows of 4-in. seam tape, which is more readily available in my area than wider rolls. The sequence is sides, then upper corners (which are less vulnerable to water and can be sealed with short pieces of flexible flashing), then across the top. After all the tape is in place, press every square inch using a hard-rubber roller.



by which I mean primarily water, mostly in the form of rain.

Moving the window head into the middle of the wall is essentially like placing it under a small roof, limiting exposure to water. The top corners of windows are the most common places for leaks—but if it doesn't get wet, then it can't leak.

Preparing the rough opening

We add materials to the rough opening that the manufacturers haven't factored into their recommended rough-opening dimensions, and that means I need to frame our openings a little bigger than the standard. The dimen-

sions for your job will vary depending on your specific assembly. To do this efficiently and minimize room for error, I find it helpful to use a spreadsheet, set up so that I can enter the window size and use a formula to calculate our framed rough-opening dimensions.

If our budget allows, I wrap the rough opening with 7/16-in. Zip System sheathing to create a durable, easily executed connection between the exterior air barrier and the rough opening. This is the most important takeaway from window installation: The water barriers and air barriers must fully connect to each other. I prefer to use Zip System sheathing in the opening, especially

SET THE WINDOW IN THE OPENING



PERMANENT BLOCKS, TEMPORARY STOPS

To protect the sill flashing tape from damage and create a gap for insulation, nail small scraps of sheathing to the top of the back dam, giving the window a place to sit. Then add temporary stops to the sides of the rough opening to locate the window during installation.



DO THE TWIST The metal installation clips, which are attached to the window on-site, lock into the edge of the window frame with a twisting motion.

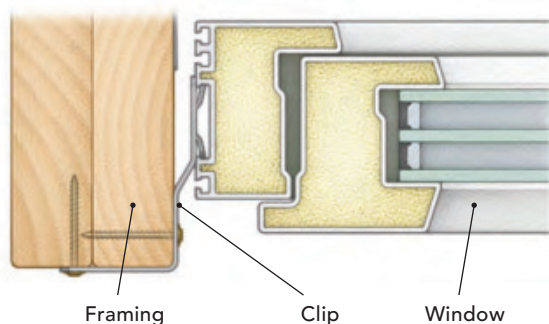


GET A GRIP

European-style triple-pane windows are heavy, so to protect your fingers and make lifting and moving easier, use vacuum cups that attach to the glass. We use cups from Wood's Powr-Grip, which sell for about \$80 apiece.



A PREPARATORY BEND To get the installation clips to sit nicely against the rough opening, first bend them toward the window, then back toward the rough opening, creating an offset.



when using Zip R-sheathing on the exterior, because it protects the exposed foam edge around the opening—but if the budget is more restrictive, like on this home, this same protection can be achieved using tape.

I use a rip of $\frac{3}{4}$ -in. stock to create a back dam on the rough sill, placed directly beneath the window, $2\frac{1}{2}$ in. from the face of the sheathing. In front of the dam I place a rip of cedar bevel siding to create a slope toward the exterior of the wall to encourage

any water that gets behind the flashing to drain to the outside. When you rip the cedar siding to width, always use the thickest edge, which provides better withdrawal resistance when nailed into place with short roofing nails. After our sill pan is built, the water-proofing process begins.

Time to start flashing

When dealing with multiple planes and angles, a fluid-applied flashing is best. It can

be pushed and dragged into nooks and crannies with ease. But needing to mask things off and wait on dry times means a stretchy flashing tape is a faster and more budget-friendly way to go. So, when the budget doesn't allow for a fluid-applied product, Zip System stretch tape is our choice. When using tape, be careful to protect it while the windows are being placed. A sharp window corner resting on the wrong plane during installation can cut holes in the tape.



CENTERED AND PLUMB Prior to fastening, adjust the window side to side as needed until the reveal is even, and verify that it's plumb.

As with most exterior assemblies, the waterproofing starts at the bottom of the rough opening and continues upward shingle-style. The first piece of stretch tape is cut roughly 12 in. longer than the width of the sill. I like to mark a centerline on both the bottom of the sill and the tape so I can align them easily. With the stretch tape, start in the center of the opening in order to better control how the tape is stretching to both sides. The stretch tape should lap about 1 in. or so

onto the back dam, wrap across the width of the cedar siding fastened to the rough sill, and turn downward and out onto the water-resistant barrier (WRB), which in this case is the Zip System R-sheathing.

When it comes to the vertical legs of the installation, I use two runs of Zip System seam tape. I prefer to use the 4-in. product because I already have the tape on-site for sheathing installation, wider tape is harder to get in my area, and I like the control you

can get with the narrow backer-free tape. Starting on the jamb side, the first row of tape sits entirely in the rough opening and is pressed mainly on the rough-opening framing. The second row of tape rests about 1 in. into the opening and then turns onto the face of the WRB, creating a durable connection (see photos, p. 59).

I treat the head a little differently than the sill—at the sill I'm very concerned about having joints that could fail, so I use one piece of stretch tape across the entire assembly. The head of the rough opening is much more protected, so I'm comfortable with joints in that location. I like to cut two 12-in. pieces of the stretch tape to detail each corner, and then I apply two runs of the 4-in. seam tape as I did on the jamb sides.

Once all this tape is applied, it is adhered with a hard-rubber roller in order to wet the tape in place. Remember, these tapes have a pressure-activated glue, and I can't stress enough the importance of this step.

Time to install the window

With the rough opening flashed, I place a couple small scraps of $\frac{7}{16}$ -in. sheathing at the outside edges of the sill, against the jamb sides. These little pieces allow me to check the sill for level and shim as needed, and then I can rest the window on top without fear of puncturing the flashing.

To ease installation, I use a trick borrowed from installing prehung, solid-jamb doors. Instead of attempting to hold the window in place inside the rough opening, I draw a plumb line up from the face of the back dam, which I know is where I want the face of the window to be, and mount temporary boards to create a stop. Then, when I lift the window into the opening from inside the house, I can simply push it tight to these temporary stops and it will be plumb. I fasten these boards with screws held close to the window so that, when removed, the screw holes will be covered by our final window tape.

The rough opening is now prepped and ready to accept a window unit. Depending on whether the Euro-style window is a fixed or operable unit, it will install with just metal clips or both clips and screws. The clips are attached to the UPVC frame on-site, and

SECURE THE WINDOW IN PLACE



TWO SCREWS WILL DO First, screw the clip to the inside of the rough opening, and then bend it around the face of the framing and drive another screw.



NO SHIMS NEEDED
For operable windows, fully-threaded “turbo screws” provided by the window manufacturer lock the frame in place, eliminating the need for shims.

I put one 6 in. from each corner, and then spaced less than 2 ft. in between those on all sides of the frame. Here’s a helpful tip: When mounting the clips to the jamb, bend the clip toward the window unit before bending the clip toward the jamb. The two bends together give the clip an offset that will help it lay flat after the screws are in place (see drawing, p. 60).

After the units are all hung from the clips, so-called “turbo screws”—fully threaded, roughly 3/16-in.-dia. by 6-in.-long screws—are driven through the interior window jambs into the rough opening through factory-drilled holes. The idea behind using a fully threaded screw is that the unit doesn’t have to be shimmed side to side because the threads grab the rough framing and window frame, locking everything into place. After

testing the window to make sure it is functioning properly and making any needed adjustments, it’s time for the final taping.

Face-sealed details

The tape I use for the face of the window is Siga’s Fentrim. It’s about 3 in. wide, has a fold with a 1/2-in. face that doesn’t have backing, and has a split backing on the rest of the width. This partial-backing design is helpful when applying the tape, but it can be difficult to cut with a knife. I have found that the best method for cutting the pieces I need is to use a large worktable and scissors. To determine the length of each piece, I measure the edge of the window I’m taping and then add 1 in.

To install it, I align the tape so that the backer-free 1/2-in. face laps onto the window and then press it firmly into place. This

allows the backing on the rest of the tape to be removed fairly easily by a single installer. Fair warning, though: This Siga tape has a very high initial grab, so it’s still finicky to work with. As usual, the sill is taped before the jamb sides and the top is taped last. Once all the tape is applied, I seal the corners, the most vulnerable area, with a bead of fluid-applied sealant.

I know some of you just panicked at the idea of taping the sill, which is often left open for drainage. I assure you, this is not the worst idea ever—I want the tape at the sill for air-sealing. While leaving the bottom of flanged windows open is considered best practice, when it comes to a Euro-style, flangeless window protected by the jamb at the head, I have much less concern about leaks. That said, part of the reason for choosing the

FACE-SEAL THE WINDOW



ONE BACKING AT A TIME Siga Fentrim flashing tape has a thin, unbacked lip and a split backing, so you can adhere the lip to the window first and then each half of the wider, backed leg to the sill one at a time for more control. Apply the unbacked lip to the window frame first, then adhere the remaining tape to the back dam and sloped sill.

Fentrim tape is that it's vapor-open, which means that if water does get behind the window, it will have an opportunity to dry. For this to work, it's important that when you add a bead of spray foam around the interior side of the window, you take care to not fill past half the depth of the jamb. This leaves a void behind the Fentrim tape, and the sloped sill keeps the water from seeping inward until it has a chance to dry to the exterior.

In short, there is no reason to be afraid of European-style flangeless windows. All it takes is a few minor adjustments to your current methods to have a properly water-managed assembly. □

Builder and remodeler Jake Bruton (@jake.bruton) owns Aarow Building in Columbia, Mo. Photos by Brian Pontolilo.



AS ALWAYS, PROCEED SHINGLE-STYLE Apply the same Fentrim tape up the rough-opening sides, then across the top, so that each layer laps over the previous layer, and then roll all of the tape.

A FLUID INSURANCE POLICY To give the transition between sill and jamb side added protection, I like to seal the corners with a bead of fluid-applied flashing, which I smooth with a quick swipe of my finger.

Build a Sturdy Shop Table

A gridded top makes clamping easy and keeps sawdust out of your way

BY PETER POLCYN

As a full-time cabinet and furniture maker, I work with a lot of plywood. I typically break the sheets down using a track saw, and finding the right surface to do this work has been a challenge. Over the years I tried everything from sawhorses to traditional workbenches, but nothing worked exactly like I wanted. I need a flat, stable, well-supported surface that won't collect sawdust and allows me to clamp boards and plywood anywhere. And it can't be too precious to cut into with a track saw.

A homemade grid-top shop table, which I call a "cut table," is my answer. I built my first about a year and a half ago. Because it was made primarily for track-saw use, the design included spots for the saw and tracks. The table worked well, but there were aspects I wanted to improve. This article follows the second iteration of my cut table, which addresses the limitations of the first version.

The biggest problem was that the table sagged a little in the 8-ft. direction, likely because it was only 4 in. thick. The new version has a 12-in.-wide apron to better resist sagging. In the first version, sawdust fell right on the floor. The new version has a sloping bottom that directs sawdust to collection bins on both ends to keep my work area tidy. Finally, I added enough on-board power to use several corded power tools at once. I'm really happy with the new table and it has greatly improved my shop and my workflow. If you do casework, I strongly recommend this as an option. □

Peter Polcyn is owner of Rail and Stile Custom Woodworks in Seguin, Texas. Photos by Colin Russell.

PREP THE PARTS

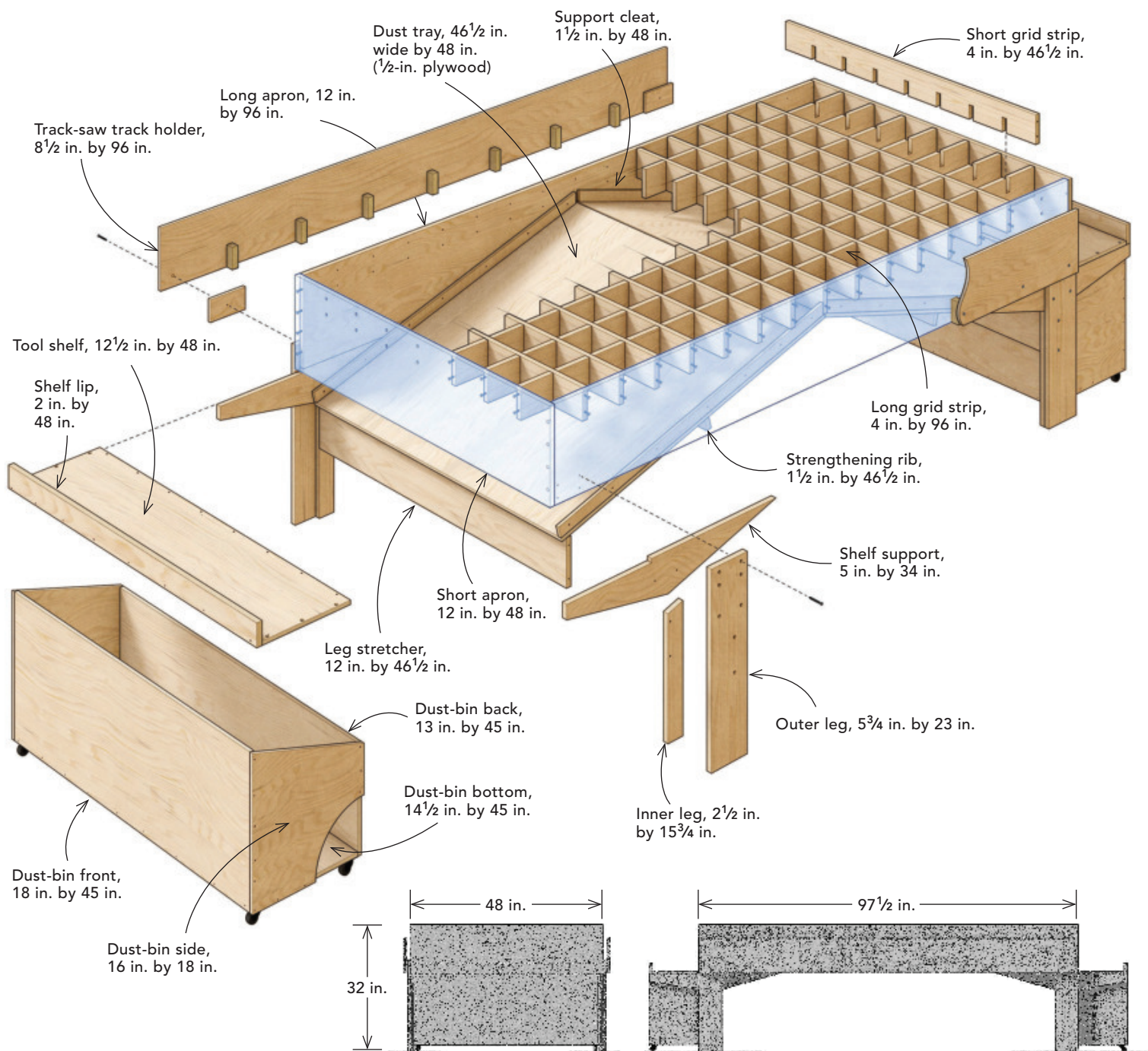
This shop cut table is made from three sheets of $\frac{3}{4}$ -in. 4x8 Baltic-birch plywood and one sheet of $\frac{1}{2}$ -in. 4x8 Baltic-birch plywood for the dust trays. Cutting the parts is the most labor-intensive part of the process—the rest is just screwing the pieces together. Start by stacking the $\frac{3}{4}$ -in. plywood flush, and trim one 8-ft. edge straight. Then separate the sheets and cut 15 4-in. strips with a track saw or tablesaw—these strips make up the top.



Align the strips. Use a square to line up the plywood strips. Snugged pipe clamps hold the strips in position, but allow them to be moved into alignment with hammer taps. Once the ends are flushed up, use clamps with full-width cauls to align the tops of the strips, tighten the pipe clamps fully, then remove the clamped cauls.



Notches come next. Lay out the half-lap notches for the grid's intersecting pieces 6 in. o.c., starting at the middle and working toward the ends. I use spacing blocks and a knife rather than attempting a precise layout with a tape measure and pencil.



Slice and dice.

Set the track saw's depth just shy of the full 2-in. depth of the notches, then cut both sides of each notch, make three or more additional cuts in between, and remove the waste with a chisel.



Flatten and split.

Use a router and jig to level the bottoms of the notches. Then cut eight of the pieces in half—do this by cutting both sides of the center notch. You will end up with 16 pieces (one will be extra), each 47⅝ in. long.

ASSEMBLE THE TOP

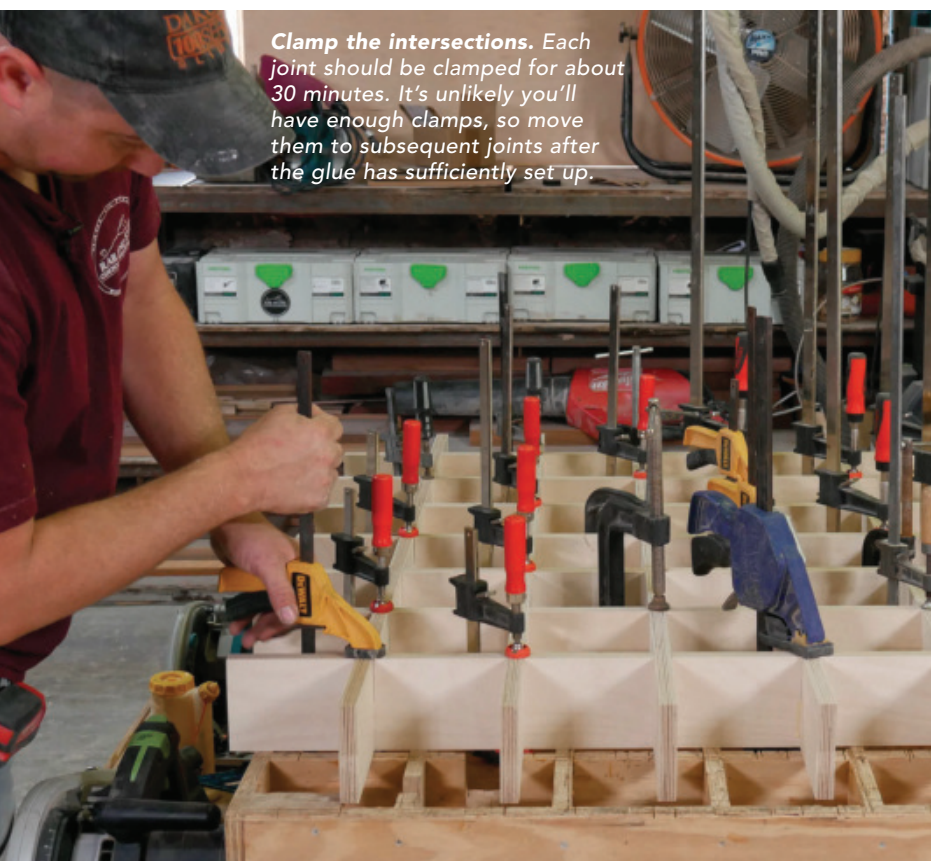
The first step in the assembly process is gluing the notched plywood strips into an intersecting grid. Once the intersecting pieces are fully assembled, the apron and legs can be attached to the top with screws.



Glue the grid. Dry-fit the parts to check the alignment, then glue them using a squirt of wood glue at each intersection.



Tap it in. Thump the overlapping pieces into place with a rubber mallet. Make sure the pieces are fully seated or the finished top will be uneven.



Clamp the intersections. Each joint should be clamped for about 30 minutes. It's unlikely you'll have enough clamps, so move them to subsequent joints after the glue has sufficiently set up.



Trim to width. The apron ends are made from 4-ft. pieces of plywood, so the assembly must be trimmed to that dimension. This can be done before glue-up, but trimming after assembly offers one last chance to ensure the sides are perfectly straight. It takes two passes to get through the 4-in. strips.



Add the apron. Tack the pieces of 12-in.-tall apron in place first, then fasten them with two countersunk 2-in. wood screws into the ends of each grid strip and four into each corner, keeping the screws at least 1 in. down from the top to protect sawblades when the table is in use.



Shelf it. Tack and then screw a 12-in.-deep by 4-ft.-wide storage shelf onto the bottom of the apron on each end. Support brackets are added later to prevent sag.



Cleats for dust trays. Plywood trays under the grid slope toward each end to funnel sawdust into collection bins. Dry-fit the trays on blocking first and trace along the bottom edge. Then attach cleats for the dust trays along these lines with narrow-crown staples and glue.



Install the legs and dust trays. Screw the legs to the apron and then attach the dust trays, made of 1/2-in. plywood, to the cleats. Finally, add 1/2-in.-tall strengthening ribs, made of 3/4-in. plywood, centered on the length of each tray and fastened with narrow-crown staples.

STRENGTHEN THE LEGS

A cut table is only as good as its base, which must be sturdy and resist racking in both directions to keep fasteners from loosening over time. I reinforce the legs with another layer of plywood and stretchers, and then use the nearly completed table to help build the dust bins.



Bolster and close. I attach $\frac{3}{4}$ -in. plywood brackets at the top of each table leg to serve multiple purposes. In addition to providing racking resistance, they also close the sides of the undertable dust trays and reinforce the tool shelves on either end.



Stretchers add sturdiness. To tie each pair of legs together, install 12-in.-wide stretchers at each end with $2\frac{1}{2}$ -in. wood screws driven through the legs into predrilled holes.



Beef up the legs. Glue and staple strips of plywood to the inside of the legs to add strength and transfer weight directly from the table to the floor.



THE RIGHT TRACK

A holder for my 118-in. track-saw guiderail is mounted on the side of the table, where the track is kept protected and within reach. The holder also acts as a support when I'm planing, sanding, and edge-profiling boards (photo left).



LESS MESS

The table's sloping bottom and the dust bins on both ends are game changers when it comes to keeping a neat workspace. In my opinion, effective dust management is the table's best feature.

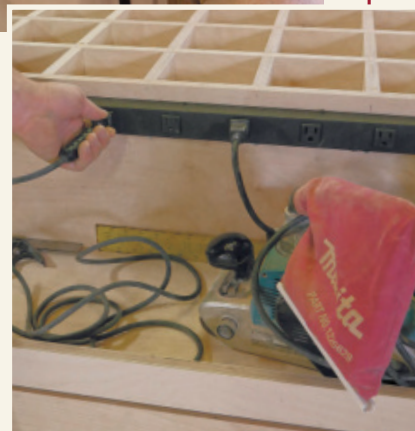
OUTFIT WITH ACCESSORIES

How you outfit the table depends on personal preference. Here's a look at how I customized my version.



POWER UP

A 4-ft.-long heavy-duty power strip with 12 outlets allows me to use a project's worth of corded tools without swapping cords, and means I rarely need an extension cord.



ONLINE EXTRAS

Go to FineHomebuilding.com/magazine to see a cut table assembly video and download a 3D SketchUp model.

HOUSES

ARCHITECTURAL CHALLENGES AND SOLUTIONS

BY DESIGN

CURATED BY KILEY JACQUES



SIMPLE SHAPE FOR PASSIVE HOUSE PERFORMANCE

Architect Bronwyn Barry uses this house as a case study when giving talks about Passive House performance. Not surprisingly, the deep energy retrofit included the addition of robust insulation, triple-pane windows, and a heat-recovery ventilation system, among other measures aimed at sealing up the leaky structure. All involved were on board with those decisions, but Barry had to fight to keep the existing low-slung roofline intact. Everyone—from the homeowners to the builder—wanted to add a dormer or a bump-out to the front roof slope to vary the shape. But Barry notes those features work against being able to deliver energy-efficient envelopes cost-effectively. She favors “boxy but beautiful” houses that benefit from their simple forms, which, she believes, are key to optimal performance yet are the hardest battle to win. Barry says it is an ongoing design challenge, which she meets with the argument that “crazy articulation” in the form of dormers, gables, and bump-outs undermine energy efficiency because of the many transitions, joints, and seams that need sealing when building more complex rooflines. She won the battle on this project, and it performs at near-Passive House levels.

Designer/Builder Passive House BB

Location Sunnyvale, Calif.

Photos Treve Johnson Photography, courtesy of Passive House BB





“Every time you add a dormer, you are adding seams, and seams always end up leaking because buildings move.”

—Bronwyn Barry, architect





BREAKING THE THERMAL BRIDGE ON STEEL BEAMS

To create a deep overhang for passive-solar shading and to support the cantilevered roof, the team at Paul Lukez Architecture spec'd steel beams for the longer spans. Steel was chosen over dimensional lumber to avoid a taller build—had they used wood, they would have needed much deeper members, which would have raised the house by up to a foot. In three locations the beams extend from conditioned interior spaces to outside the wall assembly, which means they carry the threat of thermal bridging. To create a break, the designers used Schöck Isokorb T Type S steel-connection modules, a German product insulated with expanded polystyrene that separates the interior structure from the exterior structure while transferring the load. Aesthetically, the exposed structural beams are meant to evoke the feel of a Japanese tea house. They also work to define the dining room and living area.

Designer Paul Lukez Architecture, lukez.com

Builder G Donahue & Sons

Location Harvard, Mass.

Photos Greg Premru, courtesy of Paul Lukez Architecture

SENSITIVE SCALE, MODEST MATERIALS

According to architect Peter Twombly, this project was influenced by a house designed by writer and naturalist Henry Beston, author of *The Outermost House*, which chronicles a season spent living on the dunes of Cape Cod. The new build took cues from the house that Beston designed, specifically its modest scale and pared-down simplicity. In contrast to the regional trend of razing old cottages in favor of elaborate mansions, this structure is actually smaller than the house it replaced.

Twombly says it was a challenge to achieve flood-zone elevations and provide water views over the dune while maintaining the low roof profile that the clients desired. The solution was to divide the house into small-scale, visually separate forms tied together with shared features such as shingles, shutters, boardwalks, and porches. The roof pitch was lowered as far as possible without sacrificing a traditional look, and a stone wall on the entry side reinforces the low profile and anchors the house to the site. To help obscure the flood-resistant pier foundation, Twombly used lattice panels around the base of the building.

Designer Estes Twombly Architects, estestwombly.com

Builder Fellman Brothers Builders, chathamabuilder.com

Location Chatham, Mass.

Photos Warren Jagger





“By making subtle adjustments to the grade, emphasizing horizontal massing, and keeping the roof pitch low, the scale of the house meets both code flood requirements and the owners’ criteria.”

—Peter Twombly, architect





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NEW AND NOTABLE PRODUCTS



CONTROL PANEL FOR CONNECTED HOMES

The Brilliant Smart Home Control is one of the most user-friendly systems available for managing all of the smart features in a house, and it sits neatly on the wall in place of a standard light switch. The compact touch screen seamlessly controls many of the popular smart-home brands available for lighting, doorbells, locks, climate, music, and voice assistants, including Ring, Hue, Ecobee, Kwikset, Sonos, and more—plus Amazon's Alexa is built right into the device. You can choose a model with just the touch screen or one that also includes two, three, or four touch-sensitive dimmer switches. Aside from the obvious smart features, each Smart Home Control can also display photos, show local weather, and function as an intercom between other Brilliant devices in the house. Prices run from \$300 for the touch-screen-only model up to \$450 for the four-switch version. —Rob Wotzak, *digital brand manager*



EASY FLASHING FOR HOSES AND WIRES

The most important aspect of home building is the control of water on the outside of our buildings. If we can't keep the building dry, then all those flashy finishes are doomed from the start. Wall penetrations for wires, pipes, and HVAC lines are consistently the most challenging details to flash effectively. You could try to use caulk or flashing tapes to seal things up, but Quickflash, a line of easy-to-use flashing products for pipes, wires, and structural components, produces an assortment of high-density plastic flashing panels that work much better. Each of the panels consists of a large flange, which gets integrated into the home's water-resistive barrier, and a flexible rubber grommet that forms a tight seal around whatever you're putting through the wall. There are a lot of different styles and sizes to choose from, and they can even be trimmed to size and painted to blend in better with siding and trim.

—Ben Bogie, carpenter



ONE-STEP WOOD FINISH

When it comes to choosing an ideal finish, Rubio Monocoat Oil Plus 2C checks off a lot of boxes. It's environmentally friendly, zero-VOC, easy to apply, and, best of all, applies color and protection in a single coat. The two-part formulation, oil and accelerator, is mixed together prior to application and has a consistency like traditional linseed oil, which I found easy to apply with a plastic spreader and then rub out with a clean rag. The single-coat finish has a very subtle sheen, which I love because it lets the character of the wood shine through. If you aren't convinced that a single coat is enough to protect cabinetry, furniture, and countertops, rest assured that Oil Plus 2C is a popular choice for professional floor finishing—arguably the most brutal application an interior wood finish is asked to endure. A 350-ml kit, which covers about 160 sq. ft., sells for about \$65 and comes in more than 50 standard colors that can also be combined to create custom shades. —Justin Fink, editorial director



FRANK LLOYD WRIGHT-INSPIRED ART TILES

Motawi Tileworks makes handcrafted tiles for residential and commercial installations, specializing in Art Nouveau, Arts and Crafts, and midcentury-modern aesthetics. In addition to their own unique designs, Motawi is licensed to produce art tiles based on the works of architect Frank Lloyd Wright and artist Charley Harper. New to the collection is the 8-in. by 8-in. Prairie Butterfly tile shown here, based on Frank Lloyd Wright's iconic Butterfly Chandelier designed for the Dana-Thomas House. The art tiles are ideal accents for the equally beautiful field and trim tiles in Motawi's collection. The Prairie Butterfly tiles are available in period-inspired blue and green hues and cost \$130 each, which seems like a bargain for such an iconic historical design. —Maureen Friedman, contributor

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askthe experts

YOUR QUESTIONS—PRO ANSWERS

Mystery plumbing find

During the course of some old-house remodeling, I gutted a room adjacent to a bathroom and noticed that the drain pipe on the existing bathtub has a trap that looks like a big soup can. Is this something I should plan to update while I have good access, or nothing to worry about?

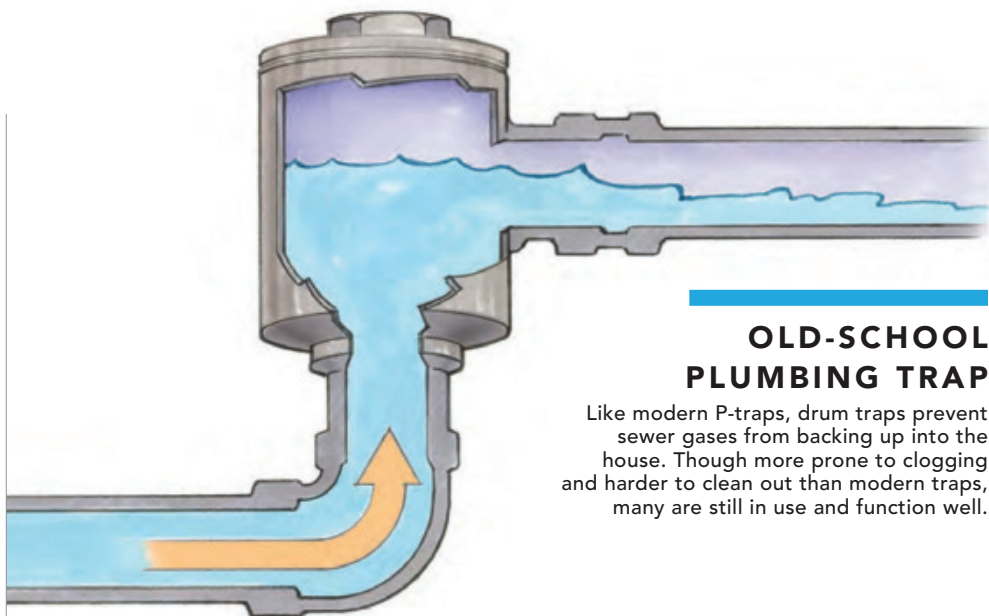
—HUGH BYRNE
via email

Editorial director Justin Fink replies: What you're describing is a now-antiquated plumbing component known as a drum trap. These iron or lead contraptions are quite common in old houses. Though they have been made obsolete by the more reliable P-trap, many original drum traps are still in use, and variations on this old design are sometimes built into modern vanities.

Your description is spot-on, because drum traps aren't much more complicated than a soup can. They were available in all sorts of configurations and might have been installed in any orientation, even with the cleanout lid facing down (a nasty chore for the plumber doing the cleanout, but better than the lid facing up and being close to the underside of floor sheathing, making it impossible to access), but the concept was the same across all situations: The drain pipe from the tub or sink connected to the bottom portion of the drum, which filled up with water that then exited the drum through a second higher drain pipe. The offset pipes ensured that the drum retained water even when not in use, blocking sewer gases from entering the living space through the tub or sink drain.

Need help?

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OLD-SCHOOL PLUMBING TRAP

Like modern P-traps, drum traps prevent sewer gases from backing up into the house. Though more prone to clogging and harder to clean out than modern traps, many are still in use and function well.

The question of whether to replace the drum trap isn't as cut and dried. As long as you have good access, the work of replacing these traps is not difficult—a couple of cuts with a reciprocating saw and installation of either threaded connectors or no-hub fittings make it a snap to retrofit a PVC P-trap drain assembly. The decision is more about whether it's necessary, and how strictly you adhere to the letter of the code.

I will say that drum traps are more prone to clogging than modern trap assemblies, which are self-scouring to help prevent blockage. Plus, if they do clog, the lids are notorious for rusting in place, making cleanout access a serious chore that often causes catastrophic damage to the trap, especially with the softer lead drum traps. The self-scouring is worth highlighting because it is language straight from modern plumbing code books, and if you're looking to be faithful to current standards, a drum trap is technically not up to code.

Also worth noting is that these drum traps aren't very effective access points for snaking a clogged drain line. All of that said, the drum trap on my bathtub has been in service since 1926, is free of obvious signs of leakage, and is still functioning well under

semi-daily use, so I have no immediate plans to swap it for a modern trap.

Sizing HVAC equipment

My husband and I are building a new house. We've received several bids on the HVAC system, and the sizes of the furnaces and air conditioners the contractors spec'd vary considerably. How should heating and cooling equipment be sized? I've heard that it should be sized to run continuously at the hottest/coldest design temperature.

—KAREN
via email

Green-building expert Martin Holladay replies: As a practical matter, you're roughly correct. If your equipment runs continuously on the hottest or coldest day of the year, and your house is comfortable under those conditions, your equipment is sized correctly.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) uses the so-called "99% design temperature" for heating systems—that's the outdoor temperature that a location stays above for 99% of all the hours in a year—and the so-called "1% design

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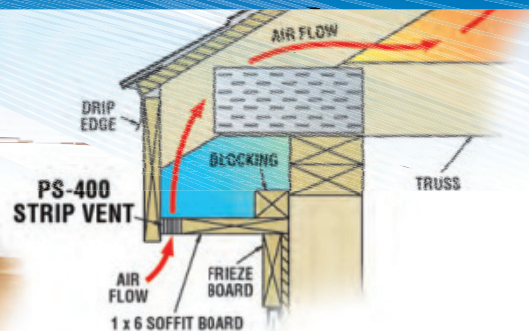
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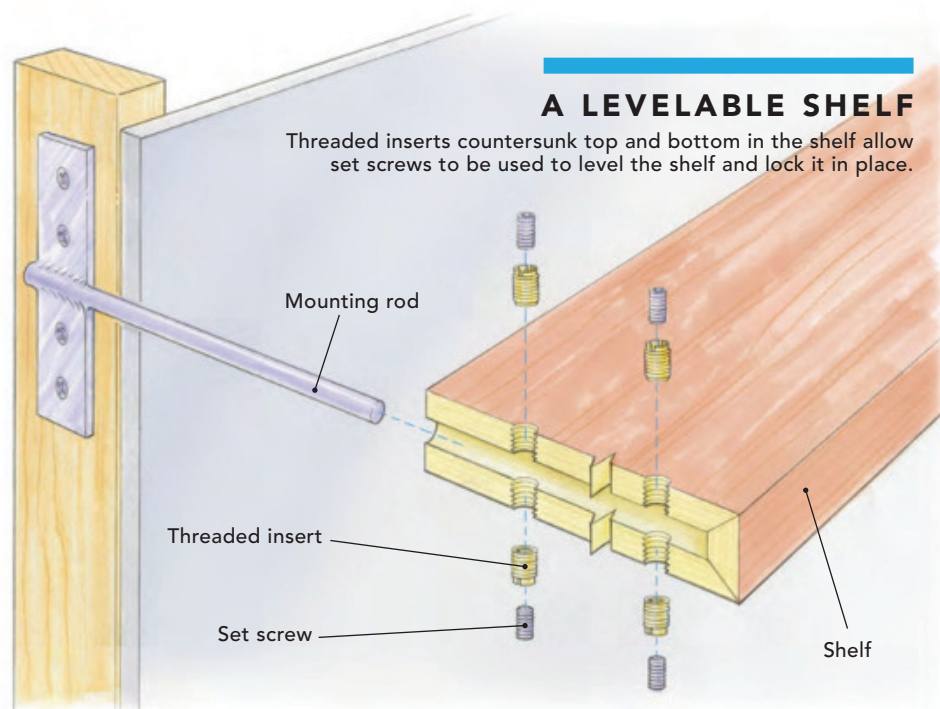
temperature” for cooling systems—that’s the outdoor temperature that a location stays above for only 1% of the hours in a year. ASHRAE and other sources publish 99% design temperatures and 1% design temperatures for hundreds of locations in North America; these design temperatures are available online.

Design temperatures are one element of a heating and cooling load calculation. Other elements include the size and orientation of the building, its air-leakage rate, and specifications for windows and insulation R-values. Once this information is collected, it can be entered (ideally, without any exaggerations or fudge factors) into a Manual J software program that calculates design heating and cooling loads.

In the United States, most residential heating and cooling equipment is grossly oversize. In many homes, a furnace or air conditioner will cycle on and off regularly on the hottest or coldest day of the year—a clear sign of oversizing.

If your design heating and cooling loads are known, you can use Manual S to select your heating and cooling equipment. For furnaces, the calculation is fairly simple. Equipment capacity must be de-rated, or lowered, for high-altitude locations (usually at a rate of 4% per 1000 ft. of elevation above 2000 ft.), but otherwise the usual rule is to select the smallest possible furnace with a capacity rating between 100% and 140% of the design heating load.

The selection of cooling equipment is more complicated. Among the variables that must be considered are the design cooling load, the climate (different equipment is required in a dry climate than in a humid climate), the sensible heat ratio of the equipment (for an explanation of “sensible heat” and “sensible heat ratio,” search the terms at greenbuildingadvisor.com), and the desired indoor temperature. Ideally, the cooling equipment will be selected by an experienced mechanical engineer familiar with the use of Manual J and Manual S. If you allow your HVAC contractor to select your air conditioner, you’ll probably end up with oversize equipment.



Floating a shelf

I want to add some floating shelves in my living room, but I don't quite know how to tackle them. How do you go about creating a stout attachment?

—HAL
via email

Lavrans Mathiesen, owner of Seattle Mobile Builders in Seattle, replies: Floating shelves give me nightmares. I imagine them falling off or sagging, and that special vase slowly making its way over the abyss. Nonetheless, they are attractive little bits of magic hovering without obvious support.

There are a variety of stock solutions. Most seem to be face-mounted, with brackets that attach to the faces of the wall studs and rods that fit into holes drilled into the back of the shelf. This is my least favorite option; the small amount of anchoring structure, often installed over drywall, feeds right into my overly active imagination.

Carpenters have come up with a variety of their own solutions that share the same basic idea of the stock options. Two examples are ½-in. pipe glued in a hole in the face of a stud, and long, ½-in. lags screwed into the studs so several inches stand out from the wall, with the heads cut off.

My favorite method is to attach a steel bracket to the sides of the studs, which requires either getting there before drywall or pulling off some drywall and then patching. That little bit of pain makes for the strongest installation—one that can support anything from a small knickknack shelf to a floating vanity.

A “T” can be made by any welder using ¼-in. flat stock for the vertical piece that screws to the side of the stud. The horizontal piece can be anything from ½-in. rod for a small shelf to 4-in. angle-iron that can support a vanity. The heavier the shelf or suspended unit, the longer I like the vertical member to be. This resists the torque from the finished piece, helping to keep it perpendicular to the wall. In the case of large or heavy installs, it can help keep the stud from bending under load.

I often see floating shelves installed by putting adhesive into the holes before sliding it onto the mounting hardware. This makes the installation permanent, and any problems later can be difficult or impossible to correct without destroying the shelf. I prefer to drill holes for the mounting rod from the back of the shelf. Then, from above and below, I countersink threaded inserts in the shelf that take set screws to both level and hold the shelf in place.

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A revolution in building

The last 15 years have seen more changes in building technology and science than the 50 years that came before. Maybe 100 years.

Pick any year between 1950 and 2000, and any capable carpenter could walk onto any residential job site and identify the building assemblies without missing a beat. We had a formula. Sure, there were slight variations, and some outliers, but for the most part every house was built from the same stuff: formed-concrete or stacked-block foundations, 2x lumber from mudsills to roof rafters, plywood sheathing, housewrap on the walls, felt paper on the roof, and fiberglass batts in the framing cavities. Manufacturers varied, but generally the products were interchangeable, and the playing field was level. For a lot of the builders in this country, that recipe is still the go-to, and still working fine—but for others, those days feel like the distant past.

Now, you might drive by a house under construction and see an insulated-block foundation stacked on-site, or a truck craning a factory-built prefab foundation into place, or maybe even a house without a concrete slab. It's increasingly common to see houses with ZIP System sheathing on the outside, a liquid membrane being rolled on, or sheets of adhesive-backed membrane being stuck into place. If you go inside, you're

likely to find one house has open-cell spray foam, another has closed-cell foam, and a third has 12-in.-thick walls full of dense-pack cellulose. This is great, right? We have so many more options than ever before, and the market of building materials is exploding with growth. The way we're building nowadays is better on almost every level—but it does raise some new concerns.

When you put yourself in the boots of those builders on the job site, you understand that their world has become infinitely more complex. Many builders are scrambling to keep up with changes in installation, material science, and maintenance concerns, and the risk of all those pieces coming

in terms of moisture. Whether from leaks or vapor movement through the structure, they could get wet and in many cases just dry out. Products installed wrong were still a problem, of course, but they may not have revealed themselves as problems for several decades, if ever. Nowadays, if you get an assembly wrong and you trap moisture, you risk the whole thing failing catastrophically—not decades down the line, but often in a year or two.

Sounds pretty scary, right? That's just part of the equation. The other change happening at the same time is a disappearing workforce. We're losing shop class in our high schools—that was our farm team. We're losing kids to

learning how to build by working for the guys who learned the trade 30 years ago—back when everybody built the same house—and didn't bother changing with the times.

So what are we left with? An incredibly broad and complex array of building-material options that gets more complicated every day, and a vastly undermanned, undertrained pool of tradespeople that gets smaller every year.

Consider this example: Most carpenters know how to install a window, but what happens if you take that window and you put it over rigid foam, or under rigid foam, or over a fully adhered membrane, or as part of a ventilated rainscreen? Things get more complicated.

Houses are more complicated, material options are multiplying, and our workforce is stretched thin. We can all do more to help.

together incorrectly or failing soon thereafter is exponentially higher. Seasonal expansion and contraction, UV degradation, fire, and other factors are still a concern, but most of what keeps builders up at night these days is water.

Those houses from 30 years ago with Tyvek, plywood, and fiberglass could take a beating

four-year colleges, because it's not socially acceptable to be in the trades anymore. And those that still choose to follow a path toward a life in building don't have as many opportunities for training. There are certainly less trade schools, and there are virtually no apprenticeships anymore. Instead, many people new to the trade are

Who's helping the builder figure it out?

There are some manufacturers dedicated to product-based solutions and technical support. There are some exceptional architects and designers working these things out and detailing them exhaustively on the building plans. And there are, of course, exceptional builders

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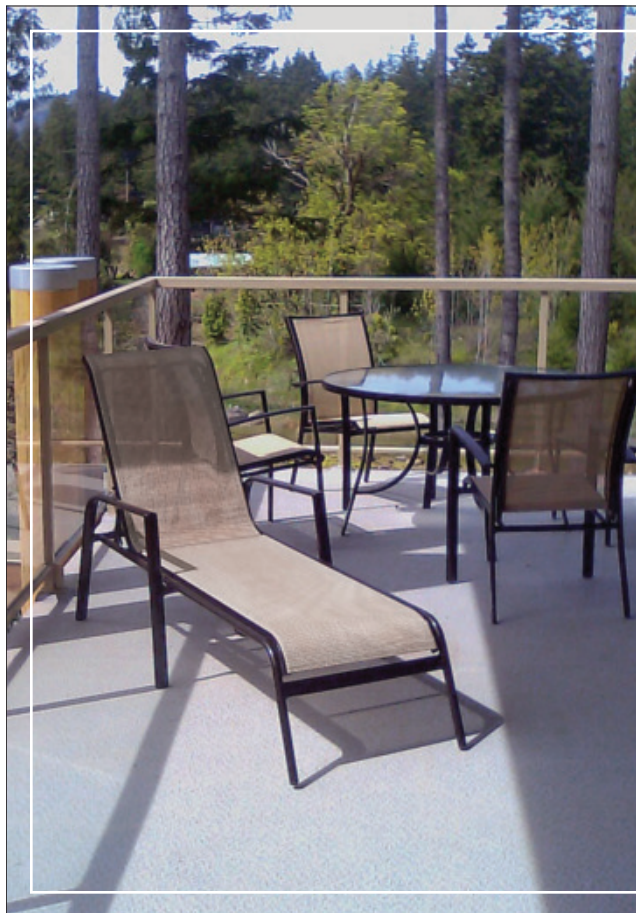
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doing deep research into building science and best practices. But in the grand scheme of American residential construction, that's just what these people are—the exception. For the most part, builders in the field are left to figure this stuff out on their own. We can help them, and they can help themselves, but it will take work, and it involves all of us.

Product manufacturers can do more

A growing number of manufacturers have realized that success depends not only on the quality of their product, but also on the skill of and the instructions given to the builder who's installing it.

Although it's not feasible in every instance, the biggest opportunity to provide crucial installation guidance is to print it right on the products themselves. If window manufacturers don't want the bottom nailing fin taped, why not print that right on the bottom nailing fin? If polyiso rigid foam isn't intended for use below grade because it can degrade in contact with moisture, why not use a small portion of the 32 sq. ft. of space on each sheet to say so? If a particular brand of housewrap requires cap fasteners for installation, why not write that on the housewrap itself? If the majority of the industry is still using faced fiberglass batts, and the manufacturer wants those batts installed so that the paper facing is on the “warm in winter” side of the assembly, why not print that on the facing? The list goes on and on.

Of course, some manufacturers already do this. For example, each piece of WindsorOne trim is still stamped with a

reminder to prime all cuts, and ZIP System seam tape now includes a graphic and label every few feet to remind installers to roll the tape for proper adhesion.

For products that require more-detailed installation guidance, manufacturers can make it easier to find help. First, list a phone number to call for technical questions, because emailing a company for additional information isn't a speedy solution. Even better, add a QR code that builders can scan with their smartphone to pull up helpful information such as technical documents and instructional videos, and make the code unique to the product in their hand; don't just drop them onto a page with 142 different products to sort through.

When it comes to creating these technical documents, the most important thing is organizing the information well, and making it comprehensive. If a product says to install according to a specific ASTM standard, and a digital copy of that standard costs \$100, what are the chances a builder will go to those lengths? Roadblocks preventing builders from accessing information that's critical to their success must be removed.

So what are we left with? An incredibly broad and complex array of building-material options that gets more complicated every day, and a vastly undermanned, undertrained pool of tradespeople that gets smaller every year.

Many manufacturers are now using video to supplement their installation information. That's great, because seeing a product demonstration goes a long way for those who are visual learners.

Finally, it's no mistake that builders tend to flock to the manufacturers who offer a “systems approach” to building. A house is made up of lots of parts—membranes, adhesives, coatings, and more—and bringing all of those parts together is a risky prospect for anybody who doesn't hold a degree in chemical engineering. If builders can use a single brand for their flashing tape, sealant, and water-resistive barrier, for example, you better believe that they will. It gives peace of mind that those products are designed and tested to work together, and it means only one phone call is needed if something fails.

The reasoning for manufacturers to raise these standards is obvious: If you make good building materials, and educate people how to use them properly, neither will be as likely to fail. This means your brand becomes more trustworthy, and you just earned the trust of a builder who will use the products again and again.

Architects and designers can do more

Let's agree to make 2020 the year when all designers and architects stop using the “by others” and “typ.” (typical) designators on building plans, which only pass the buck to the builder in the field, or assume knowledge of a “standard” detail when “standard” often no longer applies. Why not take the building plans a step further and include pertinent installation details, if only on a high level, rather than leave a builder in the field to decide between trying to look up the information on a smartphone or just winging it? This doesn't just apply to special details or products; it matters with even the most standard. Window-installation instructions are anything but “typical” from one manufacturer to the next, with each requiring different details that can mean the difference between a window that leaks and one that doesn't, not to mention retaining any chance of a warranty claim.

Some of this is as simple as architects or designers doing a bit of the legwork when it comes to product research, but there's a bigger issue at play that hampers some, and that's a lack of education focused on hands-on, real-world,



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high-performance building. Architecture-and-design school curriculums might benefit from focusing less on conceptual pie-in-the-sky student projects, and more on conventional nuts-and-bolts projects.

Builders can do more

If all of the above happens, it's still up to the builder to be the last in the long line of people thinking about the details, and putting all of the puzzle pieces together to make a house that will be comfortable, durable, and energy efficient.

Doctors are perhaps the best-known example of workers who must stay current on advances in their field of study, by way of continuing education and medical journals. Why

are builders any different? It will take some extra time to sit down with a set of building plans and get familiar with assembly details, read up on new or unfamiliar products, and pay attention to changes in our collective understanding of how all of these parts and pieces perform when assembled, but the payoff is huge.

Building publications like this one, *Green Building Advisor*, and *The Journal of Light Construction* work hard to deliver relevant, timely, useful, and—most importantly—trustworthy information. You can subscribe to all three for a sum total of a couple hundred dollars per year. Building Science Corporation also offers hundreds of deep, well-researched

articles completely free of charge on their website, buildingscience.com.

Social media, particularly Instagram, has also grown into a useful tool for anybody looking to expand their knowledge. It's not searchable in a categorical way, which makes it harder to access specific information on the fly, but it does offer a level of interpersonal communication that's akin to being part of a passionate club. Instagram connects people across the country and allows anybody with a smartphone to ride shotgun with talented designers and builders who are willing to share their advice, techniques, and failures.

There are also local discussion groups, podcasts, trade associa-

tions, seminars—the list is long, and the options are many.

The burden is on all of us as a group, and we need to do this together. If the same installation questions are coming up over and over again, we need to do a better job of finding the answers. If assemblies are failing, we need to take responsibility for the fact that we're not providing the right information, not making it easy enough to access, or not bothering to look for it in the first place. The availability of quality, vetted information is better than it has been at any time in history. So, what's your excuse?

Justin Fink is editorial director of Fine Homebuilding and Green Building Advisor.

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CELEBRATING PASSION FOR BUILDING

Ben Bogie is a second-generation builder who makes his living on the coast of Maine, a stronghold of progressive building and traditional craftsmanship. He's a production manager at Kolbert Building in Portland, a firm known for its practical approach to energy efficiency, resiliency, and quality. Ben leverages his years of site experience making sure projects come together as seamlessly as possible, or as he describes it, eliminating curse-word moments—a role every person ever to step on a job site can appreciate.

Ben's construction background is varied, but heavily rooted in woodwork. He studied at the Center for Furniture Craftsmanship with the hope of becoming a studio furniture maker. The professional prospect of such a pursuit led him elsewhere, working in demanding building and finish-carpentry positions in southern New England. There, he grew accustomed to working alongside crew members with 30 years of experience behind them. These days, his next most experienced crew member is 26 years old.

The demand for skilled carpenters and builders is so high across the region that finding and hiring a veteran crew is difficult. Like so many others, Ben can only speculate on the reasons the next generation isn't filling the void—perhaps more lucrative career prospects or more comfortable work environments.

Ben isn't afraid to address the elephant in the room, which is the industry's failure to compete with other fields. "We would love to offer those coming into the trades a wage they deserve, health benefits, a retirement account, and the professional incentives found elsewhere, but it's a challenge, and that's why so many people strike out on their own to make the business model work."

He's not wrong. If the only path to a comfortable and successful living for craftsmen and women is through business ownership, then the construction field will continue to lose talent to other industries. —Rob Yagid, executive director, Keep Craft Alive

"Keep your passion for building alive. Dive into research or nerd out on performance. It will help you improve the work you do."

BEN BOGIE
BUILDING PRODUCTION MANAGER
PORTLAND, MAINE



Keep Craft Alive is our campaign celebrating those who have chosen to passionately pursue a career in design, building, and remodeling. Find out more and show your support by visiting KeepCraftAlive.org, and use #KeepCraftAlive to share your passion for the cause.



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