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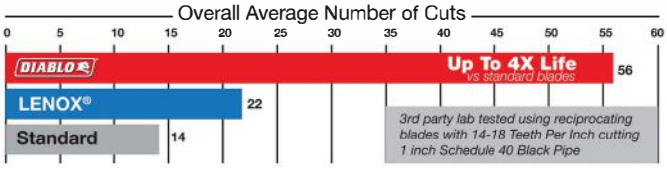


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**On the cover:** Russ Wilkins of United Construction & Engineering, Torrington, Conn., marks a cut on an ipe board. Photo by Barbara Nevins.

## FEATURES



## DEPARTMENTS



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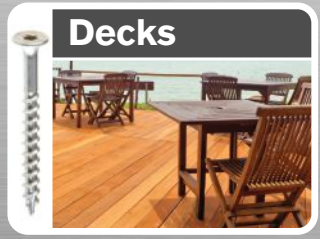





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**Q** I want to replace a ceiling fan/light with a regular light fixture. The cable from the switch box to the ceiling box has three wires—two identical blacks and a white—with one of the blacks connected to a mysterious blue wire from the fan. The light fixture I want to install has only two wires, one white and one black. What's the best way to wire the new light?

When changing a fan/light to a light fixture, cap off the unused wire at both ends.

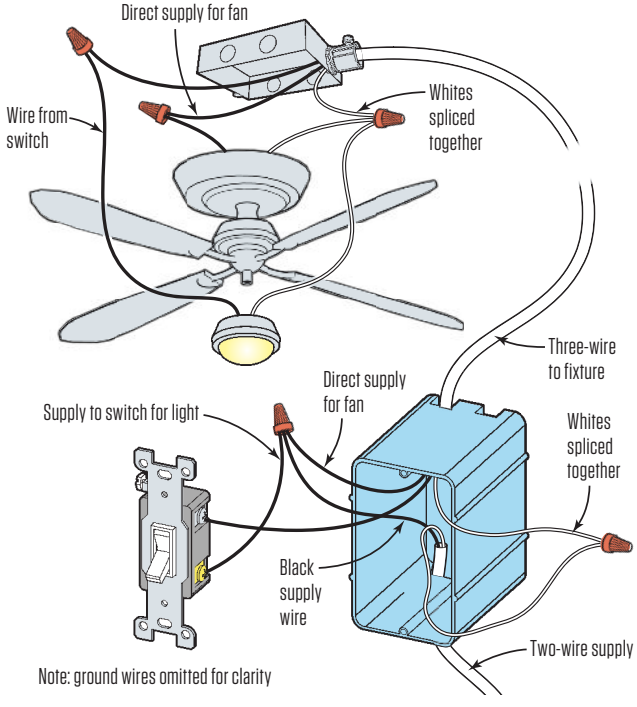
**A** Cliff Popejoy, a licensed electrician from Sacramento, Calif., responds.

The cable going to the fan/light fixture is called a three-wire cable, and it usually has one red wire and one black—instead of two black wires—to prevent confusion. In your case, one of the black wires from the cable is connected to the fixture's black wire, which goes to the light; the other black wire is connected to the fixture's blue wire, which goes to the fan. The cable's white wire connects to the fixture's white wire.

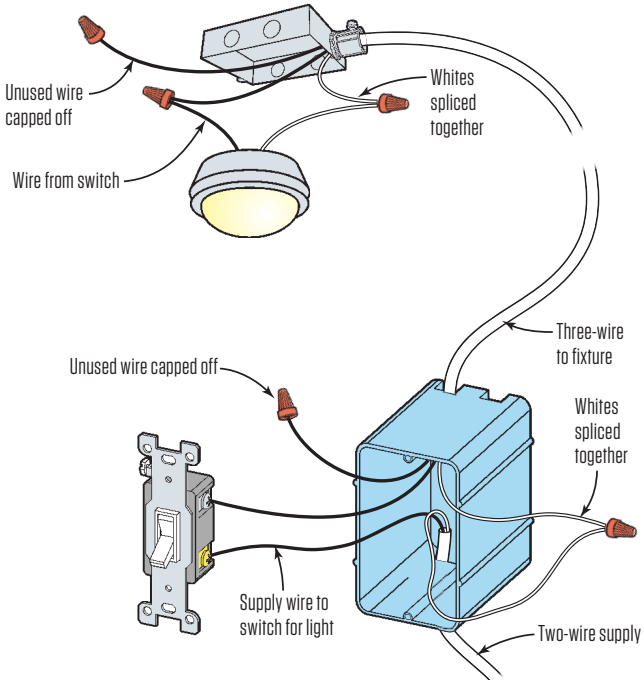
At the switch box, there should be two cables: one with two wires (one black and one white), and one with three wires (two black and one white). The black wire of the two-wire cable supplies power coming in, and it should attach to one of the switch terminals, and also to one black wire of the three-wire cable, to power the fan. The other black wire from the three-wire cable connects to the other switch terminal, to power the light. The two white wires in the switch box should be spliced together. Wired this way, the wall switch controls the light, and a pull chain on the fixture controls the fan.

Given this arrangement, here's how to wire the new light fixture. First shut off the power at the breaker or fuse and verify that it's off by testing. At the switch box, leave the whites spliced together. Keep the black wire of the two-wire cable connected to a switch terminal, but disconnect it from the three-wire cable's black wire, which you should then cap off with a wire nut. Make

**Fan/Light Wiring**




**Light Fixture Wiring**



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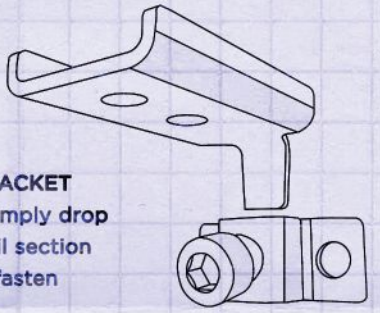

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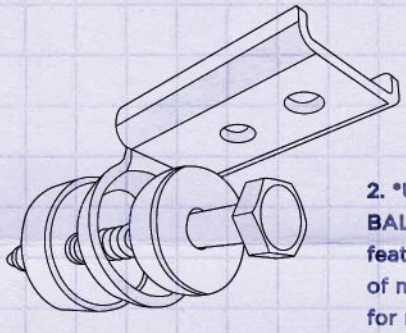

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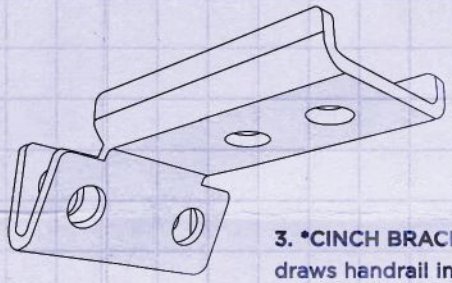

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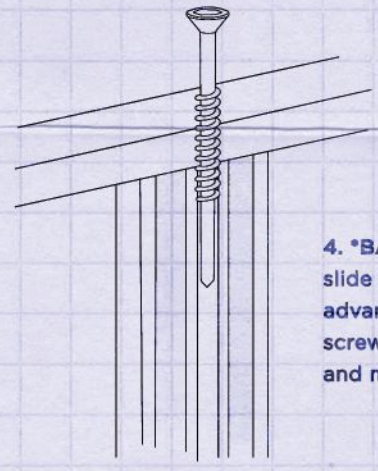

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sure that the other switch terminal is connected to the second black wire of the three-wire cable.

At the fixture box, be sure that the three wires are separated from each other and are clear of everything else, then turn the power back on. Turn the switch on and move dimmer switches to the full on position. With a voltage tester, find out which of the black wires at the fixture box has 120 volts (testing between the black and the neutral) and mark that wire with a bit of tape. Now cut the power again. Connect the black wire from the new light fixture to the black wire marked with tape. Connect the white fixture wire to the white wire from the three-wire cable. Cap the other black wire with a wire nut and finish installing the fixture.

If you don't have a voltage meter or tester to verify which black wire is connected to the switch, hook up one of the black wires from the three-wire cable to the black fixture wire before you install the fixture. Then power up the circuit and turn on the switch. If the light goes on, cap the other black wire and you're all set. If the light doesn't go on, cut power and connect the other black wire to the fixture wire. With this strategy, never suspend the fixture by the electrical-wire splices. Instead, make a hook from a coat hanger to hang the fixture from until it's installed.

**Q** We are working in an AE flood zone where FEMA (Federal Emergency Management Agency) requires treated material to be used below the BFE (base flood elevation). But on this project, non-treated LVLs were installed instead. Are you aware of any preservative treatment that could be field-applied to LVLs (or any other type of non-treated framing) to meet FEMA requirements?

**A** Colin McCown, of the American Wood Protection Association (awpa.com), responds.

If treated wood that meets AWPA standards is required (by FEMA, local building codes, architectural specifications, or the like) but untreated wood was installed, there is generally nothing you can do to the wood in the field to make it conform to those standards.

Most of the materials listed in our standards are pressure treated in a commercial facility or—in the case of composite products such as treated OSB—the components are mixed with preservatives before the product is manufactured.

Nevertheless, there are cases when non-conforming material has been installed and the governing authority or engineer of record will decide to mitigate potential problems through topical field treatment rather than force a builder or homeowner to demolish the structure and start over.

When a variance allowing field treatment is permitted, we normally suggest the use of topical preservatives with the explicit understanding that the field-treated wood does not have the same degree of protection


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as pressure-treated wood conforming to AWPA standards, and one should not expect the same performance or level of durability as with properly treated wood.

In recent inquiries from FEMA representatives regarding this topic, they indicated they knew that untreated products could not be made to conform to AWPA standards. That said, they were looking at types of field-applied products that would provide the best performance so that the homeowner could avoid having to rebuild the structure.

For this application where the wood is not expected to be exposed to precipitation, they were most interested in the use of a water-soluble boron-based wood preservative. (Regular exposure to precipitation can significantly reduce the long-term effectiveness of boron-based preservatives). Then, because floodwaters could easily absorb the boron and remove it from the wood over time, they considered applying several additional coats of a topical oil-based water-repellent finish to reduce the amount of water that could be absorbed by the boron-treated wood during a flood. Again, this treatment would not be as effective as wood treated to AWPA standards, but at least the structure would not need to be torn down if a variance allowed for this type of remedial treatment.

**Q** I was recently called back to a home because of a bad odor in the HVAC system. What caused it and how can I avoid the problem in the future?

**A** Jeffrey May of May Indoor Air Investigations (mayindoorair.com) in Tyngsborough, Mass., responds.

The odor you describe is due to the presence of bacteria, yeast, or mold. Here's what happens: In many geographical areas the coils and condensate pans in central A/C systems stay wet during operation. In hot and humid conditions, builders often operate the A/C during construction to cool the site. Sawdust gets sucked into the return system and some of it ends up on the coils and in the condensate pan. The cellulose serves as food for the microorganisms, which then grow and produce the odors.

The simplest solution is to completely avoid operating the central A/C during construction. If cooling is necessary, use portable or window-mounted A/C units. Another option is to keep dust out of the ducts with a pre-filter on all returns (MERV 2 or 3 roll filter material is available from building supply stores), and to install at least a 4-inch-thick MERV 11 media filter at the A/C unit itself to further prevent dust from getting on the coils and pan. Electronic filters are ineffective because they lose efficiency when dirty, and typical 1-inch fiberglass furnace filters (about MERV 3) won't stop heavy dust from construction getting in.

Also keep in mind that operating the hot-air system during construction in the winter will contaminate the ducts and A/C unit with dust as well. And don't forget to keep jobsite dogs outdoors to avoid contaminating the entire HVAC system with dog dander for clients who have allergies.

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BY GARY STRIEGLER

Composition ornament is a time-tested, fast, and inexpensive way to embellish interior finish details, such as this plinth block. It can be applied on site as seen here, or in the shop. Once installed, it finishes easily with minimal preparation.

Photo: Gary Striegler

# Working With Composition Ornament

**I do a lot of high-end finish work** on the houses I build, and I'm always looking to upgrade the look of my work. Applying composition ornament is the fastest, most economical way I know. Composition ornament is available in literally thousands of patterns for just about any application you can imagine.

Composition ornament, made from pressing a bulk material called "compo" into molds, has been around for centuries. With its beginnings in Europe, composition ornament eventually made its way to this country. Recipes for the compo vary from manufacturer to manufacturer, but they all contain glue that is activated by heat and water. The supplier I use, Bomar Designs (bomardesigns.com), won't divulge the details of its recipe, but it does sell compo in bulk along with instructions for making your own ornamental pieces.

Composition ornament can be installed by applying glue to the back side and securing the piece in place using brads or small nails. But the beauty of composition ornament is that once it's heated, the glue in the material itself is activated and the material becomes self-adhering. It also turns flexible when heated, making it easy to form curved or irregular surfaces. I have applied patterns to standard crown molding or 1-by stock, instantly giving me deep relief detail at a fraction of the price of carved molding. I can also make just the amount of molding I need; in fact, my supplier will sell single pieces if needed. But if you're using composition ornament for the first time, get a little extra, just to be on the safe side.

## APPLICATION

Applying composition ornament is a fairly simple process, although a little experience goes a long way. The equipment I use for heating is low-tech: a roasting pan on top of a two-burner hotplate. I made a wooden frame that is a little bigger than the roasting pan and stapled a piece of fabric over the frame. The type of cloth doesn't matter; some folks use cheesecloth or even an old T-shirt.

I start by putting water in the roasting pan and turning on the heat to get the water steaming. Then I set the cloth frame over the roasting pan and pour some more water over the cloth to dampen it (1). Some people use a spritzer bottle to moisten the cloth. When a lot of steam starts to form, I lay the pieces of composition ornament on the cloth with the relief side facing up. I have the material I'm applying the ornament to all ready to go—cleaned and free of any dust or debris.






It takes practice to know exactly when to remove the ornament from the steam. The thinnest material takes just 30 seconds or so, but thicker profiles can take a couple of minutes. With a little experience, you'll know when it's ready. If you remove the piece from the steam too soon, it will be stiff and the glue won't be activated. But you can always reheat it and then reapply it. If you leave a piece in the steam too long, it will become too flexible and can distort when you try to move it. I feel the top face of the ornament, and when it's warm to the touch, it's ready to be applied. At that point the back side gets sticky as the glue in the material activates.

I pick the piece off the cloth and set it in place. I generally use my bare hands—if the piece is too hot to handle, it has probably been left on the heat too long. You have a minute or so to adjust the exact positioning. If there is more than one piece of ornament to be aligned on a single piece of molding, I'll steam two ornament pieces at a time. As I pull one piece out and apply it, I put another in the steam. That way I develop a rhythm and can install the ornament as a continuous process.

Thinner pieces of composition ornament tend to get very flimsy when they're heated, so I remove them from the heat using putty knives or similar flat tools to support them and prevent them from stretching or distorting (2). I use these tools for large pieces as well, where it also helps to have an extra set of hands.

After sliding the ornament off the putty knives (3), I position it and press it down until it begins to cool and the glue adheres (4), usually in a minute or less. If the surface is curved, as with crown molding, it might take a little longer for the piece to conform and fully adhere to the curve. As soon as the ornament is completely cooled, the embellished piece of trim that you've made can be cut and installed using regular tools. I try to install any trim that I make with composition ornament as soon as possible.

In addition to making embellished molding, I often install medallions or rosettes as part of a pediment over a door or to dress up plinth blocks. Composition ornament can be installed on ceilings as well. When installing pieces on vertical surfaces or overhead, you may have to hold them in place longer to make sure they are completely adhered.

## FINISHING

Another plus with this material is that it takes a finish really well, and it is paint-ready without needing to be sanded (5). I like to wait a couple of days after I've applied the ornament before I finish the work. After priming, I caulk any small gaps, then apply the finish coats of paint. Composition ornament can also be stained with full-bodied dark stains to cover the dark color of the material.

Within a couple of weeks of exposure to the air, composition ornament becomes rock hard. In fact, Bomar Designs recommends putting unused ornament pieces in a plastic bag and then in the freezer if they are not being applied within a week or so. If left out, the pieces become hard and are unusable.

*Gary Striegler is president of Craftsman Builders, in Fayetteville, Ark. craftsmanbuildersnwa.com*

Photos: Gary Striegler

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/PERSONNEL/

# From Field to Office

## Two experts provide tips for making this transition

**MELANIE HODGDON:** Recently, I was working with the owner of a roofing and siding company who was in the process of switching from running his crew to running his business. Complicating the challenge of naming a supervisor who was both technically competent and a good manager was the problem of seniority.

I had no idea how highly valued seniority could be until I worked with a company for which I had to put together a job assignment board. On the board, I listed the employees alphabetically, which seemed logical to me, but the owner took one look and said, "Oh, that will never work. The boys will be offended." I soon learned that every employee list had to be arranged by date of hire, with the most recent hire at the bottom.

For the roofing company, this attitude toward seniority meant that, unless an internal candidate for supervisor also happened to have been with the company longest, he would likely be perceived to have been unfairly promoted. Seniority issues can only be overcome by someone who demonstrates extraordinary technical skills or who has exceptionally strong management and leadership skills. Anyone in between will face an uphill climb to acceptance by the crew.

You may not be able to avoid this problem altogether, but you can make for a smoother transition. Give your crew some advance notice about your plans to hire someone to replace you in the field, and make sure the crew understands that this person's job is not just technical but includes paperwork and communication with the office and perhaps the homeowner.

*Melanie Hodgdon, owner of Business Systems Management (melaniehodgdon.com), works with clients to generate realistic solutions that reflect the resources and style of their companies.*

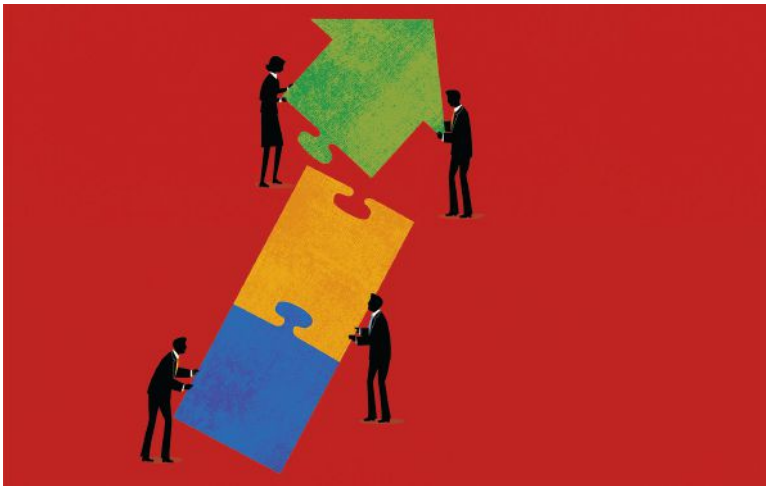

Illustration: 2013, Michael Austin, courtesy theispot.com

**TIM FALLER:** The move from field to office represents a shift from leadership by example to leadership from afar. In the best scenario, the business owner has time to transfer responsibility in increments through side-by-side on-the-job training. If time is short, next best is to put into place the person who is best-suited for the job of managing the crew. This is almost never the best technical person on the crew; but, unfortunately, promoting someone who has people skills and leadership potential but no technical skills is equally disastrous.

The best person for the job is someone who has both good leadership skills and good tech skills. Having both types of skills is more important to winning over the team than being "the best" at either.

Even with the right person, however, several negative consequences are inevitable.

- **Productivity will temporarily drop** because when the owner leaves, his authority leaves with him. Until his replacement earns the full respect of the crew, the job will not progress as smoothly as it once did. Alternatively, if the owner promotes someone from within but neglects to replace that person with a new hire, that means one less person working the job.
- **Change creates dissatisfaction.** In many cases, it will be "my best guy" who becomes unhappy and leaves for greener pastures. In my experience, though, the company will recover and often may fare better than before.
- **There is no foolproof method.** Success sometimes comes through trial and error. That argues for making this kind of change when there is time to go through several people before finding the right fit.

*Tim Faller is president of Field Training Services, in Westerly, R.I., and is author of* The Lead Carpenter Handbook.

/PERSONNEL/

# Out to Lunch

## WHAT HAPPENED

At Good Guys Construction Co., job-site supervisors schedule the workday for all field employees. Last pay period, the team was under a tight schedule to get a certain job completed. On one day the supervisor told his hourly (nonexempt) employees that, to meet the required deadline, they would have to skip lunch. The employees complained, claiming that lunch breaks are required by law. Seeking a compromise, the supervisor asked each field employee to take a 15-minute unpaid lunch that day instead of the usual 30 minutes.

## WHY IT'S WRONG

First, note that federal labor laws, and many state labor laws, do not require employers to provide a lunch period or break period to their employees who are over 18 years of age. In this case, however, the supervisor's compromise actually violated a federal Wage and Hour regulation, which says that when any unpaid break or "bona fide meal period" is offered, it must "typically last at least 30 minutes." In contrast, when employers offer short breaks, defined as "usually lasting 5 to 20 minutes," the time is considered compensable work hours and must be paid.

## WHAT YOU SHOULD DO

Carefully review your internal policies on lunch periods and short breaks and communicate these policies to your supervisors. When working conditions require an exception to established policies, the employees' final timesheets should be carefully reviewed and adjusted to comply with Wage and Hour regulations. In the case of Good Guys Construction Co., the employer should pay the employees for the 15-minute "lunch" which, because it is too short to be considered an unpaid lunch, must be considered paid time.

*Douglas Delp is founder of The Delp Group (delpgroup.com), which provides human resources, benefits, insurance, and payroll services to small businesses.*

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/LEGAL/

# Sales Agreement Specifics

A salesman told a homeowner that once the alarm and fire detection system he was selling was in place, she should never have to worry about losing her house to a fire. He explained that if a fire ever started, the system was set up to alert her as well as the closest fire station. Convinced, the homeowner signed on the dotted line. But just two months later when a lightning strike caused a fire, the alarm system never contacted the fire department. The house burned to the ground.

The homeowner's insurance company paid the homeowner's fire claim, then sued the alarm company, which in turn defended itself by presenting a copy of the signed sales contract. That document stated in bold letters that no alarm system could guarantee prevention of a loss, and that the company would not be liable to the homeowner, even if damages were caused by the company's own negligence.

While such clauses are generally not favored in the law, there is an exception if the language is a clear and obvious contractual expression of a disclaimer. In this case, the alarm company's provision releasing it of liability for its own mistakes was sufficiently obvious and found to be enforceable.

Salesmen are permitted some leeway as to what they say without incurring liability, but it depends on what is said, when it is said, and whether the statement is actually reduced to writing. The salesman's comments were made in what is legally referred to as pre-contractual negotiations. As such, they fell into the category of promotional and exaggerated statements presenting a subjective view of a product or service—statements on which a consumer should not rely.

The most important thing, of course, is the signed document. Be sure to have the right sales agreement in place, with appropriate disclaimer language. To do less should surely set off some alarms.

*Patrick C. Barthet is founder and president of The Barthet Firm (barthet.com), a 10-lawyer commercial law practice focusing on construction-related matters. pbarthet@barthet.com*

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# Personal Computer R.I.P.

**Effective business management** is all about getting the right information into the right hands at the right time. Technology has always held the promise of making those connections possible, but only if you were willing to battle the high cost and long learning curve. Well, all of that is finally changing for the better. Computing isn't going away, but personal computers are being replaced by a wide variety of devices. If you wanted to, today you could literally operate your entire business from a smartphone that fits in your shirt pocket. And that system could work equally well on a mix of PCs, Macs, and tablets, accessing all of your company and project data in real time via the "cloud" (a.k.a. the Internet).

Over the coming months we'll look at not only what technology is out there, but specifically how you can use technology to add value for your customer and to deliver your projects on time, on budget, and defect-free. In the meantime, let's start with these recommendations:

**Time is money.** Up to half of the time spent on every job site is wasted. Scheduling isn't usually the problem, it's communicating that schedule. To solve the problem, try using a shared Google project calendar that your customers, employees, subs, and suppliers can all see online.

**Money is money.** A purchase-order system gives you full control of your direct costs of construction. It doesn't have to be complicated: Start by downloading the spreadsheet templates I mentioned in my November 2011 column (they are linked from the online version of this article). Set the system up this year and put it to work starting January 2014. Once you're comfortable with it, you can move it into one of the commercially available systems, such as BuilderTrend (buildertrend.com).

**Documents are money.** Nothing is more frustrating than losing data or discovering that you've been using an outdated set of plans or the wrong version of a contract. You can kill two birds with one stone by replacing "My Documents" with Dropbox (dropbox.com) or one of the many other cloud-based services available (see "Save and Sync," *JLC,* March 2012).

**Online meetings and location services.** Today there's no reason to delay resolving minor job-site issues because you can't get the parties together on site. You can snap photos or videos of the issue using your phone camera, then conduct a Web-based meeting using GoToMeeting (gotomeeting.com) or JoinMe (www.join.me) on your smartphone or tablet.

There's lots more to look at. In coming months I'll take a closer look at business management systems that use generic services such as Dropbox, Evernote Premium (evernote.com), and Microsoft Office365 (office365.com). And I'll look at how to use a product such as Canvas (gocanvas.com) to create your own mobile software without having to do any programming.

*Joe Stoddard consults with contractors on technology.*
*jstoddard@mountainconsulting.com, twitter.com/moucon*

APP OF THE MONTH

## CloudMagic

It's one thing to squirrel away information in the "cloud"; finding it again is something else. CloudMagic (cloudmagic.com) is pretty close to magic. Once you've set up all of your cloud accounts (Evernote, Dropbox, Google, SkyDrive, Facebook, Twitter, and the like), CloudMagic does the rest—pulling together multiple calendars and message services, searching across all of your online accounts for those long-forgotten documents, digging out messages you were sure were lost. Type a word or two you remember in the search bar; results appear as you type. You can further limit the results by category by tapping the "filter" button.

CloudMagic installs as an app on all your mobile devices and as a browser add-in on your computer. For more information, check out the developer's blog (blog.cloudmagic.com). Available for most mobile platforms and major Web browsers, it's free for up to 50 searches per month and costs $5 per month after that.


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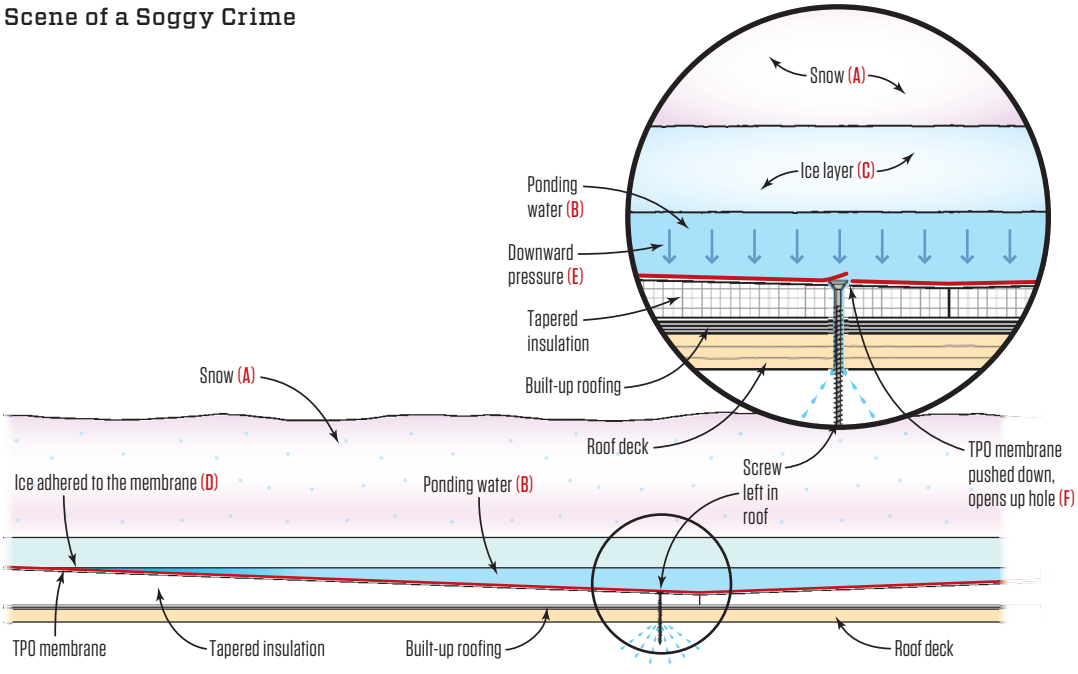
BY STEVE CLISSET

Scene of a Soggy Crime




**Chain of Events** Heavy spring snow falls **(A)** and begins to melt, forming a pond on top of the membrane **(B)**. Temperatures drop and ice forms **(C)**, adhering to the roof at the edges of the pond **(D)** and trapping the water below. Ice continues to form, creating downward pressure against the membrane **(E)**. Water pushes the membrane down around an overlooked screw, opening a hole and letting pressurized water flow into the ceiling **(F)**.

# Mysterious Leak in Roof Membrane

**I have been in the roofing business** since 1973 and often get calls to help find leaks that other companies have been unable to locate. Recently I got an email from an associate about an ongoing and elusive leak in a "butterfly" roof at a home in Boulder County, Colo.

I began my investigation as I usually do: at the home talking with the homeowner. I learned that the 80 mil TPO membrane roof leaked only in the springtime and only after a snowfall of 9 to 12 inches. If the snowfall was less than that, the leak didn't show up. Spring snowfalls of that amount are common in this area, so the roof had leaked in each of the six years since it had been installed.

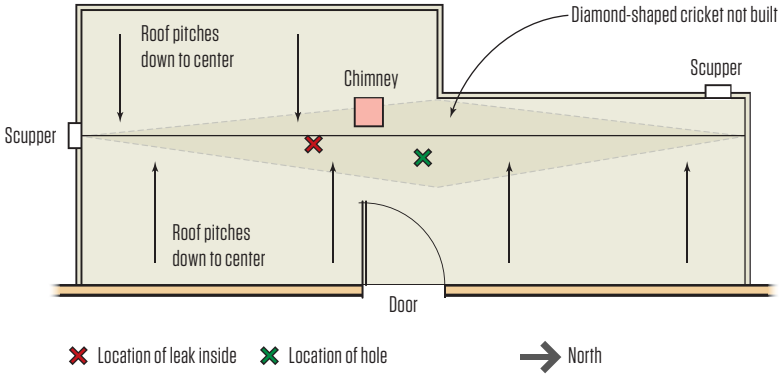
The TPO membrane replaced an EPDM membrane roof, but the original built-up roof system had been left in place. A taper system was added to create a 1/4-inch-per-foot pitch from the long sides of the roof down to the approximate centerline. I also learned that the crew was originally supposed to install a diamond-shaped cricket on the roof that would have pitched toward the scuppers, but the cricket wasn't built because the contractor thought it would interfere with the doorway onto the roof.

At first glance, the membrane seemed to be correctly installed, and I was surprised that it was leaking. Over the years counterflashing had been added, patches applied, and new scuppers installed. That particular day the roof was dry and the leak was not active, so I spent a lot of time "nose down and butt up" examining the membrane near the leak and at the outflows. I did find some scuffs from snow shovels, but no definitive holes or breaches of the membrane. I peened the outlets of the scuppers so they rolled downward, minimizing the possibility of water working its way back to the house via surface tension. I also caulked a couple of possible cuts, but I really wasn't sure that I'd fixed the problem.

A few days later, we had a spring snow with more than a foot of accumulation. All day long I expected a call from the homeowner, but it never came. By dinnertime I thought I was in the clear. Then, at about 9:45 p.m., I got an email saying that the leak had just started. This, it turns out, was a key bit of evidence.

First thing in the morning I headed to the house. Once inside, I saw water dripping steadily from a half


**Roof Plan**




Instead of installing a cricket under the new TPO membrane, the roof was pitched to the middle and ponding occurred. The water then gushed into the roof system, via a breach in the membrane, and flowed south before leaking through the ceiling.

dozen places in the ceiling with buckets under each one. Up on the roof I discovered an ice-encrusted pond in the middle of the roof along the low point. When I stepped onto the ice, it cracked to reveal about 1¼ inches of ice over about 1½ inches of water with about 6 inches of snow on top of everything. It was obvious that the leak was somewhere under the ice-encrusted pond.

I shoveled off the south half of the roof over to the area of the leak and got rid of as much water as possible. At this juncture I noticed that the scuppers were a bit high, which contributed to the ponding effect, but I still didn't find anything obvious. I went back inside and cut through the ceiling from below, looking for clues. This was the "fun" part, as every cut I made unleashed more water that combined with drywall dust and ran down my neck.

Once things were opened up, I found a lot of moisture — most of it on the bottoms of the joists and on the ceiling drywall. However, the joists got progressively wetter north of where the leak had shown up.

I went back up, shoveled off the north side of the roof and repeated the "nose down, butt up" routine. This time I discovered the tiniest hole in the membrane about 10 feet north of the leak location inside. The hole was over a screw, probably left from when the original EPDM membrane had been removed. It was barely visible until I pushed down next to it. With pressure against the screw head, the hole opened up like a flap. It was hard to imagine a hole that small could cause so much damage—until I thought through the logic of it.

The spring snow was particularly wet and had been falling and melting somewhat during the day. The leak didn't start until after the roof had had time to freeze, hence the 9:45 p.m. time frame. So how, exactly, did these conditions cause the roof to leak only in this specific scenario?

When snow melts, the water created builds up below the snow pack. When water freezes, it freezes from the top down. So the ice was getting thicker from the top down throughout the evening, creating a pocket of water beneath it.

Water also expands as it freezes, and the initial layer of ice can expand in all directions at the same time. But once the top layer has frozen solid to the membrane along the edges, any ice forming can only expand downward, adding pressure to the bubble of water below the ice. This pressure from the thickening ice, combined with additional snow weight, pressed down on the membrane around the screw head, finally causing the tiny flap to open like a valve, and the water—under pressure—squirted into the roof system.

In fact, the hole itself might have come from this ice-expansion effect. Maybe that first year a significant snow fell and froze solid down to the membrane. In those conditions, the pressure would be extreme and the cold membrane would be at its most brittle. Conceivably, the pressure at the screw head, combined with the brittleness, could have caused this tiny fracture, which then stayed unnoticed until conditions were perfect for the leak to occur.

The fix was simple: a patch applied over the hole. Once our spring snows stopped, a cricket was installed to minimize ponding. Had the cricket had been installed initially, the leak probably never would have occurred.

*Roofing specialist Steve Clisset is an instructor for the Colorado Roofing Association, colorado roofing.org, and owner of the Lifetime Roofer's Guild, lifetimeroofers.com.*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BY DOUG GARRETT

# Code Conflict

**There appears to be a major conflict**—one that poses a real danger to the life and safety of building occupants—in the 2012 International Energy Conservation Code (IECC) and 2012 International Residential Code (IRC). The 2012 IECC sets a mandatory blower-door-tested maximum air-infiltration rate at a tight 3 ACH50 (50 air changes per hour) in most of the country (climate zones 3 to 8) and 5 ACH50 in hot, humid regions (climate zones 1 and 2).

The problem lies in the fact that the new IECC/IRC also allows builders to install natural-draft gas appliances in these homes with no safety testing. There is a significant danger that negative pressure near combustion appliances will cause backdrafting, drawing carbon monoxide into the building. The IRC says that if your home meets the ACH50 standards of the IECC, you must comply with the ASHRAE 62.2 mechanical ventilation standard, which could be met with an exhaust-only system, but it says nothing about combustion appliance zone (CAZ) safety.

The IRC also says that if you have gas appliances in this home, you must comply with the fuel gas requirements of the International Mechanical Code (IMC), and the IMC says something weird: If the house is less than 4 ACH (50 or natural; it's not clear) you must have combustion makeup air so the fire can breathe. But there is nothing to address CAZ depressurization due to fans.

Now we have climbed through several codes, none of which makes this trail easy to follow, and we still don't have the assurance we need. Unless there is language in the IMC, or someplace else, that I'm not aware of, we have a threat to life and public safety.

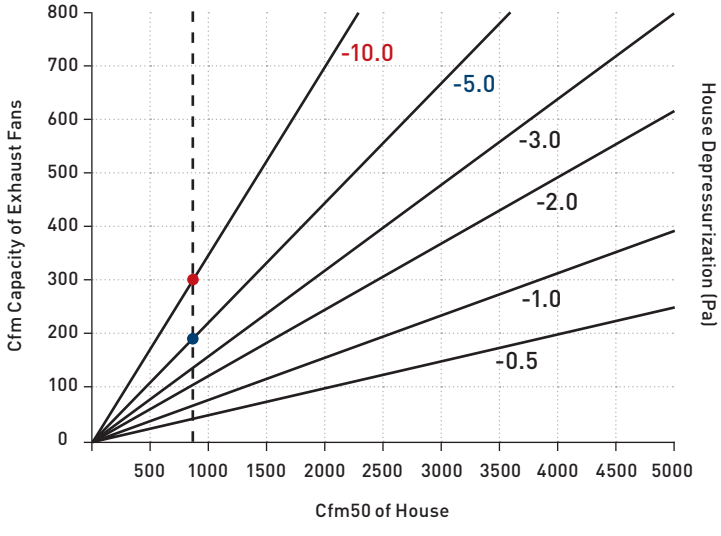
CAZ safety limits established by the Building Performance Institute show that natural-draft gas appliances can suffer backdrafting when placed under a pressure of as little as -2 to -5 Pascals (Pa). When a home is very tight, even very small exhaust fan flows will exceed these safety limits. Take a 2,000-square-foot home with an average ceiling height of 9 feet (volume = 18,000 cubic feet). To meet the 2012 code, this house would have to test-out at 900 cfm50. This is the leakiest a home this size can be built under the 2012 code. What happens when you turn on an exhaust fan in this home?

The chart at left depicts the relationship between tightness, airflow, and depressurization. The vertical dotted line represents 900 cfm50. The red dot represents what happens when you turn on a 300-cfm kitchen exhaust fan. A natural-draft gas water heater depressurizes the house to -2 Pascals, which is the BPI CAZ safety limit. But the 300 cfm fan will depressurize the home to -10 Pa. This is twice the safe maximum depressurization allowed for a gas furnace and two to three times what a natural-draft gas water heater can safely operate against. Turning on a clothes dryer or two bathroom exhaust fans to generate an exhaust flow of 200 cfm (blue dot) will result in a depressurization of -5 Pa. This says nothing about any "worst-case depressurization" scenarios when all exhaust appliances may be operating and bedroom doors are closed. Homes built tighter than this will experience even greater depressurization as the dotted line shifts to the left.

What's the solution? It's easy: If you seal to the 2012 IECC requirements, install only draft-induced or sealed combustion appliances. Any natural-draft combustion appliance is a disaster waiting to happen.

*Doug Garrett, CEM, is president of Building Performance & Comfort, in Jarrell, Texas. bpchomeperformance.com*

House Depressurization




A 300 cfm exhaust fan can depressurize the leakiest 2,000-square-foot home allowed by code (blower door at 900 cfm50, as indicated by dotted line) to -10 Pa (red dot). No natural-draft gas appliance in the home could safely draft under these conditions.

Graph: Adapted from The Energy Conservatory


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Photo: Mike Guertin

# Strong, Safe Decks
## A guide to best practices for building and repair

BY JLC STAFF WITH MICHAEL CHOTINER

It's difficult to determine how many injuries are caused by deck collapses each year in the U.S. Estimates vary wildly. In two recent studies of overlapping 5-year periods, for example, one reports more than 30,000 injuries, the other cites 1,100. One thing is certain, however: Stories of deck collapses are in the news every week. And while they rarely report a fatality, they almost always mention injuries.

It's also difficult to find much data on what causes deck failures. Certainly some are caused by rotted decking or railings, but anecdotal evidence seems to indicate that most of the failures that make the news occur at framing connections. Based on what we have seen, two types of connections in particular are most vulnerable: the connection of the ledger to the house, where fasteners are undersized, inadequately linked to house framing, and poorly flashed against water intrusion; and at the guardrails, which are almost never anchored to withstand the forces they could be called upon to resist.

Over the years at *JLC* and our sister magazine *Professional Deck Builder,* we have published dozens of articles focused on virtually every aspect of deck design, engineering, and construction. In this first edition of our Best Practices series, we have selected the most critical details from those articles, updated them to reflect new and modified material, and brought them together in one location. We hope that these details will help you improve the strength and safety of decks you are building now, and inform your work with the existing decks you are asked to evaluate and repair.

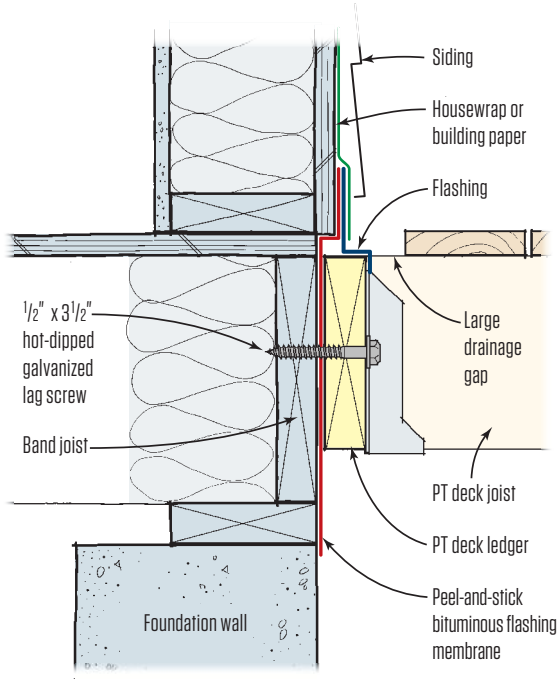
## DECK LEDGERS

Improper sizing and fastening of the ledger board is the single biggest cause of deck failures. The details at right show methods for fastening the ledger to the band joist directly or through sheathing, with either lag screws or bolts. Also shown are flashing and spacing details that promote drainage and protect the structural members and fasteners from moisture.

In the best case, the ledger is through-bolted to a band joist, and the band joist is laterally braced to other components in the floor frame of the primary structure (see Bracing, page 40). When this isn't feasible, other methods are available (see Ledger Support Alternatives, page 38).

Solid-sawn two-by, preservative-treated southern pine or hem-fir is typical for ledger boards. A ledger should be a minimum of 6 inches deep and at least the same thickness as the deck joists. Choose the straightest board available for a deck ledger.

### Attaching Ledger Directly to Band Joist

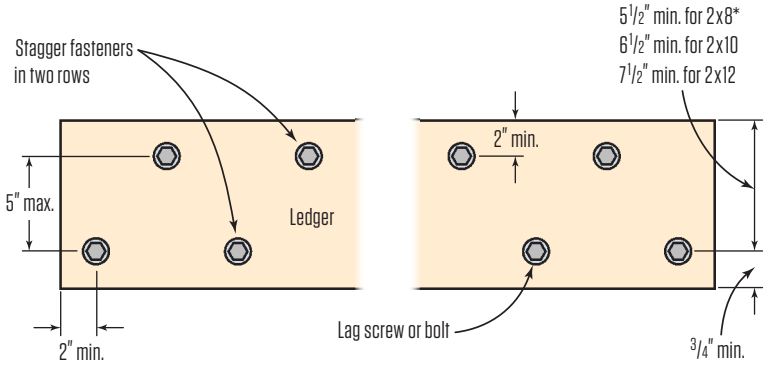



## LEDGER FASTENER PLACEMENT

Fasteners should be hot-dipped galvanized or stainless steel and staggered along the ledger face according to code (see illustration and tables at right). Make sure that ledger fasteners won't fall on the joist layout. Fasten through any spacers used to hold the ledger off the sheathing.

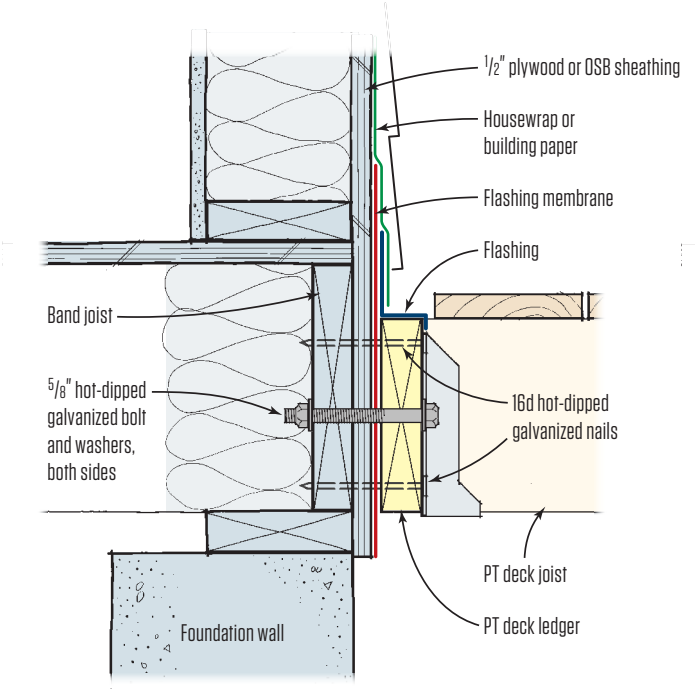
Structural fasteners are available that meet or exceed the shear design values of ½-inch lags. They typically come either coated or in stainless steel, require no pre-drilling, and can be driven with an impact driver or a ½-inch drill at low speed. Manufacturers provide size and spacing charts that will meet code, depending on the materials used and the maximum joist span of the deck.

### Placement of Lag Screws and Bolts in Ledgers

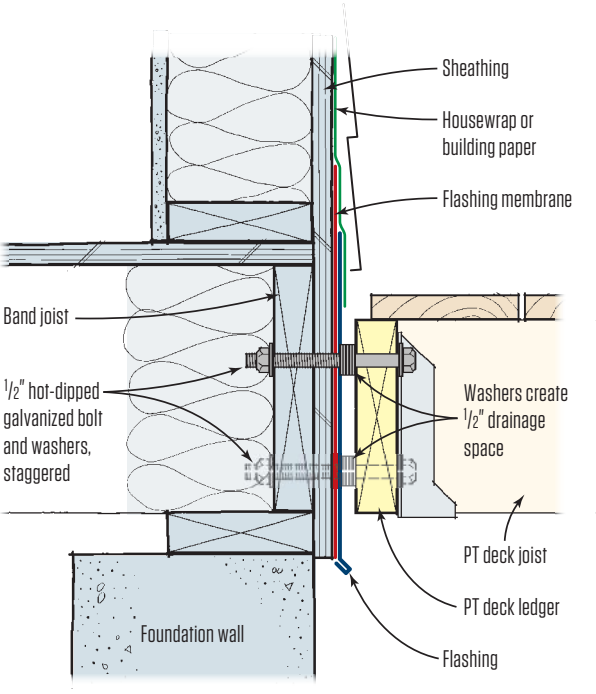



* Distance can be reduced to 4 1/2" if lag screws are used or bolt spacing is reduced to that of lag screws to attach 2x8 ledgers to 2x8 band joists.

### Attaching Ledger to Band Joist Over Structural Sheathing




### Attaching Ledger With Drainage Spacers




## Deck Ledger[1] Fastener Spacing
(inches)

| Lag screw[2] | Bolt[2] | Spaced bolt[3] |
|---|---|---|
| 30 | 36 | 36 |
| 23 | 36 | 36 |
| 18 | 34 | 29 |
| 15 | 29 | 24 |
| 13 | 24 | 21 |
| 11 | 21 | 18 |
| 10 | 19 | 16 |

**1** For SYP or hem-fir ledger; solid-sawn 2-by SPF band joist or 1x9½-inch (min.) Douglas fir LVL rimboard.
**2** ½-inch-diameter lag or bolt with 15/32 (max.) sheathing.
**3** Bolted ledger spaced ½ inch off sheathing.

## Placement of Lag Screws & Bolts
Minimum end & edge distances & spacing (inches)

| | Ledger[a] | Band joist[b] |
|---|---|---|
| Top | 2[c] | 3/4 |
| Bottom | 1/4 | 2 |
| Ends | 2[d] | 2[d] |
| Row | 1-5/8[d] | 1-5/8[d] |

**a** Stagger lags or bolts according to illustration at left.
**b** For engineered rim joists, use manufacturer's recommendations.
**c** Follow illustration (left) for minimum distance from bottom row of fasteners to top edge of ledger.
**d** Maximum 5 inches.

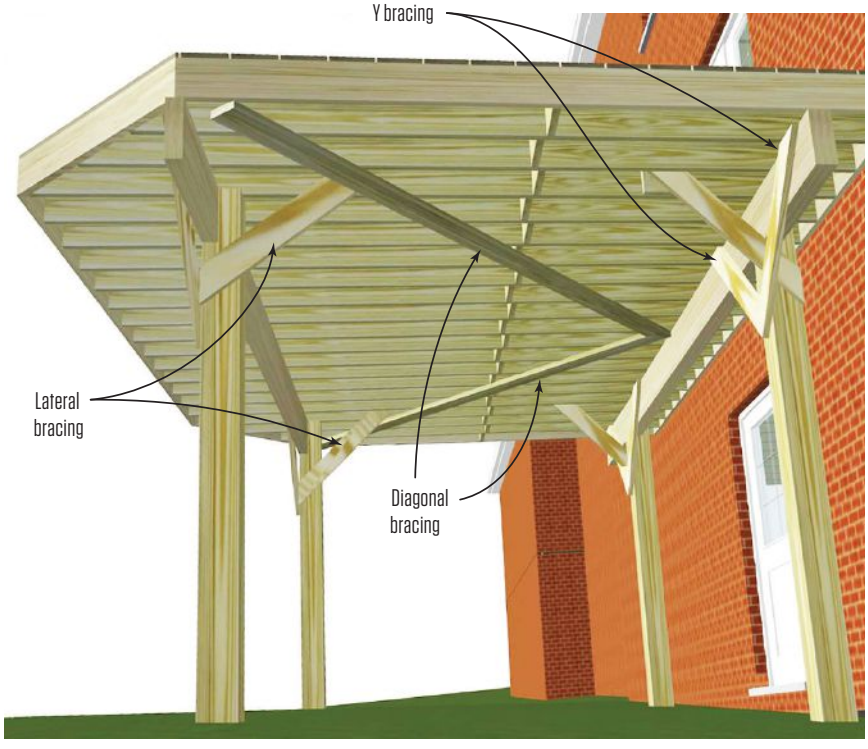
**Notes:** The tip of the lag screw should fully extend through the inside face of the band joist. The maximum gap between the face of the ledger and the face of the wall sheathing is ½ inch. Flash the ledger to prevent water from contacting the band joist. Stagger lags and bolts (see bottom illustration, facing page). Deck ledger should be minimum 2x8 PT #2 grade lumber or other approved material. When fastening solid-sawn PT ledgers to 1-inch-thick (min.) engineered rim joist, use an engineered attachment. Wood structural panels, gypsum boards, or rigid foam are permitted as sheathing; the maximum distance between the face of the ledger and the face of the band joist/rimboard is 1 inch.

[Editor's note: These tables, all notes, and the fastener spacing illustration are adapted from the 2012 IRC Tables R507.2, Table R507.2.1, and Figure R507.2.1(1).]

## LEDGER SUPPORT ALTERNATIVES

Where access to house floor framing is uncertain, supporting the ledger with posts offers a sound solution (see illustration, facing page). Another alternative to connecting a ledger to the band joist is to build a freestanding deck (right). In this case, it is critical to anchor posts to piers to prevent uplift (see Connections, page 42), and to brace all posts in both directions, as shown at right. To prevent racking of deck joists, use diagonal bracing fastened to the underside of the framing members.

Freestanding Deck




## DECK FOUNDATIONS

Most decks can be supported by wood posts resting on concrete footings, piers, or a combination of the two.

**Size.** Assuming a minimum soil bearing capacity of 1,500 psf, 8-inch-diameter concrete piers bearing on square footings measuring 2 feet on a side and 9 to 11 inches thick are adequate for most single-story decks where beams are spaced 14 feet apart or less and joist spans are 14 feet or less (see Footing Size table at right).

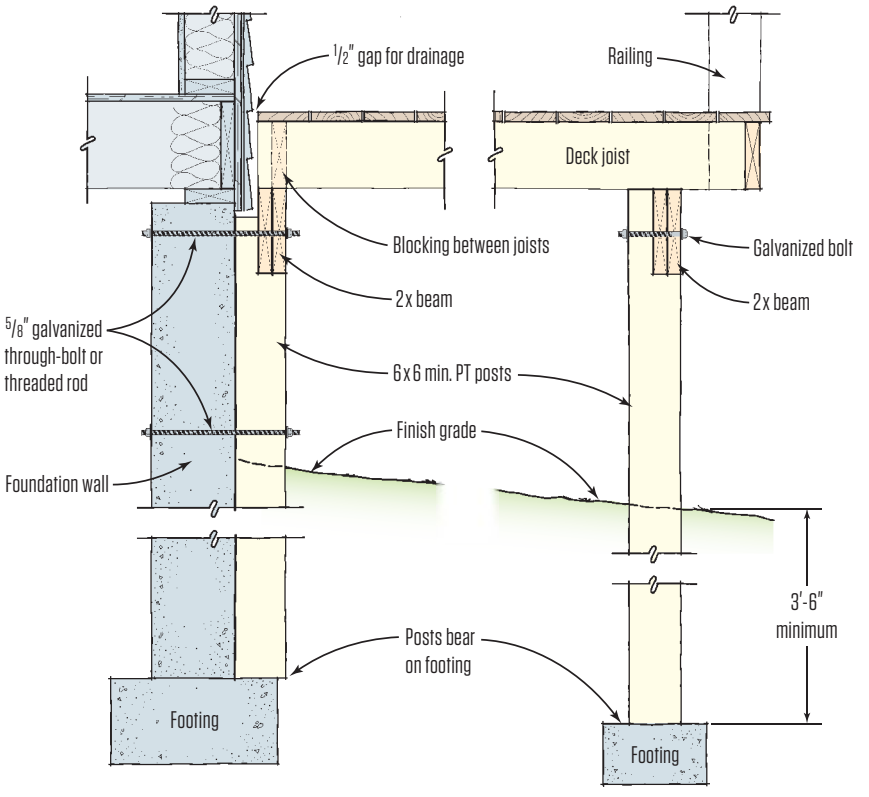
**Depth.** Keep deck footings at least 5 feet from a house foundation. Deck footings closer than 5 feet should be set at the same depth as the house footing. Otherwise, place footings below the frostline or at least 12 inches below grade.

**Reinforcement.** To prevent cracking of the footing due to point-load forces, add steel reinforcing. Make sure an unreinforced footing is not too wide. It should extend at least 2 inches beyond the pier but no more than the thickness of the footing. In all cases, center piers or posts on footings.

**Engineered alternatives.** For problem soils, steep slopes, or sites with difficult access, or where environmental or other conditions preclude excavation, several engineered alternatives to conventional concrete footings and piers are available. Hydraulically driven helical piles (photo, near right) are typically installed by subcontractors who use torque readings to achieve the required bearing capacity in a variety of soils. Precast pin footings (photo, far right) bear on steel pipes driven using a hammer drill through sleeves in the piers to a depth determined by the frostline.

**Call 811 before you dig.** Whether you plan to dig holes for footings or use an engineered pier system, take the precaution of calling ahead to determine the existence and location of any underground services in the project area. In most of the U.S., simply call 811 at least three days before digging (in Canada, each province has a separate phone number for information).

### Deck Fully Supported With Posts



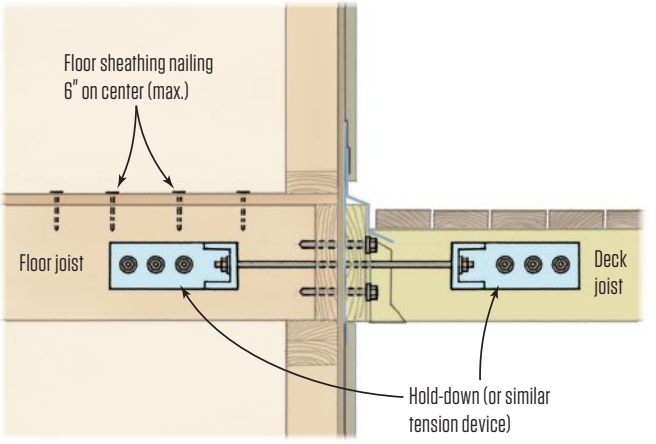

Supporting a ledger with posts is a good option when a deck is to be built next to a brick-veneer, stucco, or concrete wall. A strong post-to-beam connection and through-bolting to the wall provide resistance to lateral forces. Where posts bear on below-grade footings, use treated lumber rated for use in permanent wood foundations and structural building poles.

### Footing Size

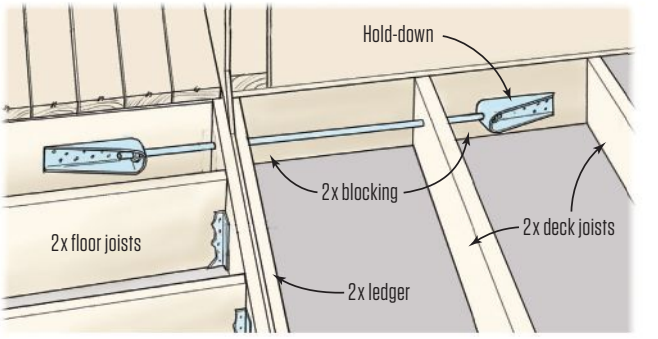
| Beam span | Joist span | Round (diameter) | Square (per side) | Thickness |
|---|---|---|---|---|
| 8' | <10' | 17" | 15" | 6" |
| | <14' | 20" | 18" | 8" |
| | <18' | 23" | 21" | 9" |
| 10' | <10' | 19" | 17" | 7" |
| | <14' | 22" | 20" | 9" |
| | <18' | 25" | 23" | 10" |
| 12' | <10' | 21" | 19" | 8" |
| | <14' | 24" | 22" | 10" |
| | <18' | 28" | 26" | 11" |
| 14' | <10' | 22" | 20" | 9" |
| | <14' | 26" | 24" | 11" |
| | <18' | 30" | 28" | 12" |
| 16' | <10' | 24" | 22" | 9" |
| | <14' | 28" | 26" | 12" |
| | <18' | 32" | 30" | 13" |

Adapted from "Prescriptive Residential Wood Deck Construction Guide"

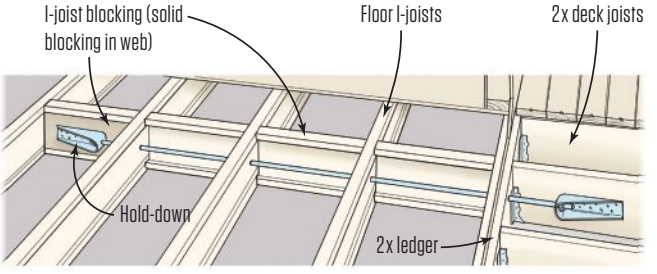
### Parallel (Sawn Joists)



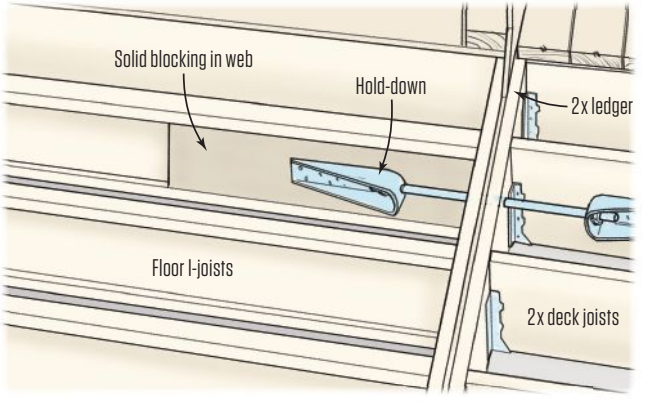

### Perpendicular (Sawn Joists)




### Perpendicular (I-Joists)




### Parallel (I-Joists)




## BRACING

While the fasteners in a ledger-rim joist connection made according to IRC specs should be adequate to resist shear forces, lateral forces may still pull the ledger and rim board away from the house. The best practice, suggested by the 2012 IRC (Figure R507.2.3), is to use hold-down tension hardware in at least two locations to tie deck joists to floor joists of the primary structure. The illustrations above show suggested methods for bracing ledgers when the deck joists run either parallel to or perpendicular to solid-sawn or wood I-joist floor framing.

## SIZING POSTS, BEAMS, & JOISTS

Here are some rules of thumb for sizing framing members for simple deck designs. To size framing for complex designs, or decks with long spans or multiple stories, consult your building department or an engineer.

**Sizing deck posts.** Most decks that are 8 feet or less above grade with beam spans of 10 feet or less can be built safely with 4x4 posts, but the American Wood Council (AWC) recommends using 6x6 posts in all cases for decks up to 12 feet off the ground, primarily because they are better able to resist bowing.

The material and size for structural posts for decks taller than 12 feet, or that support multistory decks, should be determined by a professional engineer. Posts taller than 12 feet may also require lateral bracing to resist bowing.

**Beam and joist sizes and spans.** The *Prescriptive Residential Wood Deck Construction Guide* (free download with registration at awc.org), published by the American Forest & Paper Association, offers useful span tables (facing page) for the wood species typically used for deck beams and joists.

## Maximum Joist Spans

| Species | Size | Joist spacing (o.c.) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Without overhangs[1] | | | With overhangs up to 1/4 max. joist span[2] | | |
| | | 12" | 16" | 24" | 12" | 16" | 24" |
| Southern pine | 2x8 | ~~13'-8"~~ 13'-1" | ~~12'-5"~~ 11'-10" | ~~10'-2"~~ 9'-8" | ~~10'-9"~~ 10'-1" | ~~10'-9"~~ 10'-1" | ~~10'-2"~~ 9'-8" |
| | 2x10 | ~~17'-5"~~ 16'-2" | ~~15'-10"~~ 14' 0" | ~~13'-1"~~ 11'-5" | ~~15'-6"~~ 14'-6" | ~~15'-6"~~ 14'-0" | ~~13'-1"~~ 11'-5" |
| | 2x12 | n/a 18'-0" | ~~18'-0"~~ 16'-6" | ~~15'-5"~~ 13'-6" | n/a 18'-0" | ~~18'-0"~~ 16'-6" | ~~15'-5"~~ 13'-6" |

## Deck Beam Spans[1]

for joists framing from one side only

| Species | Size | Joist spans less than or equal to: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 6' | 8' | 10' | 12' | 14' | 16' | 18' |
| Southern pine | 2-2x6 | ~~7'-1"~~ 6'-11" | ~~6'-2"~~ 5'-11" | ~~5'-6"~~ 5'-4" | ~~5'-0"~~ 4'-10" | ~~4'-8"~~ 4'-6" | ~~4'-4"~~ 4'-3" | ~~4'-1"~~ 4'-0" |
| | 2-2x8 | ~~9'-2"~~ 8'-9" | ~~7'-11"~~ 7'-7" | ~~7'-1"~~ 6'-9" | ~~6'-6"~~ 6'-2" | ~~6'-0"~~ 5'-9" | ~~5'-7"~~ 5'-4" | ~~5'-3"~~ 5'-0" |
| | 2-2x10 | ~~11'-10"~~ 10'-4" | ~~10'-3"~~ 9'-0" | ~~9'-2"~~ 8'-0" | ~~8'-5"~~ 7'-4" | ~~7'-9"~~ 6'-9" | ~~7'-3"~~ 6'-4" | ~~6'-10"~~ 6'-0" |
| | 2-2x12 | ~~13'-11"~~ 12'-2" | ~~12'-0"~~ 10'-7" | ~~10'-9"~~ 9'-5" | ~~9'-10"~~ 8'-7" | ~~9'-1"~~ 8'-0" | ~~8'-6"~~ 7'-6" | ~~8'-0"~~ 7'-0" |
| | 3-2x6 | ~~8'-7"~~ 8'-2" | ~~7'-8"~~ 7'-5" | ~~6'-11"~~ 6'-8" | ~~6'-3"~~ 6'-1" | ~~5'-10"~~ 5'-8" | ~~5'-5"~~ 5'-3" | ~~5'-2"~~ 5'-0" |
| | 3-2x8 | ~~11'-4"~~ 10'-10" | ~~9'-11"~~ 9'-6" | ~~8'-11"~~ 8'-6" | ~~8'-1"~~ 7'-9" | ~~7'-6"~~ 7'-2" | ~~7'-0"~~ 6'-8" | ~~6'-7"~~ 6'-4" |
| | 3-2x10 | ~~14'-5"~~ 13'-0" | ~~12'-10"~~ 11'-3" | ~~11'-6"~~ 10'-0" | ~~10'-6"~~ 9'-2" | ~~9'-9"~~ 8'-6" | ~~9'-1"~~ 7'-11" | ~~8'-7"~~ 7'-6" |
| | 3-2x12 | ~~17'-5"~~ 15'-3" | ~~15'-1"~~ 13'-3" | ~~13'-6"~~ 11'-10" | ~~12'-4"~~ 10'-9" | ~~11'-5"~~ 10'-0" | ~~10'-8"~~ 9'-4" | ~~10'-1"~~ 8'-10" |

**1** Assumes 40 psf live load, 10 psf dead load, L/360 simple span beam deflection limit, No. 2 grade, and wet service conditions. **2** Assumes 40 psf live load, 10 psf dead load, L/180 cantilever deflection with 220 lb point load, No. 2 grade, and wet service conditions.

The tables excerpted above show changes made as of June 1, 2013, to reflect new design values for visually graded southern pine. (Old design values are grayed-out/struck-through and shown above new values.) The full tables also show values for Douglas fir-larch, hem-fir, SPF, redwood, western cedars, ponderosa pine, and red pine, for joist sizes 2x8 through 2x12, and beam sizes 3x6 through 3x12 (or 2-2x6 through 2-2x12), 4x6 through 4x12, and 3-2x6 through 3-2x12.

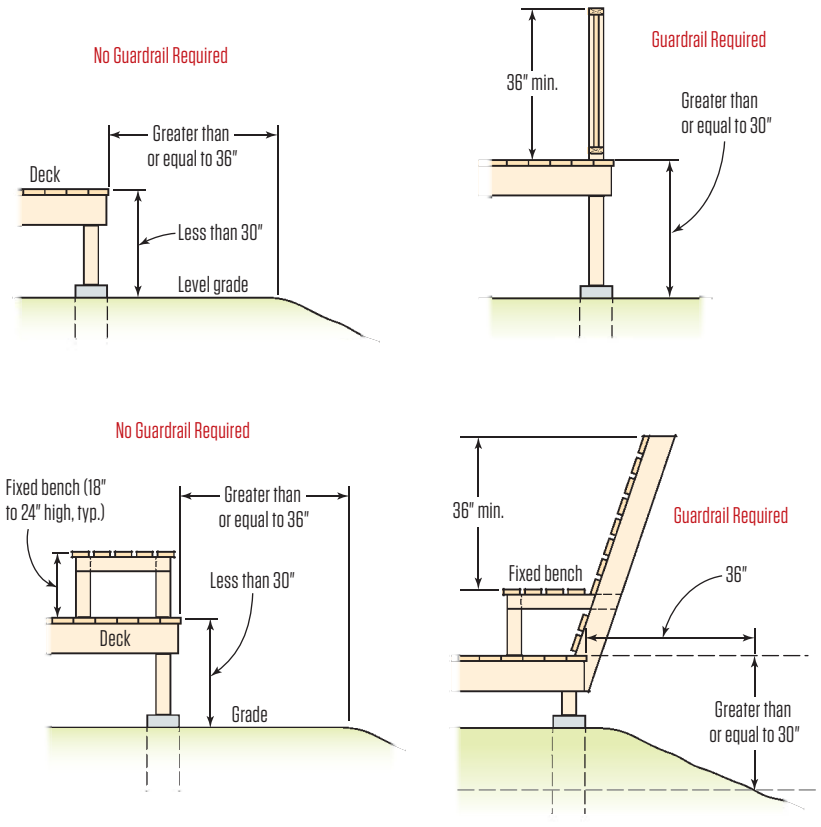
## SAFE DECK RAILINGS

Deck guardrails offer builders a great chance to set a distinctive style and show off their ingenuity and craftsmanship. But plain or fancy, a deck guardrail must meet minimum requirements for strength and safety.

Primary structural strength of a deck guardrail is provided by posts—preferably 6x6 or larger—that extend from the deck foundation or are fastened to rim or end joists at the deck frame perimeter. The key to building strong deck railings is to fasten railing posts in a way that resists the lever force exerted at the post base when someone leans against the top rail. How this is done depends on where a post will be attached to the deck frame, but here are key best practice guidelines:

- Space guardrail posts no further than 6 feet apart.
- Don't notch posts around joists or beams.
- Use at least two ½-inch bolts (preferred) or lag screws to fasten the base of each post to the face of the joist.
- Use metal, deck-post tension ties and wood 2-by blocking to counteract forces at post bottoms.

### When Do You Need A Guardrail?




## CONNECTIONS

While some deck failures are caused by rotted or split wood components, most are due to inadequate or deteriorated fasteners and post, beam, and joist connections. These failures can largely be avoided by selecting from a wide assortment of metal structural connectors and fasteners that are available for virtually every purpose in joining deck frame members. In most cases, structural connectors provide stronger, longer-lasting joints than nails, screws, or bolts alone.

### Post-to-Pier Connections

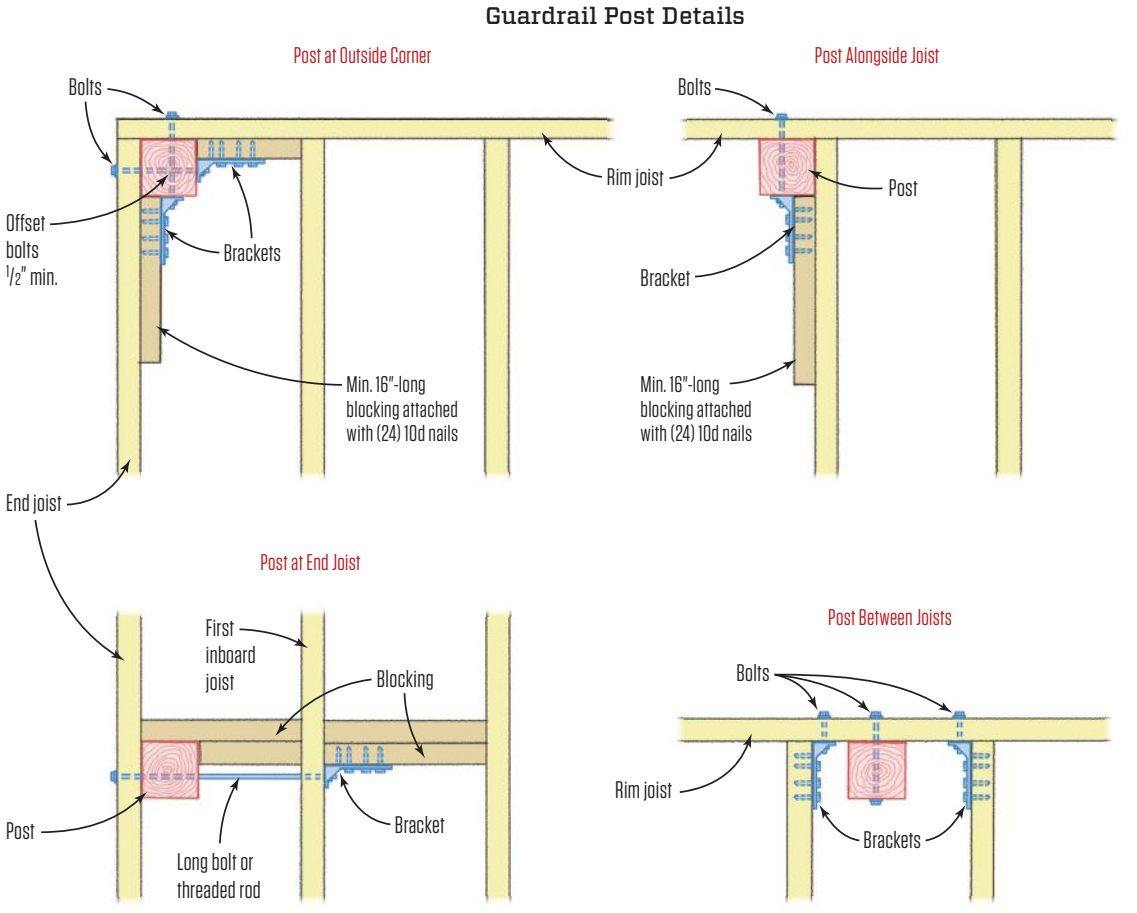
An assortment of adjustable (photo, near right) and stationary (photo, center at top) steel connectors are available to anchor posts to concrete piers. Some are designed to be set in wet concrete; others can be fastened with anchors or epoxy in cured concrete. While wood posts treated and rated for ground contact can be encased in concrete or earth, connectors of this type provide for good drainage, with a standoff of an inch or more, as well as resistance to uplift.

### Post-to-Beam Connections

Horizontal deck beams should rest directly on top of posts. Avoid hanging beams from the sides of posts; over time, deck loads can overstress the bolts or lags. Many types of metal brackets and connectors are available to reinforce beam-to-post connections against lateral and uplift forces (photo, center at bottom). However, many builders prefer to notch post tops to let-in beams, then fasten them to the posts with structural screws or bolts (photo, far right). This method not only reinforces post-beam connections against lateral and uplift forces but also may be more visually appealing.

### Joist-to-Beam Connections

Secure joists with hurricane ties where they bear on a beam or girder. Also add blocking between joists to reinforce them against twisting and rolling. Use joist




hangers for support and to resist uplift where joists are flush-framed between a ledger and a structural deck rim joist.

### Corrosion Resistance

Because most deck frames are constructed with copper-infused pressure-treated lumber and most structural hardware is made from galvanized steel, some degree of galvanic corrosion, which occurs when dissimilar metals are in contact, is inevitable.

Stainless-steel hardware offers the highest level of corrosion resistance. Types 304, 305, and 316 all comply with IRC standards; Type 410 is not as corrosion resistant and is *continued on page 44*

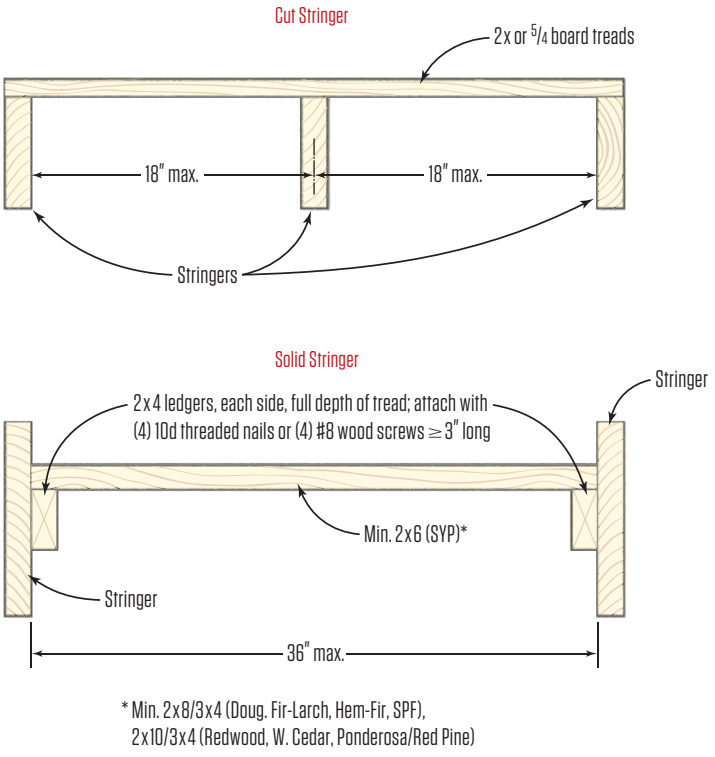
## DECK STAIRS

By code in most jurisdictions, a deck stairway must be at least 36 inches wide. This is also the maximum width of a stair built with closed stringers. Note also that new design values for visually graded southern pine have changed as of June 1, 2013, resulting in changes to maximum span for both cut and solid stair stringers (see Stair Stringer Requirements, right).

Best practice is to attach the stringer with full bearing against the deck header, and use a metal connector. At the bottom, the stringer should rest on a footing designed to resist a 40 psf live load and a 10 psf dead load. The new design values also increase the minimum size for southern pine treads in solid stringers from 2x6 to 2x8 (cut-stringer tread size is unaffected).

At a minimum, a stairway with four or more risers must have a handrail on one side. Handrails must be graspable (see Handrail Grip Size, right) and must run continuously from the lowest to the highest riser (allowing for interruptions by posts at turns in the stair).

### Tread Connections




* Min. 2x8/3x4 (Doug. Fir-Larch, Hem-Fir, SPF), 2x10/3x4 (Redwood, W. Cedar, Ponderosa/Red Pine)

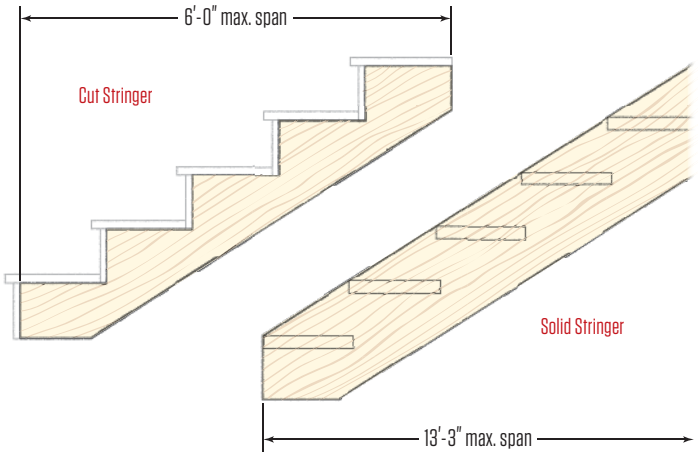
*continued from page 43*

not recommended for salt air or harsh chemical environments.

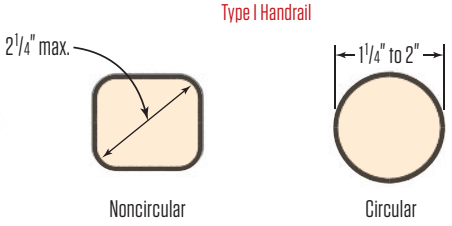
When stainless steel is too costly, galvanized hardware generally offers the next-best level of corrosion resistance. But not all galvanizing processes are equally effective. Mechanically galvanized Class 55, hot-dipped galvanized (ASTM A-153), and various "double-barrier" coatings for hardware and fasteners generally meet the applicable code for corrosion resistance. Also make sure that the steel connectors and all fasteners are made from the same or compatible metal and have similar rust-preventative coatings.

As a further precaution, some deck craftsmen line the inner surfaces of connectors and brackets with flashing tape to prevent contact between the steel and the treated-wood surfaces (left). While this seems to slow corrosion significantly, the added material and labor for this time-consuming step can make it as expensive as using stainless steel hardware and fasteners.

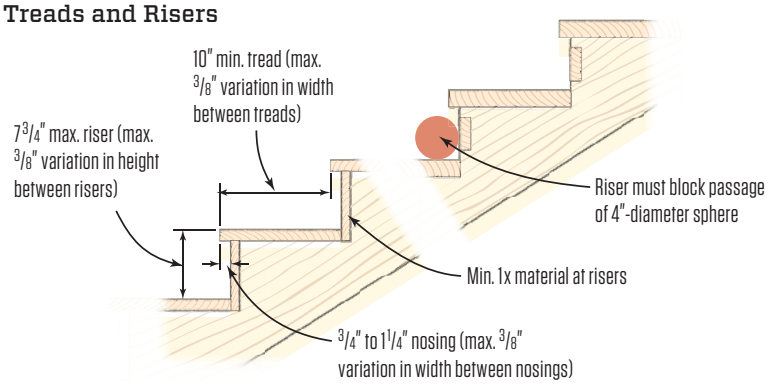
## Stringer Span



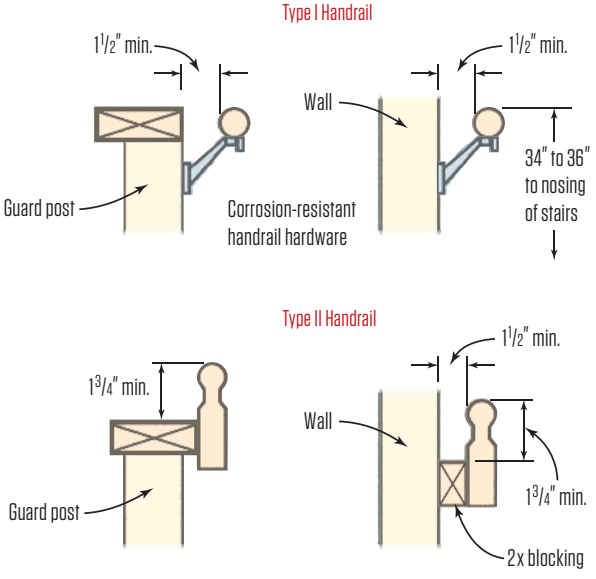

## Handrail Grips



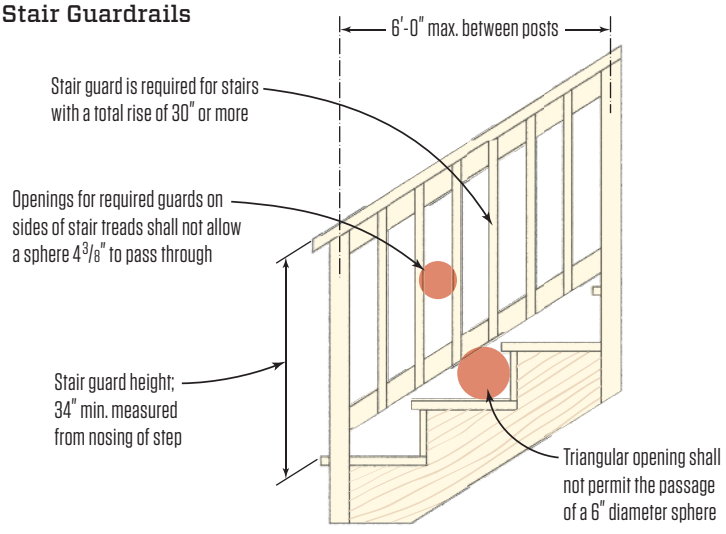

## Treads and Risers




## Handrail Mounting




## Stair Guardrails



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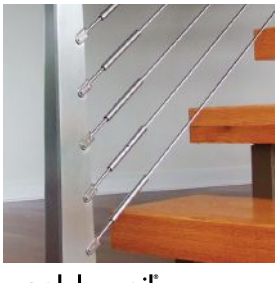

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# Modular Tool Organizers

## Choose a system that fits your work style, budget, and desired level of customization

BY GREG BURNET

When I was a remodeling contractor, I was constantly looking for better ways to organize tools and supplies. After I became a specialty contractor (we do window and door replacements), that quest became a passion.

For us, the key to becoming better organized has been the use of modular organizers—boxes that share the same footprint, stack easily, and can be latched one-to-another for storage and transport. We've tailored the shelves in our trucks and trailers to the size of the organizers. No more haphazard stacking of mismatched toolboxes and having to guess what's inside; since the boxes are labeled, we know what each one contains.

In the U.S., the big players in modular organizers are Festool, Bosch, and DeWalt. For this article my crew tested products from all three companies.

## FESTOOL SYSTAINERS

Festool Systainers were the first modular organizers to be sold in this country. They are widely distributed and have the most comprehensive product line. Systainers are produced by Tanos, a subsidiary of Tooltechnic Systems, the company that owns Festool. Tanos also sells under its own label, and its Systainers are compatible with Festool's, sharing the same latching mechanism, handles, and 15 5/8-inch by 11 5/8-inch footprint.

Shipped as standard carrying cases with specific inserts (1) for Festool power tools (and a few accessories), Systainers are also available empty under the Tanos label from some online sources.

What makes these ABS plastic boxes so versatile is that they can be stacked and latched together (2), allowing several tools to be moved at once. They can be carried by the handles or rolled around on wheeled accessories.

### T-Loc Latches

The top handle recesses into the lid so another box can be stacked on top of it; the two boxes are joined at the rear by mating slots and tabs and at the front by a rotating T-Loc mechanism. The T-Loc can be oriented to hold the lid closed, secure the box to the box above it, or allow the lid to be opened. Older Systainers and current Tanos boxes use clip-like latches to hold lids closed and gang boxes together. The T-Loc models are faster and easier to operate and are partially compatible with earlier models; they can be stacked on old-style boxes but not the other way around.

### Durability

Our company has used Systainers for several years and we've found them to be durable. We cracked one or two of the older ones, but that was a result of rough handling. We're now more careful and have had no problems since. If you like to toss your boxes in the back of the truck and throw a ladder on top of them, then Systainers are not the organizers for you.

### Using Systainers

Some of our hand-held power tools are from Festool, but most come from other manufacturers—and we house those tools in Systainers. We often put multiple similar tools, such as drill and impact drivers, into a single Systainer (3). This cuts down on the number of organizers we have to haul and ensures specific tools and related accessories are kept together. There are recessed areas for labels on the sides and front of the boxes; we label all our boxes so we can tell what's inside.

Though most of our tools fit into the standard boxes, longer tools—such as recip saws and cordless kits—require the use of Maxi Systainers. These jumbo-size boxes have twice the footprint of standard models. They are 8 1/4 inches tall and use the older-style latches. But they're still modular: You can gang them to one another or put a pair of standard-size Systainers on top (4).

At the opposite end of the spectrum are the Mini Systainers (5). We use these pint-size boxes to hold bits, marking instruments, and other small items.

### The Sortainer

Another variation of the Systainer is the Sortainer (6), a modular box with drawers. Available in multiple configurations, it provides an excellent way to organize fasteners, bits, and other small parts. The drawers are modular and are easily interchanged; most have adjustable dividers. There's a spot on the outside of each drawer for the included label.

### Transport Options

Systainers can be carried by the handles, clipped onto one of the manufacturer's dust extractors, or rolled around on a wheeled base or carrier. Festool offers the SysRoll hand truck, the SysCart, and the SysPort, which allows you turn a stack of Systainers into a European version of a rolling mechanic's tool chest. Tanos makes a Folding Trolley.

The SysRoll hand truck (7) is a four-wheel carrier with an upright back that doubles as a handle. There's a shallow storage drawer under the base and a strap to lash the stack to the carrier. The SysRoll is surprisingly sturdy given that it's made from ABS plastic. My only gripe is that it doesn't fold to take up less space when not in use.

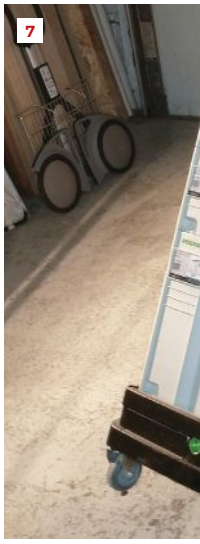
The SysCart resembles a mover's dolly and has clips to hold a Systainer on top. The wheels roll easily on hard surfaces, but are a bit on the small side. We leave one permanently attached to the stack of tools we use most often. It's one of the first things off the truck when we get to the job.

We particularly like Tanos' Folding Trolley (8). The large wheels roll easily over rough terrain, and it folds flat (5 inches thick) when not in use. The only thing missing is straps, but it's easy enough to fasten the load with bungees.

### The Bottom Line

Systainers cost more than other modular tool organizers, but there are more boxes and accessories to choose from. They're a good fit for the tradesman who wants to be highly organized and can pay what it costs to get that way.



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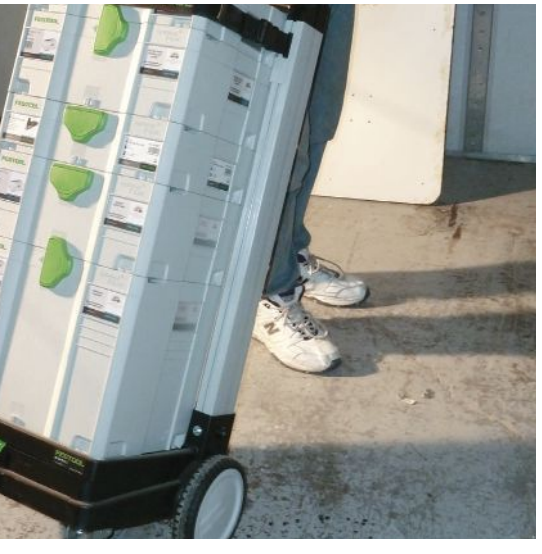
FESTOOL SORTAINER

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BOSCH


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## BOSCH L-BOXX

Bosch introduced the L-Boxx to the U.S. a little over a year ago and continues to roll out additional elements. The boxes are made by Sortimo, a German company that sells L-Boxxes in Europe under its own label.

In concept, L-Boxxes are similar to Systainers: All L-Boxxes share the same footprint, can be stacked and locked together (1), and are available in multiple depths and configurations. Current offerings include four boxes, an organizer with removable bins (2), and the L-Boxx 3D—an interesting customizable storage box.

### Sizes

At 14 inches by 17½ inches, the L-Boxx's footprint is larger than that of the Systainer. L-Boxxes come in depths of 4½, 6, 10, and 15 inches and can be purchased empty or as cases with select Bosch tools. They may accept tools that won't fit in other modular boxes. For example, the L-Boxx-4 is the only modular box large enough to accept our 10¼-inch circular saw.

### Click & Go

The manufacturer refers to this product line as the Click & Go system because boxes can be connected very quickly. We found it easy to operate the connector clips: You stack boxes so they align (3), push down on top, and the spring-loaded clips latch on to the box below. Reversing the process is a matter of grabbing the sides of the L-Boxx and lifting while pressing the clips.

### Construction

L-Boxxes have generously sized top handles that recess into the lid when not in use and indentations for lifting from the side. The three smallest boxes also have front-mounted handles so you can carry them from the side, suitcase-style (4). That's a more comfortable way to carry a shallow box, but if the contents aren't secured, you risk jumbling them all together.

The walls of L-Boxxes appear to be about the same thickness as those of Systainers, but we put some calipers on them and discovered that they're actually about half again as thick. The tops and bottoms contain grids of reinforcing ribs. These boxes feel like they should hold up well. But we're not so sure about the lid latches; they seem less sturdy than the rest of the box.

### L-Boxx-3D

We were particularly impressed with the L-Boxx-3D (5), which has a shallow compartment under the lid and a large front opening into which drawers or compartmentalized organizers called i-Boxxes (6) can be inserted. There are several i-Boxxes to choose from. It's a clever design that allows the user to tailor the box to the task at hand.

If the box comes with a tool, it contains a molded insert for that tool. Inserts can be purchased as accessories for certain Bosch tools, and the manufacturer offers "pick and pluck" foam—similar to what's found in Pelican cases—that can be customized to fit any tool.

### Wheeled Transport

A two-wheeled folding aluminum hand truck recently hit the market but was not available at the time of this review. Bosch also offers a four-wheel flat similar to a mover's dolly (7). L-Boxxes can be clipped onto it and rolled around.

### The Bottom Line

We like the L-Boxxes, especially their larger footprint relative to Systainers. The Click & Go system makes it possible to quickly gang boxes together. Our one concern is with the long-term durability of the latches. If I were starting from scratch, I would definitely consider standardizing with L-Boxxes—though it would be easier to get to yes if Bosch offered a larger selection of accessories.

## DEWALT TOUGHSYSTEM

The design philosophy behind DeWalt's ToughSystem boxes is different from the one that inspired Festool's and Bosch's boxes. There are fewer models to choose from and they are not as customizable as Systainers or L-Boxxes. But you can stand on a ToughSystem case (1), beat on it, and leave it out in the rain without damaging it or its contents. The same can't be said of boxes made from ABS plastic.

### Construction

Constructed from 3/16-inch structural foam, ToughSystem boxes are the most rugged modular containers we tested. A gasket at the perimeter of the lid creates a positive seal against water and dirt. Sturdy metal latches secure the lid, and there's a place to put a padlock. Every box has a pair of side handles and a top handle that recesses into the lid.

### Product Line

The system includes three boxes of varying depth, an organizer box with removable part bins (2), and a wheeled "DS Carrier" for transport. ToughSystem boxes are considerably larger than other modular organizers—large enough to hold recip saws, rotary hammers, and other bulky items.

The boxes are all the same length, so they can be ganged and clipped together (even though the tallest model is an inch wider than the others). I have some reservations about the clips. They're plastic, and although we didn't break any, they seem like the weak link in the system. I can't see using the clips that often anyway—not if I had the DS Carrier.

### DS Carrier

The DS Carrier (3) is a wide two-wheeled dolly designed to carry ToughSystem boxes and other items. The beauty of the system is that boxes do not have to be ganged to ride on the carrier; they also can be individually attached to adjustable brackets that project from the tubular steel frame of the carrier.

It's a quick and easy install: Lift the box by the spring-loaded side handles and place it between the brackets, and when the handles are released they will clamp the box onto the brackets. This makes it easier to get at your tools because you can remove boxes without disturbing the ones above or below. Also, if the lower position is not occupied by a box, you can use the platform to carry bulky items that are not in boxes. The brackets fold out of the way when not in use, so you can use the carrier like a regular dolly. We've used it to haul trash cans and bags of concrete.

The large wheels travel easily over rough ground, but the wide stance makes it tricky to roll the carrier through openings less than 30 inches wide. The carrier is ruggedly built and can support 260 pounds on the ground and 175 pounds on stairs. ToughSystem boxes are nice, but the DS Carrier is the star of the show—we really like what it can do.

### The Bottom Line

ToughSystem boxes are a good fit for the builder or remodeler who needs heavy-duty boxes that can be ganged together or rolled on a specialized carrier. To get the most out of this system, buy the carrier.

## DEWALT TSTAK BOXES

DeWalt recently released the TSTAK line of modular organizers. Smaller and less rugged than ToughSystem organizers, these polypropylene boxes are nicely designed and very affordable. They come in four configurations and have a 13-inch by 17-inch footprint. The TSTAKs stack and latch (4) like ToughSystem boxes, though due to the size of its handle, the Long Handle Tool Case must be on top (5). DeWalt recommends against lifting more than three boxes at a time.

### Construction

The walls of the TSTAKs are pretty rugged, and we found the oversized metal latches easy to operate even with gloved hands. They're not as water-resistant as ToughSystem boxes but still offer more-than-adequate protection.

Attention to detail is evident in this line. Depending on the model, there are metal ball-bearing drawer slides, removable lidded boxes (6), foam inserts, and areas to affix content labels. DeWalt does not make a cart for these boxes, so we took to hauling them with a lightweight folding hand truck, lashing them in place with bungees. This improvised method works, but a dedicated cart with a means to secure boxes would be a welcome addition.

### The Bottom Line

These organizers are well-suited to storing and transporting small tools, parts, and components. The shallow depth was a limiting factor for our needs. That said, we were impressed by the overall quality and excellent value offered by TSTAK. This line may be just the ticket for electricians and plumbers, as well as any other tradesmen in need of compact storage solutions.

*Greg Burnet runs Chicago Window and Door Solutions, a carpentry contracting firm in Chicago that specializes in door and window installations.*



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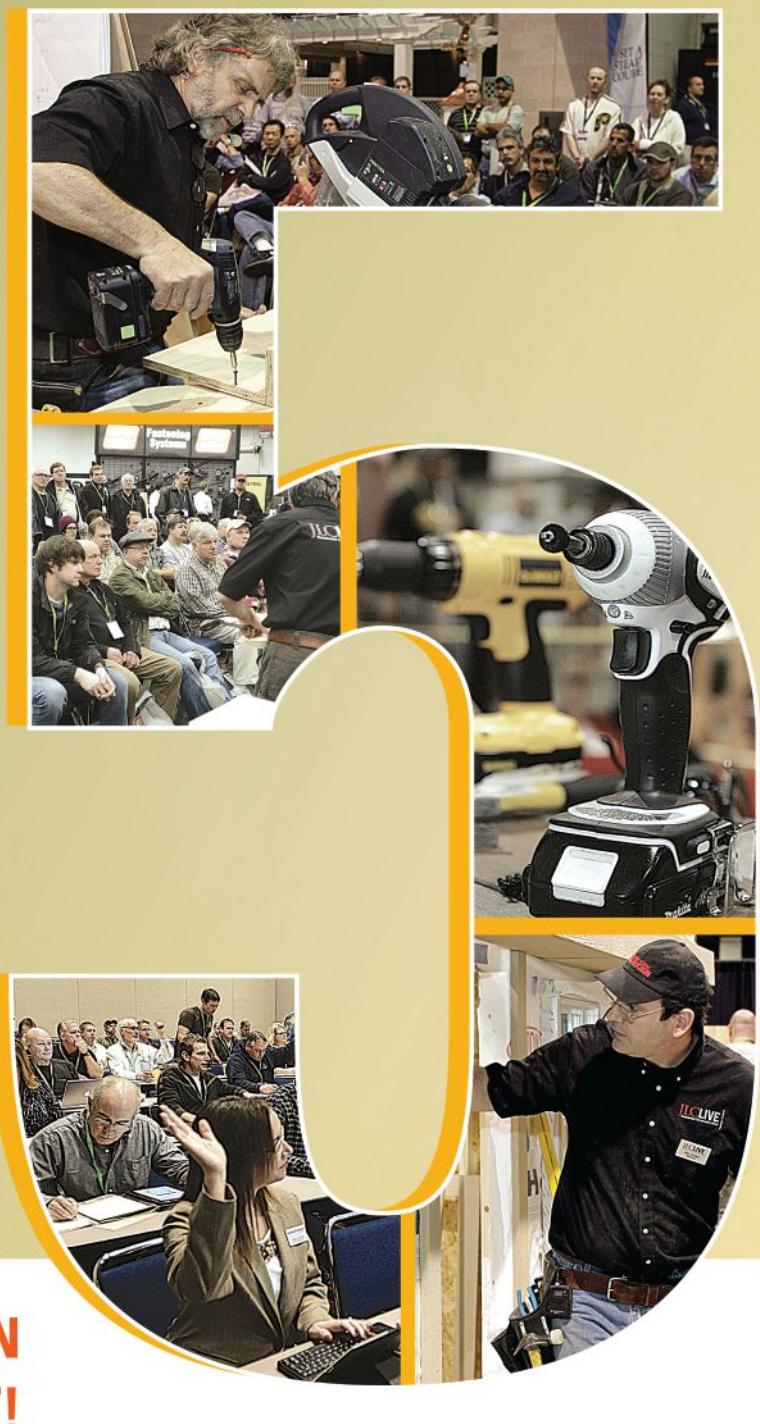

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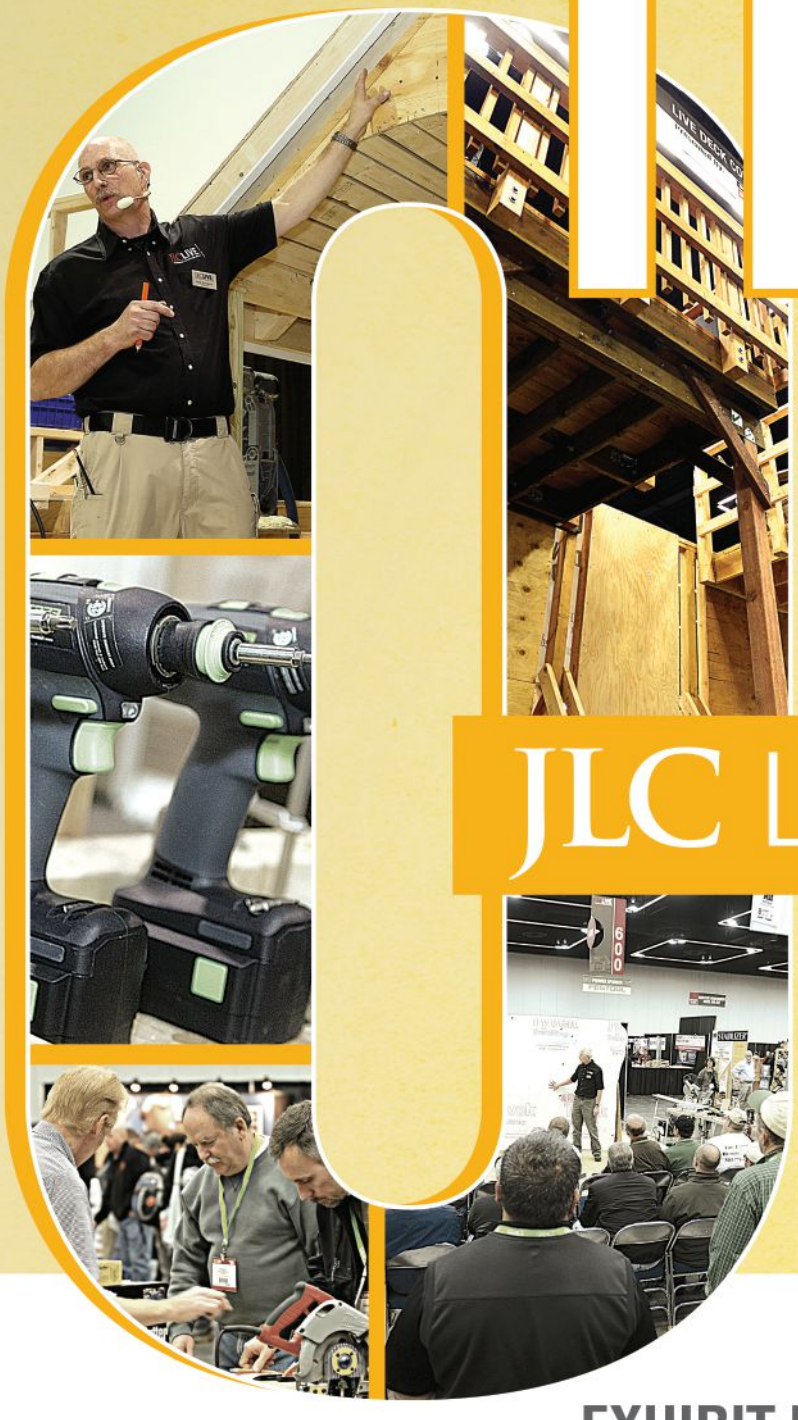

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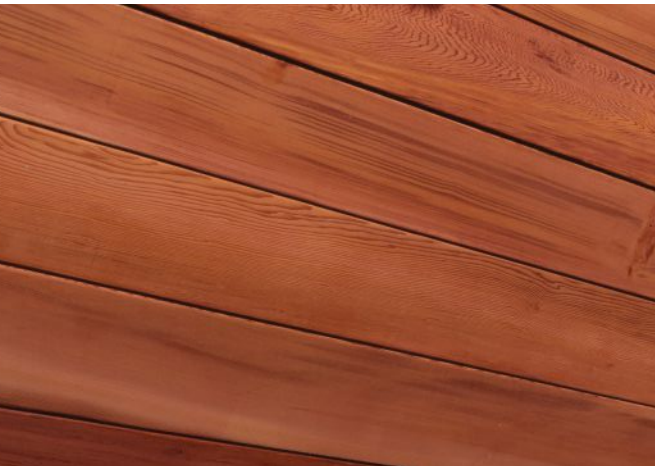

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# Framing a Hip Roof

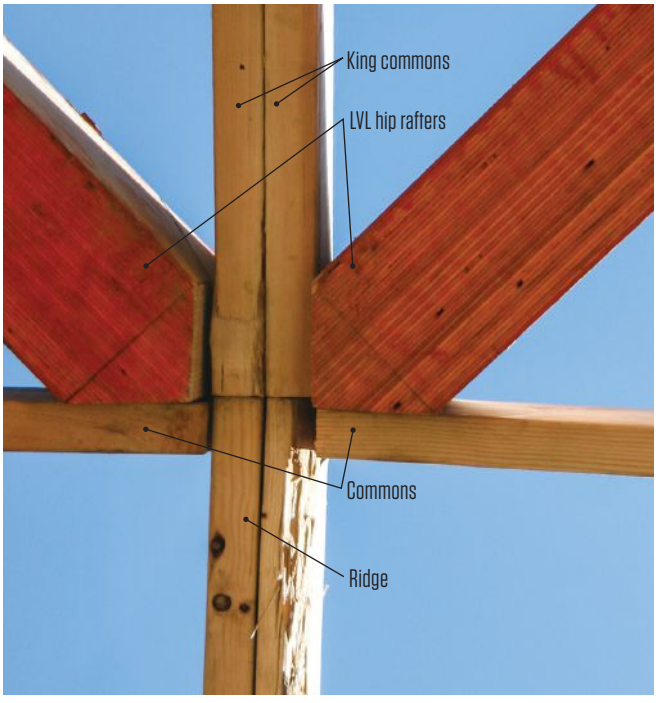
## For a perfect fit, pay attention to how the roof will be stacked when calculating lengths and laying out cuts

BY TIM UHLER

As a framer, I enjoy cutting and stacking a hip roof more than any other roof design. It's very satisfying to precut all the different pieces—commons, hips, and jacks—and have them fit perfectly when they are all put together. In this article I will outline the basic principles for framing a regular (equal-pitch) hip roof, including how to lay out the hip and precut the jacks. The methods I use are derived from production techniques. I like to save time by figuring out and cutting as much as possible on the ground before climbing up on the plates to stack the roof. This means the order of calculating and cutting may not be the same order as stacking, but it saves time overall. I also keep an eye on how all the pieces will go together as I cut. The jack layout, for example, will affect the sheathing layout, and I try to think that through at the outset so I'm not left with a lot of extra sheathing cuts.

### BASIC HIP LAYOUT

There are a couple of ways to lay out a hip roof at the ridge: with single cheek cuts or double cheek cuts. I prefer to run king




commons off the end of the ridge and cut double cheek cuts on the hips, as shown in the photo at left. Especially when we set 4-by or 6-by LVL hips using a forklift, it is easier to drop the hip into a nice pocket created by the king commons and the last commons running perpendicular to each other.

To figure a hip roof, we need to know the span of the roof (measured from the outside of the sheathing), the pitch, and the thickness of the ridge. From that information, we make all our calculations.

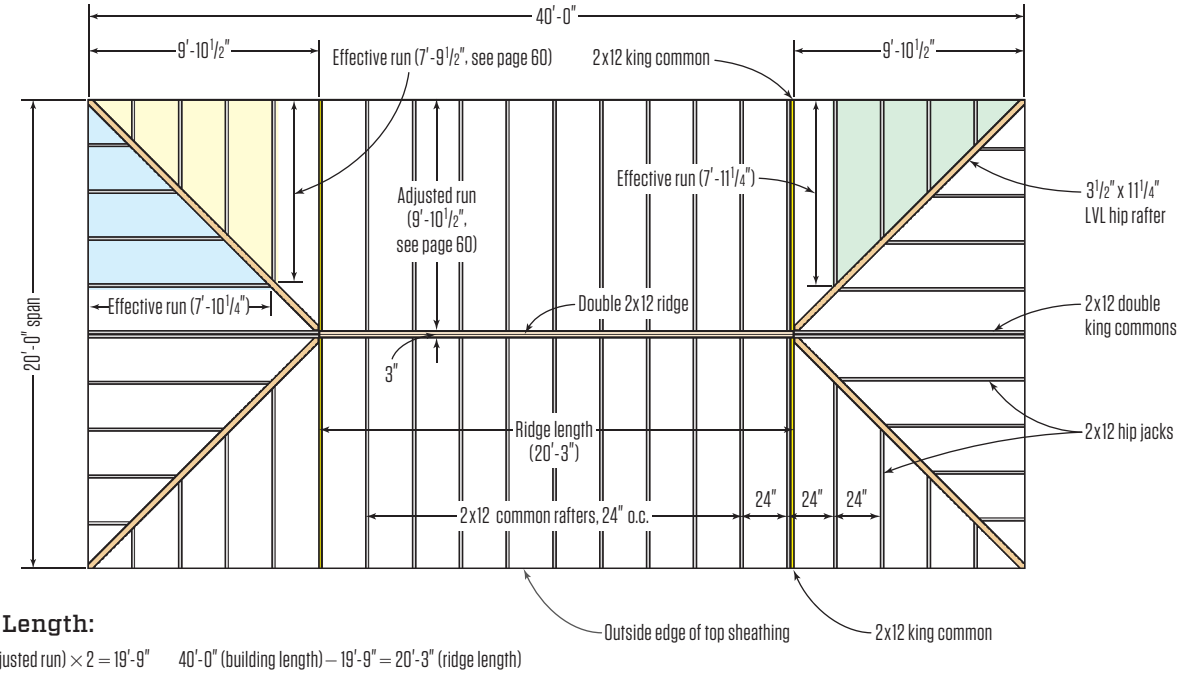
I use a Construction Master Pro Trig calculator (calculated.com). I also have the BuildCalc app (buildcalc.com) on my smartphone because it is more versatile and will generate the compound miters I need for bird blocks and also the backing bevels for hips and valleys. I have recently started using Rafter Tools for Android (raftertools.com), as well. This app is full of features and is worth the few dollars it costs. But in this article, I will demonstrate the calculations using the Construction Master because not everyone has a smartphone.

### Rafter Calculations

I always start by calculating the length of the commons and the ridge height. Let's say the house is 40 feet by 20 feet and we have a double 2x12 ridge. The rafter pitch is 6:12.

The common rafter calculation using a Construction Master is shown in the illustration on the facing page (Calculating Rafter Lengths and Ridge Height). This gives me a common rafter length

**Hip Roof Plan**




**Ridge Length:**

9'-10 1/2" (adjusted run) × 2 = 19'-9" 40'-0" (building length) – 19'-9" = 20'-3" (ridge length)

of 11 feet 1/2 inch. To find the hip rafter length I hit Hip/V, then write down the result, 14 feet 9 3/4 inches, and store it for later.

By subtracting the ridge thickness early in our calculations, we avoid having to make any other adjustments, and because we are subtracting the ridge thickness from the span, all our framing members (commons, king commons and hips) will touch the ridge. The hip touches the ridge where the sharpened end (tip of the double cheek cut) hits the corner of the ridge. Drawing this out in plan view (see Hip Roof Plan, facing page) lets us scale off the drawing if we need to have a hanger welded to tie the hips and commons to the ridge.

## Ridge Height

With a common rafter length of 11 feet 1/2 inch, I can get the theoretical height of the ridge: 4 feet 11 1/4 inches (see illustration below). Because I am using 2x12s for all the rafters, I need to know the depth of my rafter, or Height Above Plate (HAP), at the outside edge of the walls. I like to use even numbers for calculation purposes and also to maximize the height at the wall for insulation. An 11-inch HAP gives me about a 3-inch seat cut. (I can figure the seat cut on the Construction Master by entering the depth of my rafter, 11 1/4 inches, and clicking Run; entering 6 and clicking Pitch, then Diag. This gives me 12 9/16 inches. Subtract the 11-inch HAP from this, and use that as the Rise, then click Run. The result is 3 1/8 inches. Or you can draw it out on a 2x12 and measure the seat cut, which is what I often do.)

The exact ridge height is then calculated: We start with 4 feet 11 1/4 inches, the theoretical height that the calculator gave us, and add the 11-inch HAP to get 5 feet 10 1/4 inches to the top of the ridge, as shown in the ridge height calculation below.

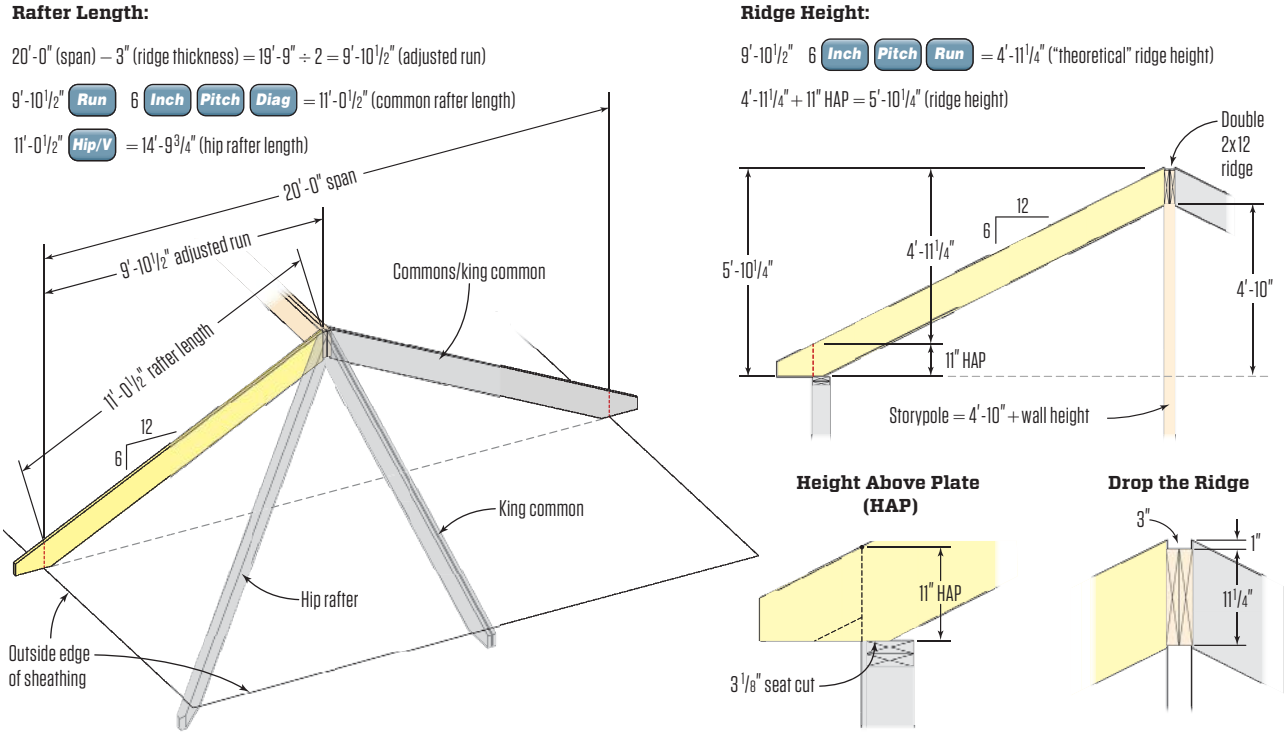
Anytime I have a ridge thicker than a single-ply LVL, I lower the ridge 1 inch to allow for plenty of airflow to the ridge vent. So this makes our actual ridge height 5 feet 9 1/4 inches.

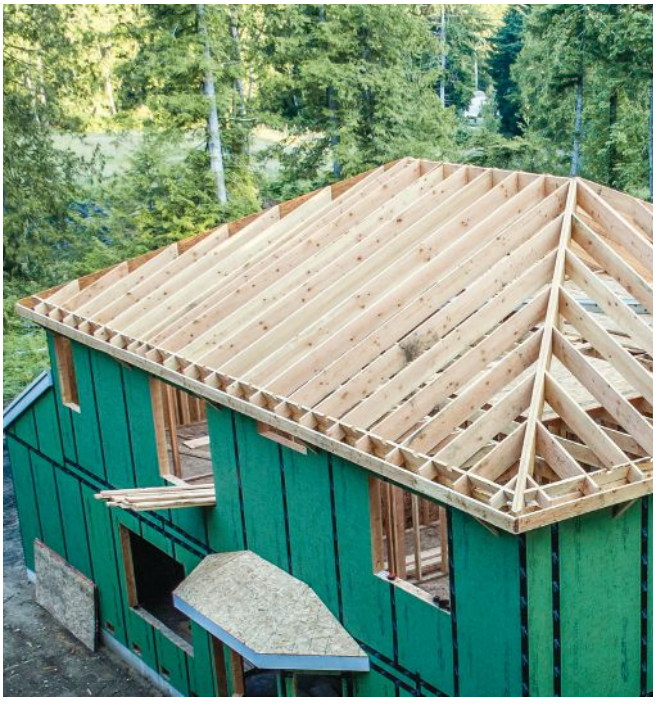
Last, we have to figure out the height of the post needed to support the ridge: We subtract the depth of the ridge (11 1/4 inches) from the actual ridge height to get 4 feet 10 inches. The post itself is the wall height plus this number. Because I have done this wrong so many times, I story-pole the layout. This is much faster than setting a heavy ridge beam and then having to take it down and cut the posts down. Trust me on this. It's worth the extra time.

## Ridge Length

Because we have a 3-inch ridge, I put two king commons on the end of the ridge. This means two extra rafters for this design, but it allows me to double-cheek the hip and set it in the intersection of the kings, and it keeps all the commons the same. It also reduces the amount of calculating and offsetting that would need to happen otherwise.

### Calculating Rafter Lengths and Ridge Height





To figure out the length of our ridge, we start with the run of all our common rafters, including the kings parallel with the ridge. Because the main commons butt the ridge, I want the kings to butt the end of the ridge, too. This makes the run of all the commons the same, and of course, all are the same height and slope. We calculated 9 feet 10 1/2 inches as the adjusted run of the common rafters. This means that we measure in from each end of the building 9 feet 10 1/2 inches to establish both ends of the ridge.

We can measure between these marks on the plates to get the ridge length, or we can calculate it using the building length: If our building is 40 feet long, we simply subtract 9 feet 10 1/2 inches from this length twice (because we are losing this in length on each end of the house), giving us a ridge length of 20 feet 3 inches. (The calculation is shown on the plan on page 58.)

### Calculating Hip Jacks

There are two approaches to calculating hip jacks: We can start at the corner of the building and work to the middle (ridge), thus making all the jacks exactly the same length (even for hipped sections of the same house that may have a different span). This way, we cut equal pairs for every hip section, but we end up with an odd spacing near the king commons that makes sheathing a pain. This is what truss companies often do with hip sets. Or, we can start from the center and work out to the corner. This means that if we have more than

## Calculating Hip Jacks

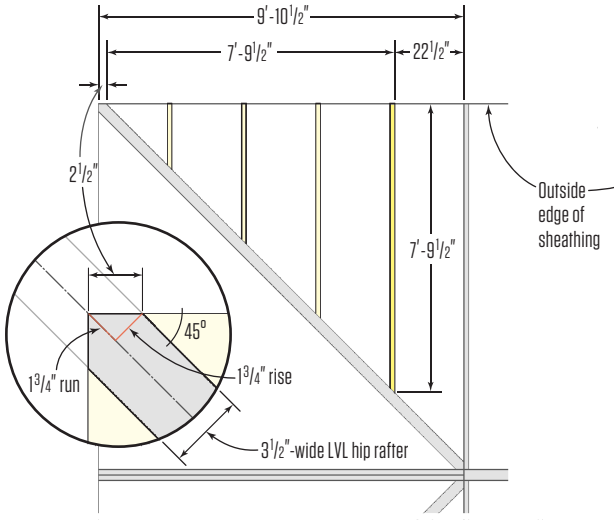
**Find Effective Run of Longest Hip Jack:**

Adjusted run – rafter spacing (less jack thickness) – hip adjustment = effective run of longest jack

Adjust for thickness of 3 1/2"-wide LVL hip: half of hip (1 3/4") crosses top plate at a 45° angle, therefore:

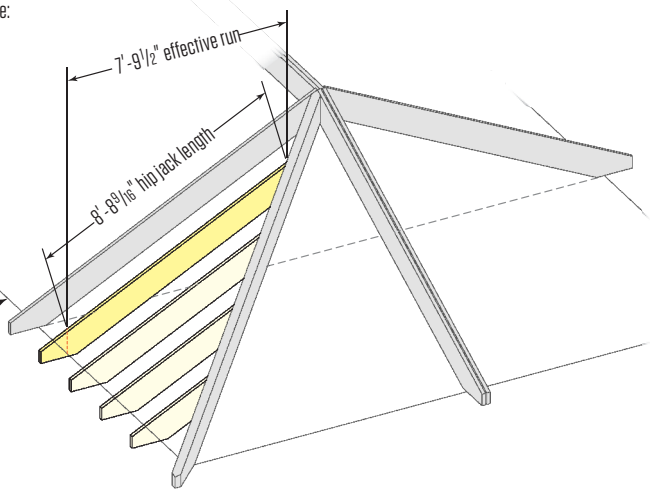
1 3/4" Rise 1 3/4" Run Diag = 2 1/2" (hip adjustment)

9'-10 1/2" (adjusted run) – 22 1/2" (rafter spacing) – 2 1/2" (hip adjustment) = 7'-9 1/2" (effective run)




**Find Length of Longest Hip Jack:**

7'-9 1/2" Run 6 Inch Pitch Diag = 8'-8 9/16" (hip jack length)




**Determine Remaining Hip Jack Lengths:**

6 Inch Pitch 7'-9 1/2" Run 24 Inch Stor 5 Jack (24" o.c. spacing stored)

Jack = 6'-5 11/16" Jack = 4'-2 7/8" Jack = 2'-0 1/16" Jack = 0'-0"

one hipped section on the roof with a different span, we can't have all the jacks be equal, but it does mean sheathing will be faster. This is the situation on the roof shown in the plan view on page 58. After I run through the basic hip-jack calculation, I'll explain how the three different sets of jacks on this roof vary.

To calculate jacks, we need to know the run of the longest jack. From there the calculator will step them down and adjust for rounding errors. Here's how I find the length of the longest jack: I want to cut all my jacks to the long point of the cheek cut, so I take 9 feet 10 1/2 inches and subtract 22 1/2 inches (rafter spacing less jack thickness) to get to the long side of my first jack. Then I adjust for the thickness of the hip: Since half of the LVL hip (1 3/4 inches) crosses the plate at a 45-degree angle, I can enter 1 3/4 Rise, and 1 3/4 Run. This gives me 2 1/2 inches, the required adjustment for the hip thickness.

Now let's put that altogether and calculate the whole set of hip jacks: Take 9 feet 10 1/2 inches (the common length) – 22 1/2 inches – 2 1/2 inches to get 7 feet 9 1/2 inches as the effective run of the longest jack (see Calculating Hip Jacks, page 60). Enter that as the Run in the calculator, and then 6, Inch, Pitch, and hit Diag to get the length of the longest jack (8 feet 8 9/16 inches). From there keep hitting the Jack key to get each shorter jack (6 feet 5 11/16 inches, 4 feet 2 7/8 inches, 2 feet 1/16 inch). Note: The Construction Master defaults to a 16-inch rafter spacing. The button sequence at the bottom of page 60 shows how to store 24-inch rafter spacing.

This is the basic hip jack calculation. On our roof, however, we will have three different sets of jacks. That's because on the ends we have that doubled king. To get the sheathing layout right, we pretend we have a single king centered on the end wall instead. This keeps the jacks on 2-foot centers. To figure this we use half the span minus the thickness of the king: 20 feet – 1 1/2 inches ÷ 2 gives us 9 feet 11 1/4 inches. We use this as a theoretical run for the centered king and calculate the run of our longest jack on a 2-foot center layout: 9 feet 11 1/4 inches – 22 1/2 inches – 2 1/2 inches = 7 feet 10 1/4 inches. Using the Jack key on the Construction Master I will then calculate my second set of hips.

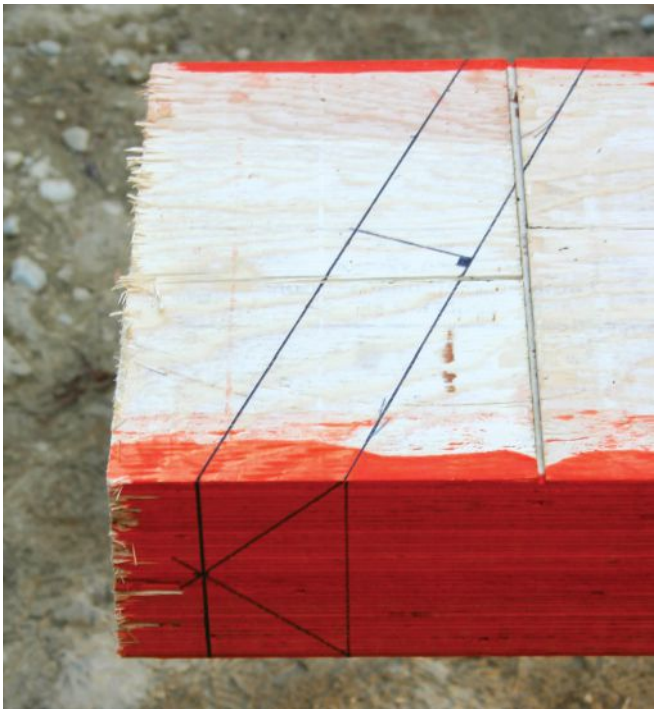
And I do the same thing at the opposite end of the roof (see plan, page 58), where I have an extra common in the layout. I need to add 3 inches to the effective run to get to the other side of the doubled-up king common, so my sheathing falls on 2-foot centers. Calculate: 10 feet 1/2 inch – 22 1/2 inches – 2 1/2 inches = 7 feet 11 1/4 inches to get the run of the longest jack in my third set of hips.

It takes a little more math and a little more organization to keep track of three different-length sets of hip jacks, but it allows me to have most of the roof on 2-foot centers. If I didn't do this, almost all of the sheathing would have to be cut.

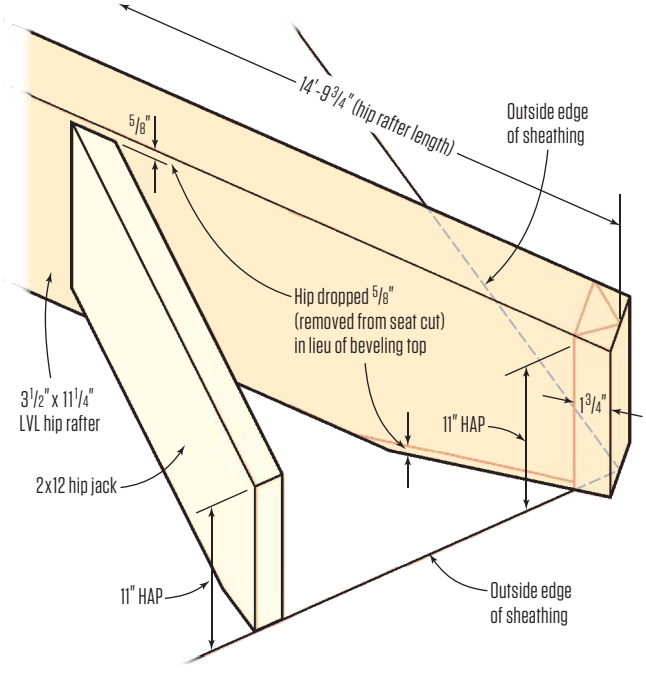
When I order framing material for the rafters, I calculate what length will work for the commons and add 2 feet. Then I order one stick for each jack on one side of each hip. When I'm cutting I can

**Cutting a Double Cheek**

**Eaves Cheek Layout**



### Dropping the Hip




get the longest and shortest jacks out of each stick and work through my list. This means less handling and less scrap.

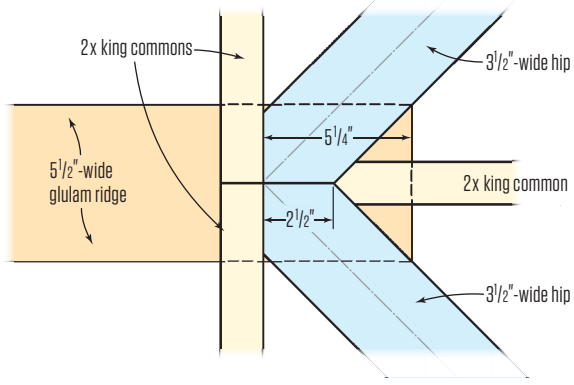
## LAYING OUT THE HIP

Laying out an equal-pitch hip is simple, but often there is confusion in accounting for the thickness of the hip. Here is a simple way (at least for me) to visualize it: Think of common rafters butting a ridge. Because the commons don't butt each other, we shorten them to allow for the ridge. Unless we bevel both edges of the top of the ridge, we need to lower the ridge to account for its thickness. We do the exact same thing for the hip: We have to lower it or bevel it. It is much faster to lower it than bevel it. This is commonly called "dropping the hip." I never calculate this number, I just lay it out and measure it off the hip as shown at left.

### Ridge Cut

When I cut a hip, I first make the ridge cut with double cheek cuts. To make this cut I draw two plumb lines with the hip slope (6:17). These lines are parallel to each other by the thickness of the hip (see Cutting a Double Cheek, page 61). I cut the first one to the long point (the "sharp") of a 45-degree angle, and the second one on the line "downhill." This way I don't have to flip the material over when I cut.

### Ridge Beam-Hip Beam Intersection




### Eaves Cut

I hook my tape on the sharp tip and measure out the hip length along the top of the stock. The length we have calculated is the center of the hip, so we need to transfer the layout to the side of the hip. I square the mark across and draw my hip/val plumb line (see Eaves Cheek Layout, page 61). Then I take half the thickness of the hip (1¾ inch) and draw a parallel hip/val plumb line that represents the length at the center of the hip. This second mark is where I measure the 11-inch HAP. All that is a lot of words to describe something very simple: All we have done is draw on the side of the hip where the hip crosses the plates.

## WHEN HIPS & RIDGES ARE BEAMS

Sometimes on big roofs we have 3½-inch glulam hips and a 5½-inch glulam for the ridge. In this situation, we set everything on the ridge. I run the ridge long to be even with the inside edges of the glulam hips (see Ridge Beam-Hip Beam Intersection, facing page) and cut birdsmouths on the hips and commons. In this case, we use a "special" king with a double cheek cut to fit in the corner between the hips, and butt all the commons at the ridge. This way there is no deduction in rafter length for the ridge itself. To draw the seat cut I draw a line parallel to the plumb cut at the end that is 5⅝ inches away to allow room to fit. I then measure down my HAP to find the seat cut. I layout and cut the birdsmouth after I cut all my commons.

## STACKING THE ROOF

I like to leave the ridge a few inches long, and set one pair of kings and hips on one end of the building to lock in the ridge. Then, on the other end of the ridge, I use the plumb cut at the end of a king common to mark the length of the ridge, and cut it off in the air, as shown in the bottom-right photo on the facing page. This makes things fit better.

The order of stacking goes like this:

1. Set the ridge, with one end long.
2. Set the king commons on one end of the ridge.
3. Set the hips on the same end of the ridge.
4. Move to the other end of the ridge, hold the king in place and mark the ridge and cut it to length.
5. Set all the kings on this end.
6. Set the hips on this end.
7. Work from one hip to the other setting jacks. We start with the smallest jacks (both sides of the hip) to keep it square to the plates, and then run a string down the hip, as shown below.
8. We set the jacks in any order on a hip to push it straight to the string. We first nail it to the layout on the wall with the end of the seat cut exactly even with the outside of the wall plate. We don't lay out the hip. The jack is already cut to length, and as long as we keep the hip straight, our jacks will be within ¼ inch of layout.

*Tim Uhler is lead framer for Pioneer Builders, in Port Orchard, Wash.*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**Bio-Based Batts**
Johns Manville Fiberglass Batt Insulation has changed from white to brown on account of the company switching from an acrylic to a plant-based binder. The company claims that field testing has shown the new batts to be easier to cut, with less dust. Cost remains the same. Johns Manville, 800.654.3103, jm.com


**Prefab Cavity Wall Drain**
The TotalFlash system for masonry cavity walls comes in either 50-foot rolls that include a drainage mat, integrated flashing membrane, mortar dropping collection mesh, and integrated weep tabs, or pre-assembled panels. Per linear foot: $4.50 (panels), $2.90 (rolls). Mortar Net Solutions, 800.664.6638, mortarnet.com

**Codeworthy Film Tape**
Shurtape's DC 181 film tape for HVAC ducts is designed for sealing Class 1 Flex duct. The tape is hand-tearable, UL 181B-FX listed, and has a polypropylene face film and water-based acrylic adhesive. Available in 2- and 3-inch widths for about $9.50 and $14 per roll. Shurtape, 888.442.8273, shurtape.com

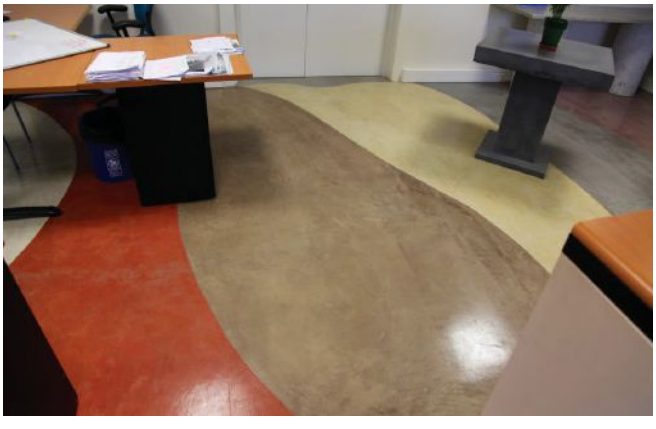
BY CHARLES WARDELL

### Classic American

The Premium Series 6'-0" x 6'-8" hinged patio door offers simulated divided lite low-E glass, oil-rubbed bronze multi-point locks, a choice of seven wood species for interiors, and 12 colors, with upgrade options, for the aluminum-clad exteriors. MSRP: $2,700 to $3,800. Weather Shield, 877.452.5535, weathershield.com

### Ipe Alternative for Decks

Abaco is a tight-grained tropical hardwood. Kiln-dried, it's termite and rot resistant, with properties comparable to ipe. Available in 3/4- and 1-inch thicknesses in widths of 3½ or 5½ inches, with square or grooved edges, prices start at $4.50 per linear foot. Universal Forest Products, 855.235.4659, abacodecking.com



### Micro Concrete Coating

Mix Trowel-Top polymer-modified cementitious coating with water, then trowel a 1/16-inch-thick layer over existing concrete for a finish similar to polished concrete. Stain in place or mix in integral color before application. A 40-pound bag ($60) covers 400 to 500 square feet. Rhino Linings, 866.447.1471, concretesolutions.com

### Euro Style Sliding Door

The lift-slide mechanism on Zola's PanoramicView aluminum-clad series sliding door makes a tight water and air seal when the slider is closed, yet is reportedly easy to operate even with large panels. Doors are custom-made in Poland; the lead time is 10 to 12 weeks. About $15,000. Zola Windows, 303.578.0001, zolawindows.com

**Sink Accessories Built In**

The Galley Sink isn't just a sink: It's a kitchen workstation with built-in accessories that slide on two tiers inside the sink. Suitable for indoor or outdoor installation and available in undermount or apron-front versions in 3-, 4-, 5½-, or 7-foot lengths, the MSRP ranges from $2,500 to $7,000 depending on size and accessories. The Galley Sink, 918.794.2700, thegalleysink.com


**Flex Can Cover**

The CanCoverIt recessed can cover ships flat, pops open without assembly, and is cut to fit around brackets, wiring, and framing. Press it onto the can light's brackets to make indentations, cut along the indentations, then push the cover in place. Foil tape can be used to seal the base. Price: $16 standard cover; $13.50 low-profile. EcoCycleSolutions, 949.275.4861, cancoverit.com


**Flex Filler for Wood**

Once cured, Flex-Tec HV epoxy repair is hard to the touch yet will expand and contract with wood. It holds screws and can be drilled, routed, sanded, and otherwise tooled like wood, so it could be a good choice for drill and refill jobs such as resetting hinges. Pricing: $62 for 450 ml; $34 for 150 ml. Advanced Repair Technology, 866.859.2787, advancedrepair.com

**Natural Engineered Flooring**

Eco-Strand is a three-ply engineered flooring with 2-millimeter sawn-cut Aspen veneer as a wear layer placed over a 9 mm Baltic birch core and 2 mm spruce balancing backer. The tongue-and-groove flooring can be stapled, glued, or floated. Boards are 5¼ inches wide and cost from $4.30 to $4.80 per linear foot. Award Hardwood Floors, 888.862.9273, awardfloors.com

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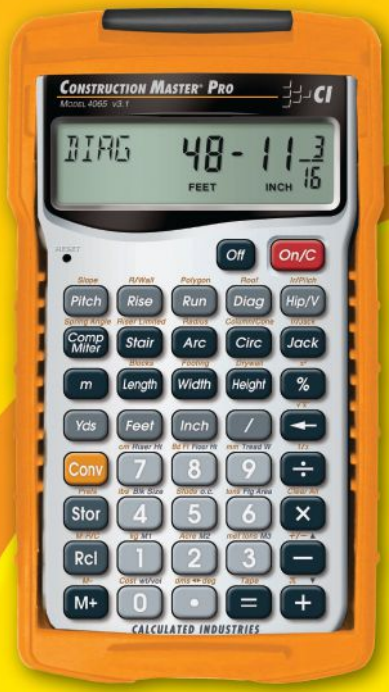


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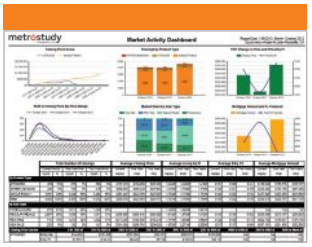



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EDITED BY BRUCE GREENLAW

# PamTite Hot-Melt Adhesive System

BY BILL ROBINSON

**I've been looking for** the perfect hot-melt glue and gun for years, ever since I saw a solid-surface fabricator install countertops with the help of hot-melt glue. I've tried all kinds, from a little pink craft gun with glue sticks to the Titebond HiPurformer Advanced Bonding System, and they've all fallen short.

Then I was introduced to the PamTite Adhesive System at the 2012 Remodeling Show in Baltimore. It includes the corded model HB 220 industrial-grade glue gun, plus a choice of two nontoxic, waterproof, and virtually odorless thermoplastic adhesives called PamTite and PamTite Plus. The former has a working time of 1 minute and instant tack, and it fully cures within 5 minutes. The latter has a working time of 3 minutes, has a less-aggressive tack, fully cures within 8 minutes, and is more resistant to cold and heat. Both have a shelf life of several years. If you make a mistake with either, you can melt them with a heat gun and reposition your work. The adhesives aren't structural, but they bond to a wide range of materials and, according to the manufacturer, can often substitute for construction adhesives or traditional fasteners in controlled environments.

I've been using the gun with the instant-tack PamTite adhesive lately, and so far I'm really liking it.

### HOT-MELT WEATHERIZATION

At the moment, I'm tuning up and weatherstripping lots of windows and doors in houses that are 50 to more than 100 years old, and the kit has been indispensable.

For instance, I weatherstrip old double-hung windows by routing grooves in the

### LADDER SAFETY APP

For maximum stability, extension ladders should be pitched at a 75.5 degree angle. One way to check the angle is to stand with your toes against the bottom of the ladder and your arms extended straight out. If you can grasp a rung at shoulder height, you're in the ballpark.

Another way to determine the angle is to use the Ladder Safety app from the National Institute for Occupational Safety and Health (NIOSH). Just hold your mobile device against a side rail and the app displays the angle while using visual and audio cues to guide you. A red indicator tells you the ladder pitch is too steep or shallow; a green indicator accompanied by a steady tone means you're within 2 degrees of 75.5 and are good to go.

The app also features a guide to choosing, inspecting, accessorizing, and using ladders. Accessibility features include a high-contrast mode that you can activate at the touch of an icon. Ladder Safety is free and is compatible with iOS and Android devices. Download it from iTunes or at the NIOSH website (search for "ladder safety app" at cdc.gov). *—Bruce Greenlaw is a contributing editor to* JLC.

In addition to the glue gun, the PamTite kit's sturdy plastic case conveniently holds twelve 1/2-inch-by-10-inch glue sticks as well.

The kit has been helpful for tuning old windows and doors. Here, the author is gunning instant-tack adhesive to secure a hinge shim.

edges of the sashes and inserting either Q-Lon foam seals or silicone bulbs—a method that doesn't detract from the historic appearance. When this weatherstripping is loose at the ends of the grooves, I'm using the hot-melt to secure it while I return the window to the frame. Where window parts are worn and the fit is loose, a bit of hot-melt can make them work like new with no milling required. I also just used the gun to fix some leaky French doors and to glue plastic shims behind door hinges to realign the doors with their jambs.

**TOP GUN**

What I like most about the PamTite system is the gun itself. It has a built-in stand, lets you set the perfect temperature, activates the glue in less than 5 minutes, has an adjustable stroke with a consistent feed, and accepts optional tips. It appears to be built to last, and also comes with a compact, sturdy plastic case that conveniently holds 12 of the ½-inch-by-10-inch glue sticks. The gun costs about $110, and the adhesives cost about $13 to $17 per pound. I'll be using the kit for other things soon, so I might have more to say ... stay tuned.

*Bill Robinson is a weatherization expert, trainer, and multimedia construction consultant currently working in New Orleans. He also presents the Moisture Management Inside and Out clinic at JLC Live and moderates the Exterior Details forum at jlconline.com.*

**PamTite Adhesive System** / Pam Fastening Technology / 800.699.2674 / pamfast.com

## Festool Track Saw Recall

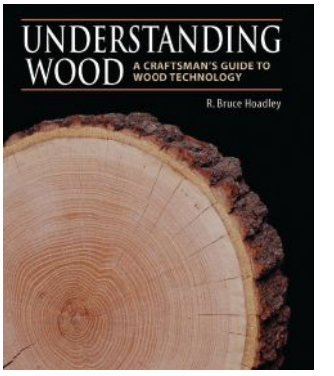
Festool recently posted the following notice on its Festool Owners Group forum:

"Festool has notified the Consumer Product Safety Commission (CPSC) and Health Canada of a potential problem with the plunge mechanism on some TS 55 REQ Plunge-Cut Track Saws. While investigation is continuing, Festool, in cooperation with the Consumer Product Safety Commission (CPSC), intends to recall affected units. If you have a TS 55 REQ Plunge Cut Track Saw, please discontinue use immediately and call Festool directly at 1-855-784-9727." ***—B.G.***

**MASTERING WOOD MOVEMENT**

Moisture meters have been mentioned several times lately in JLC. When I bought a Lignomat mini-Ligno pin-type moisture meter years ago for architectural woodworking and finish carpentry, I also bought the hardcover book *Understanding Wood* and read it cover to cover.

First published by The Taunton Press in 1980, the book was revised in 2000 and is still in print. There's an incredible amount of useful information in there about working with wood, but for me the chapters on water and wood and on coping with wood movement were worth the price of admission. After studying them, I could use the meter to predict the shrinkage and swelling of hardwoods and softwoods whether I was working in the arid mountains or on the humid coast. That was a game-changer. The book costs $40 at tauntonstore.com. ***—B.G.***



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# Collomix Xo 1 Hand-Held Mixer

BY MYRON FERGUSON

**I've been hanging** and taping drywall since 1982, so I've mixed countless buckets of joint compound. For years, I mixed with a paddle powered by a heavy-duty ½-inch corded drill. It worked, but there were drawbacks: having to bend over slightly while mixing was hard on my back; the constant high torque was a drill-killer; and with thick compounds, I had to hold on for dear life.

About 10 years ago, I picked up a Collomix CX 20 hand-held paddle mixer, and I haven't mixed with a drill since. I can stand upright while mixing, and the two handles make the tool much easier to control. Using the recommended paddles, I've mixed compounds, heavy plasters, concrete, paint, driveway sealers—even dirt—and its rugged 7.2-amp motor and variable-speed transmission have been bulletproof. For the past few months I've been using the model Xo 1, the latest version of my old CX 20, and it appears to be even better.

## FEATURES

The variable-speed Xo 1 is noticeably quieter and more powerful than my old model. The handles are a bit higher, so I can stand upright with my shoulders comfortably level. And a quick-change chuck means that I no longer need two wrenches to install and remove paddles.

The Xo 1 comes with a universal paddle that can mix a variety of materials, but I prefer to use the optional KR 120 HF "birdcage" paddle for mixing joint compounds. It's less aggressive, but it requires less torque to spin, reduces splattering, and doesn't draw the material right out of the bucket at high speeds. I can also simply spin it in a bucket of water to clean it without splashing water all over the floor.

I really like the ring guards at the bottoms of both paddles because they let the paddles spin smoothly against the inside of the bucket without cutting into the plastic. The paddles are made of steel, so they're built to last.

You can view a video at collomix.us.

*Myron Ferguson is a drywall contractor in Middle Grove, N.Y., and presents the Drywall Trade Secrets clinic at JLC Live.*

**Xo 1 SPECS**

**Origin:** Germany
**Weight:** 11.7 pounds
**Amps:** 10
**Rpm:** 0–650
**Price:** $330 with universal paddle, plus $45 for "birdcage" paddle
**Warranty:** 2 years

**Collomix USA**
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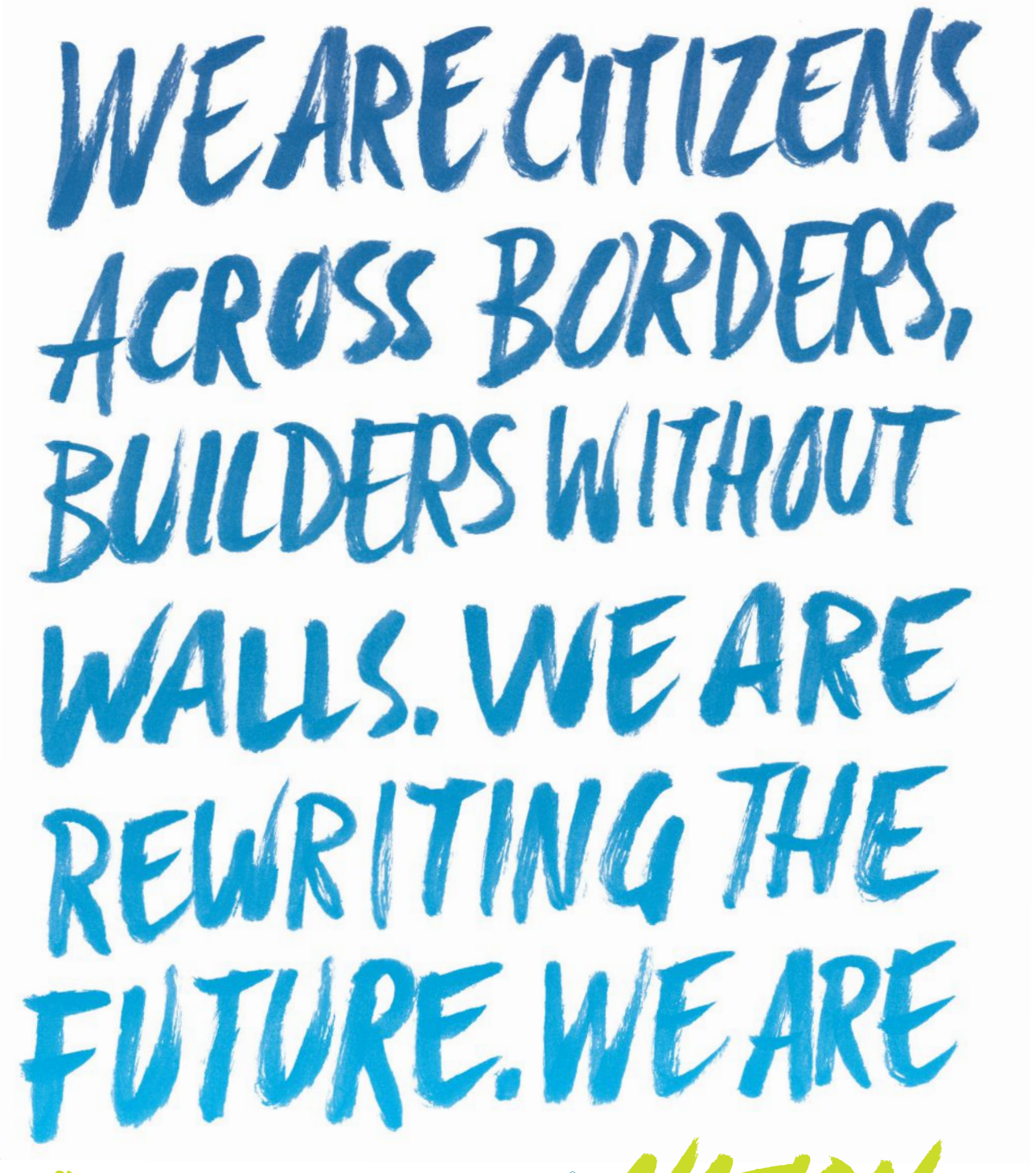


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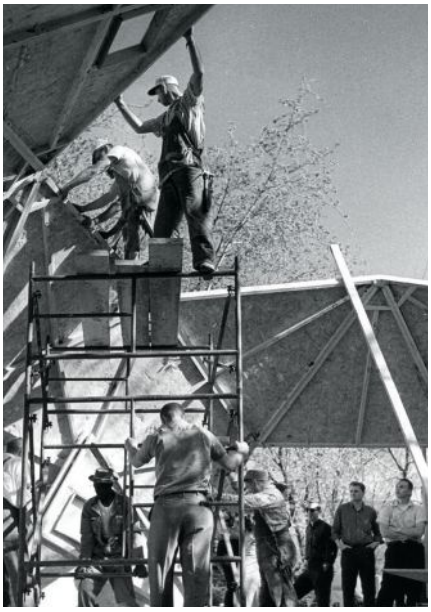
BY JON VARA



Built at a cost of less than $8,000, the 37-foot dome seemingly lived up to the manufacturer's claim that it "provided maximum space at minimum cost, in a revolutionary ratio." Unfortunately for its inhabitants, it also leaked.

# A Dome of One's Own

**Although R. Buckminster Fuller** didn't invent the geodesic dome—that honor belongs to Walther Bauersfeld, a German engineer who received a European patent for the concept in 1922—Fuller was unquestionably its most vocal and best-known champion. And in 1960, while teaching at Southern Illinois University in Carbondale, Fuller put his money where his mouth was by building a geodesic dome home of his own, where he and his wife, Ann Hewlett Fuller, would live until 1971.

But the famously pragmatic Fuller chose not to design a one-of-a-kind structure for his own dwelling. Instead—as surprising as this may sound today—he was able to purchase a stock plywood dome from a Hamilton, Ohio, company called Pease Homes and have a local contractor assemble it on Fuller's own slab foundation.

Pease Homes was primarily a builder of conventional panelized homes, and its 1957 catalog depicts an assortment of modest ranch-style structures with evocative-of-the-time model names, including the Cliffwood, Dalewood, Fairwood, and Maywood. But sometime in the late '50s, the company decided to prepare for an expected boom in geodesic structures by adding its own line of panelized domes.

Fuller's personal 37-foot dome home was reportedly erected in a mere seven hours at a cost of less than $8,000, but things went less well after that. According to Carbondale architect Thad Heckman—who is active in a group (fullerdomehome.org) that plans to restore the dome later this year—the structure apparently leaked like a sieve from the beginning. "As far as I can tell, the only seal between the panel joints was tape and a coat of paint," he says.

Because "Bucky," as he preferred to be called, spent most of his time traveling, Ann Fuller presumably spent more time dealing with the leaks than he did. Perhaps at her instigation, the exterior of the dome was sprayed with urethane foam in an effort to make it watertight. That attempt apparently failed, because several years later the foam was peeled off and the plywood surface was covered with first one layer of asphalt shingles and then another.

In about 2003, the deteriorating dome was enclosed in a more modern dome, where it awaits structural repairs and a new TPO roof.

*Jon Vara is a writer in Cabot, Vt.*

Photos: Ben Gelman

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