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On the cover: A crew member with Lehto Design/Build installs blown cellulose into the attic of a zero-energy home in Connecticut. See the story on page 49. Photo by Ted Cushman.

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BY DON BOIVIN

Opening Up a Bearing Wall

At over 6 feet 3 inches tall, my client always felt as if he had to duck when walking through the narrow pass-through between the dining room and living room in his recently purchased retirement home. For this remodeling project, he not only wanted to expand the width of the opening to more than 8 feet, but he also wanted to raise the height of the opening as much as possible.

Dealing with a bearing wall. The first step was determining if the pass-through was in a load-bearing wall—I suspected it was. The home was a 1 1/2-story Cape, and the wall with the opening ran through the middle of the house, supporting the floor of the living space above. When I stripped the drywall from the studs, the solid header over the existing opening further confirmed my suspicions. The client had also removed ceiling drywall, in anticipation of a kitchen remodel, and the ceiling joists resting on the wall proved beyond a doubt that I was dealing with a load-bearing wall **(1)**.

To modify the opening, I needed an engineer to spell out my options, and I needed to temporarily support the load on both sides of the wall. Because widening the opening would change the point loads, I also had to make sure that the loads would transfer directly to the main girder under the house. I took measurements in the basement to confirm that the side of the new opening would be sitting directly over the floor joists to transfer the load to the main girder.

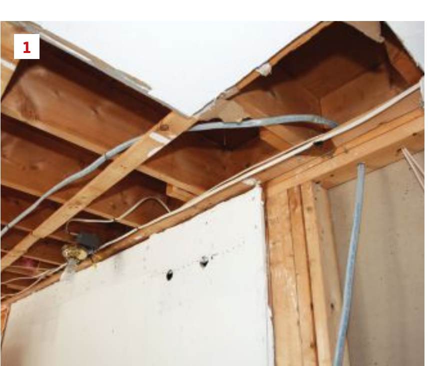
Header strategies. To support the wider opening, I would need a longer header beam to replace the existing one. In these cases, there are two options for a new header beam: a carrying beam that supports the floor joists from below, or a flush beam that attaches to the ends of the joists via joist hangers.

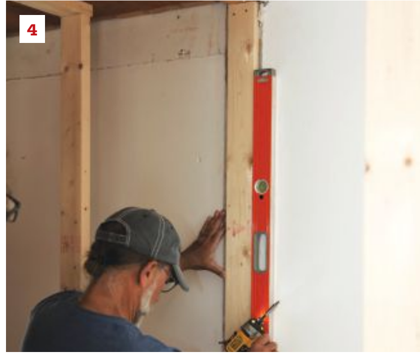
Because a flush beam sits above the ceiling plane, it would have provided the maximum headroom. But retrofitting a flush beam would have required removing a lot of the ceiling to access the joists, which would then need to be cut back enough to slide the beam up to the subfloor above. Finally, after adding joist hangers, I'd need to put the ceiling material back.

All that extra work would have made a flush beam the more expensive option. A carrying beam, on the other hand, would require much less invasive carpentry than a flush beam. In addition, because it would be visible, a carrying beam would maintain the visual transition between dining room and living room that we wanted.

Engineering consultation. After deciding to use a carrying beam, I visited the structural engineering department at a local building supply company, Shepley Wood Products. The structural designer, Joe Madera, asked a few questions (building and room width, second-floor layout, and the like) and determined that a double 1 3/4-inch-by-7 1/4-inch laminated veneer lumber (LVL) beam would work for the new, 8 1/2-foot opening.

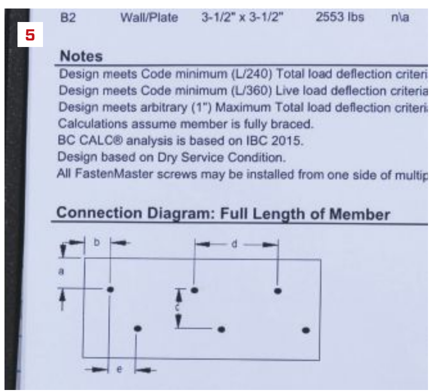
The original header consisted of two 2x10s below a double 2x4 top plate. Removing one of the top plates is allowed in the 2015 and 2018 code (IRC R602.3.2, Exception 3), so with the shorter LVLs, the bottom of the header would





Floor joists resting on the wall plates are a good indicator of a load-bearing wall **(1)**. Temporary support walls should be placed below solid framing **(2)**. Removing one of the plates creates more headroom **(3)**. King studs flank the new opening **(4)**.

Photos by Roe Osborn



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Connection Diagram: Full Length of Member

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A spec sheet with the LVL beams included a connection diagram and fastening schedule **(5)**. After cutting the LVLs to length, the author lays out the fastener pattern **(6)** and then drives the appropriate fasteners at each location **(7)**.

The crew raises the new beam into place and pushes in the first jacks for support **(8)**. The tight fit requires a hammer to drive the jacks home **(9)**. Before fastening the jacks, the author taps the beam into alignment with the rest of the framing **(10)**.

be more than 3 1/2 inches higher. LVLs were more expensive than 2x10s, but the client would be happy with the extra headroom.

Support walls and demo. With the drywall removed, my first task was constructing temporary support walls on either side of the location of the new opening. I measured and cut the vertical studs to fit snugly between top and bottom plates. To put them up, I first measured off the bearing wall top and bottom and set the bottom plate in place. After attaching the top plate to the two outermost studs, I folded in the studs slightly and positioned the top plate at my measurement on the ceiling. Then I just tapped the studs out until they were tight and vertical and added more studs as needed.

One word of caution. Be sure there is solid support above the top plate. In this part of the country, carpenters use furring strips on the ceilings below the joists. For the support against the dining room ceiling, I was careful to align the top plate with a furring strip **(2)**.

Next, my assistant and I removed the studs across the width of the new opening. To keep things simple, we let an existing stud be the terminating point for the framed opening. After removing the studs and the header, I cut out the top plate with a reciprocating saw **(3)**. On one side of the opening, we installed a king stud against the last existing stud. At the exterior wall, we put the king in on top of a short section of plate **(4)**. After plumbing the kings and fastening them in place, we were ready to cut and assemble the beam.

Building the beam. We measured the distance between the kings and then cut the LVLs to length. Although LVLs are supposed to be very stable and these LVLs had been stored under an open cover, the ends had swollen significantly—perhaps as the result of wind-driven rain. I was able to cut the lengths I needed without using the bad ends.

The LVL engineering package included a connection diagram and fastening schedule **(5)**. Madera told me not to bother gluing LVLs together because they are coated with paraffin, which keeps glue from adhering. We set one LVL on top of the other and laid out the fastener locations: 4 inches from the ends, 2 inches from the edges, and then 24 inches on-center in a 1-inch staggered pattern **(6)**.

I was surprised at how few screws I'd need until I realized that

The first screws attach the kings to the header beam **(11)**. Toe-screws fasten the jacks to the plate at the bottom **(12)** and to the header at the top **(13)**. The jacks are screwed to the kings as well. The crew fastens the second jacks the same as the first **(14)**. Toe-screws attach the header to the plate **(15)**, and the support walls can be removed **(16)**.

the specs called for 3 1/2-inch FastenMaster FlatLok Engineered Wood Fasteners. After speaking with the engineer, I used what I had on hand—3-inch FastenMaster Guard Dog Exterior Wood Screws, doubling the number of screws and driving them from both sides **(7)**.

Install the beam. LVLs have no crown, so I opted to place them with the manufacturer's print right-side up. The engineering diagram called for two jacks to support each end, pretty common for spans greater than 6 feet. But it's always good to check local code to be sure. I cut the jacks and set them within reach at each side of the opening.

My assistant and I raised the header in the opening, holding it in place up against the remaining top plate while we slid jacks under each end to take the weight **(8)**. I had cut the jacks for a snug fit, so I needed to tap them into place with a hammer **(9)**. With the jacks now holding the header beam in place, I tapped the beam into alignment with the wall framing **(10)** and aligned the jacks with the king studs we had installed earlier.

Fasteners. Driving nails—either by hand or with an air nailer—can cause drywall fasteners to pop and electrical boxes to loosen. Instead, I opted to screw everything together with 3 1/2-inch hardened screws, breaking out my hammer only occasionally.

The first screws we drove anchored the king studs to the header beam **(11)**. We also screwed the first jacks to the kings and toe-screwed the jacks to the plate at the bottom **(12)** and to the header at the top **(13)**. After tapping the second jacks into place, we fastened them in a similar fashion **(14)**. Along the top of the header, we drove screws every 12 inches or so to anchor the header to the plate **(15)**.

With all the fasteners driven, we removed the temporary support walls **(16)**. Later, the opening would be plastered without trim per the client's request. The rooms will have a much more open feel, and the big man won't have to duck as he walks through the opening.

Don Boivin is a contractor and craftsman from Hyannis, Mass.

For a more detailed discussion of opening up a bearing wall, go to **www.jlconline.com/training-the-trades/opening-up-a-bearing-wall**.

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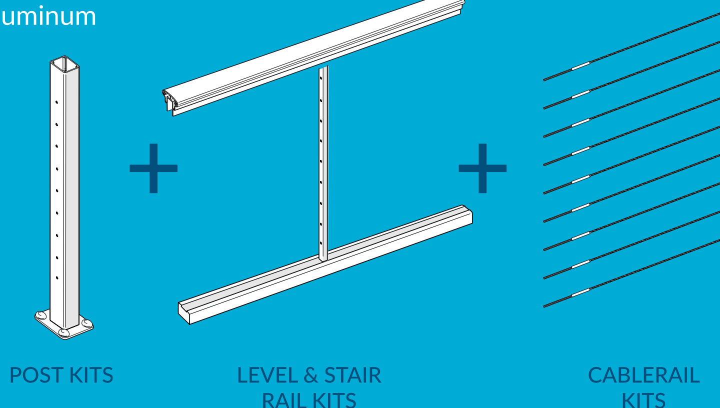

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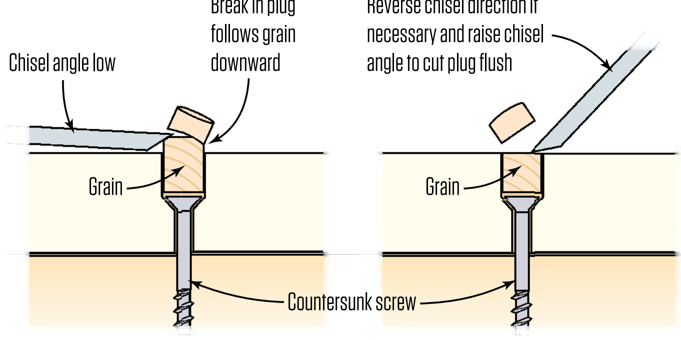
Q In Gary Striegler's article last month on starter steps, he uses filler in the fastener holes. Aren't wood plugs a more attractive alternative?

A Roe Osborn, senior editor at *JLC*, responds: When I questioned Gary Striegler about this detail, he explained that his company found that using finish-head screws for fastening and putting stain-compatible filler in the holes is the most cost effective and least visible way to take care of the screw holes. Finish-head screws leave very small holes—with just over 1/8-inch diameters—that are quickly and easily filled, while working with plugs can be time consuming.

Sometimes, though, plugs may be preferable. I worked as a carpenter in the joinery shop of a boatyard for a number of years, and we concealed all of our fasteners with wooden plugs, or "bungs," as they were referred to in the joinery shop. Well-installed plugs can add a note of craftsmanship to a project, and I've always enjoyed the almost Zen-like process of plugging screw holes.



Make the first pass of the chisel with the blade slightly high and note which way the grain of the plug breaks. If it breaks down and away from you, reverse the chisel direction for the final pass.

Illustration: Tim Healey

Early in my stint in the joinery shop, I got a set of Fuller countersink bits with tapered bits for screw sizes #4 through #14, along with plug cutters for 1/4-inch, 3/8-inch, and 1/2-inch plugs. For drilling the countersunk holes, a portable drill works fine if you keep the bit close to perpendicular to the work surface. For cutting plugs, a drill press offers the best control and enables you to maximize the number of plugs you make from the material.

When plugging a countersunk hole, I first look at the grain of the board where it was interrupted by the hole, and I try to find a plug that has a similar character across its top. Woods such as quarter-sawn oak and mahogany are usually easy to match, but matching wood grain with more character and variations in color can be a bigger challenge.

In the boat shop, we used to save scraps from various shades of teak and mahogany so that we could match whatever we happened to be working with. It usually doesn't take a very big scrap of board to make the plugs you need. To make oak plugs, I usually just differentiate between red and white oak unless the grain is particularly gnarly and rustic.

After choosing a plug, I line up the grain of the plug parallel to the grain of the board and push it into the hole with my thumb. Then I tap the plug home with a lightweight finish hammer. A bigger hammer could mash the plug.

I used to put a dab of yellow glue on each plug before installing it, and some of my buddies at the boatyard insisted on using varnish to glue plugs in place. But a tight-fitting plug squeezes the glue out around it, and that glue will discolor the wood unless it is cleaned up completely and immediately. I now prefer to rely on the friction of the fit to keep the plug in place, using glue only if the hole is shallow or if the plug seems to be loose in the hole.

Once the plug is driven into the hole, I use the largest, sharpest chisel that I have to trim the plugs (I often use a large slick). The idea here is that the weight of the larger chisel helps to carry the blade through the plug with minimum impact. I keep the flat side of the chisel facing up (see Two-Step Plug Cutting, left) and start with the handle close to parallel with the work. That puts the cutting edge

slightly above the finished surface. After the first cut, I look at the plug to see if it has broken off at an angle. If the break is slanting down and away from me, I reverse the direction of the chisel to complete the cut. This keeps the plug from breaking off below the surface.

When I need to remove a plug that has broken off below the surface of the board, I simply drive a coarse-head drywall screw into the center of the plug. When the tip of the screw hits the screw in the hole, it keeps spinning and augers the broken plug out of the hole.

If matching the grain and color of wood that has a lot of color variation is too much of a challenge, consider using a different type of wood with a contrasting color to accent the plugs instead of trying to make them disappear. I've used mahogany or cherry plugs in light-colored pine, or a light-colored wood, such as ash or maple, in dark oak. This approach makes the plugs stand out and can create a striking design element.

Matching the variable grain of the native pine shelving on the left would have been difficult; instead, mahogany plugs were used to create a contrasting accent. In the even-grained outdoor mahogany plank table on the right, plugs made from the same boards fill the fastener holes almost invisibly.

Photos: Roe Osborn

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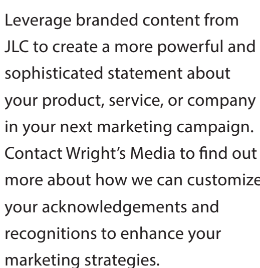

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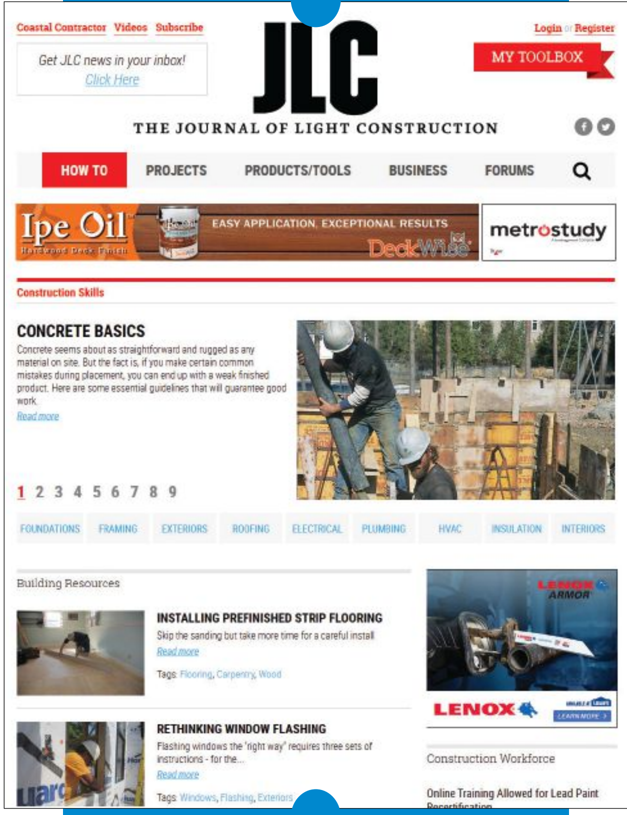

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This occupied room over a garage included a substantial area of cathedral ceiling **(1)**. The author decided to ensure the durability of that portion of the roof by building a robust venting system. He stapled 1 1/2-inch furring strips to the top edge of each rafter in every bay **(2)**, then stapled OSB to these nailers **(3)** in order to create a large vent channel.

Photos by Jeremy Kassel

A 'Best Principles' Cold Roof Assembly

BY JEREMY KASSEL

This past winter, we built a large, freestanding, two-bay garage. The footprint of the building is 26 feet by 32 feet, and the entire structure is finished inside, including a second-floor home office. Total finished space is approximately 1,500 square feet. The second-floor office is heated and cooled with a ductless mini-split.

With a straight gabled roof profile constructed using 2x12 dimensional lumber, the second-floor office has large sections of cathedral ceiling, where the finished drywall is directly under the roof rafters. These sections of framing can be tricky to insulate and air-seal (see "A 'Never Worry Again' Insulated Ceiling," Jan/19). In consultation with the architect for the garage, we decided to use 7 inches of closed-cell spray foam to insulate this rafter space.

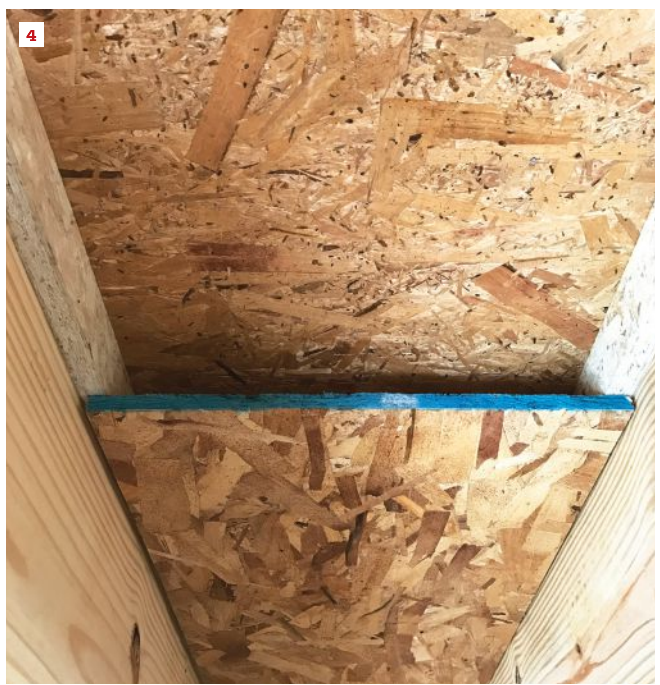
The properties of closed-cell spray foam made using it a no-brainer. It is an excellent thermal barrier, with an R-value of approximately 6.5 per inch. Closed-cell also has first-rate characteristics of being air- and vapor-impermeable. This makes it a great form of insulation in our neck of the woods (climate zone 5). Spraying 7 inches of closed-cell would yield an approximate finished R-value of 45.5.

THE HOT-ROOF OPTION

The most typical installation of spray foam in a rafter cavity is when it is applied directly to the underside of the roof deck. This leaves no ventilation for the roof sheathing and is commonly referred to as a "hot roof" by architects and builders. Because closed-cell spray foam is a vapor and air barrier, the theory is that air and water vapor will never make their way to the roof sheathing, thereby eliminating the need for a vented roof section. The problem with a hot roof assembly is that it relies on a perfect installation of the two-part insulation foam. However, any number of factors could potentially create a loss of integrity in the system, including, but not limited to, the following:

- Improper temperature of the substrate that is being sprayed with insulation (in this case the underside of the roof deck)
- Improper temperature of the spray-foam chemical parts
- A substrate that is not free of moisture (factors include changing humidity and atmospheric conditions on a jobsite and framing lumber that didn't adequately dry after being exposed to rain)
- Improper technique by the person actually performing the foam installation.

Furthermore, a hot roof assembly also relies on the premise that the framing lumber will never shrink, twist, or otherwise change its shape. If this phenomenon occurs, there is a potential for



The $1\frac{1}{2}$-inch vent channel terminates in the vented attic of the building **(4)**. Spray foam is applied to the underside of the vent channel **(5)**. If there are imperfections in the spray-foam application, the vent provides backup to clear any moisture.

micro-channels to form. In winter months, these channels can allow warm, moist air to make its way through the assembly and condense on the underside of the roof sheathing. For this reason, a good air-control layer is important and needs to be in place, inboard of the insulation.

So what does the long-range forecast look like when you're constructing a hot roof? What happens if spray foam isn't installed properly? What if it is installed properly but there are conditions out of control that create a failure? What are the consequences?

I have read articles about hot-roof spray-foam failures and seen these failures in person, with consequences including rotten roof sheathing, mold, and in some cases, extensive condensation damage to drywall. It's ugly, it's expensive to remedy, and it's potentially avoidable—if the roof can be ventilated.

OUR APPROACH: A COLD ROOF ASSEMBLY

With images of these failures vivid in my mind, I try to avoid hot roofs. Instead, I like to build a fully vented roof assembly that is insulated with closed-cell spray foam. This roof assembly is often referred to as a "cold roof" and is the antithesis of a hot roof. With two strategies employed (the airtight, vapor-impermeable foam, plus the ventilation as a safety valve), you might call this a "belt and suspenders" approach to building. A cold roof assembly can also be created using other types of insulation.

The primary goal here is to avoid trapping moisture under the roof deck. The second and nearly as important goal is to keep the roof deck as cold as possible during upstate New York winter months. Cold roof sheathing is one of many components in keeping ice dams at bay. To create a cold roof, we provide each rafter bay with a full-width vent chute that leaves a $1\frac{1}{2}$-inch air channel under the roof deck. This provides for ample airflow. It is important when building this assembly to ensure that we have proper soffit intake, as well as ridge venting for exhaust, as specified in the building code. If the spray foam was applied improperly, or there is any future movement of the framing lumber, we still have a fully vented rafter assembly. Any vapor that potentially makes its way through the insulation layer can escape through the vent chute.

The design and the installation process of the cold-roof components for this project were simple (see photos).

First, we ripped and installed $\frac{3}{4}$-by-$1\frac{1}{2}$-inch OSB furring strips up against the underside of the roof deck, stapled to the top edge of the rafters with 18-gauge crown staples. We used cutoffs of the OSB subfloor as well as other $\frac{3}{4}$-inch commodity OSB materials.

Next, we covered the furring strips with $\frac{7}{16}$-inch commodity OSB to create a vent chute. We also fastened the OSB panels with crown staples, about 6 to 8 inches on-center.

Finally, the spray-foam installer applied closed-cell spray foam directly under the OSB chute in 2-inch lifts.

In preparation for the spray-foam installation, I needed to ensure a few extra things. We chose to run parts of the ductless

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Cold Roof Assembly (Cathedral Ceiling Portion of Roof)

1 1/2" vent chute at each rafter bay, terminates in vented "attic"
2x12 rafters at 16" o.c.
Ridge vent
7" closed-cell spray foam
Metal connectors installed to resist outward thrust
3/4" x 1 1/2" OSB furring strips, stapled to sides of rafters
7/16" OSB baffle
Drywall
12"
12"
2x10 collar ties with kraft-faced fiberglass batts (R-38)
Wide sole plate (2x4 and 2x8)
Vent chutes widened to 3 1/2" at eaves
Closed-cell spray foam (approx. R-45)
Second-floor office
5/8" Zip System sheathing and asphalt shingles
2x6 knee wall
Two-bay garage
16"-deep wood I-joists, 16" o.c. with 3/4" AdvanTech subfloor
Perforated soffit vent panel

The author builds a ventilated cold roof instead of a hot roof. Air entering the assembly through a soffit vent passes up the rafter bay to exit at the top through a ridge vent, providing drying ability while limiting snow melting to help prevent ice dams.

mini-split line set partially in a rafter space. We knew this line set would come in contact with the spray foam, but we didn't have a good grasp of how the line set would withstand the high heat of the spray foam. The spray foam comes off the installation gun at approximately 130°F to 140°F. Then the foam components chemically combine in an exothermic reaction that releases heat, so the foam elevates in temperature by about another 10 or so degrees after it's been applied.

I have an excellent relationship with our spray-foam contractor, and he was willing to do a little bit of testing for us while he was getting set up to insulate the garage rafter sections. He test sprayed a cutoff of the line set and weep hose from the ductless mini-split. I also wanted to see how a traditional polystyrene insulation baffle might perform, so we took the opportunity to spray and test that as well. We could glean information from the test that might be valuable on future jobs.

The results of the testing definitely quelled our fears about the heat of the spray foam and gave me the confidence to have him continue with the insulation job as planned, including spraying directly on the mini-split line set.

BEST PRACTICES VS. BEST PRINCIPLES

For years, when reading trade magazines, attending trade shows, watching videos on YouTube, and most recently, viewing endless content on Instagram, I have seen the construction industry use the term "best practices." The term typically refers to the superior way to build or install a specific product or fixture. In reality, there aren't best practices—there are only "best principles." "Best practices" assumes that we have unhindered budgets as well as access to the best building materials, subcontractors, skill, knowledge, and perfect conditions to build. In the real world, budgets, conditions, and client goals vary from job to job. Our role is to apply the best principles to these variable contexts.

Many architects, designers, and contractors consider a hot roof to be the best practice for insulating a roof section. But, like anything, spray foam insulation has limitations, and I'm not comfortable installing a hot roof. Based on my practical knowledge, experience, and a bit of intuition, I'd like to think that the cold roof is a manifestation of some of my best principles:

- Controlling what I can
- Engaging my subcontractors
- Mitigating risk
- Setting expectations for customers
- Keeping my reputation intact.

As contractors, it's important to acknowledge "we know what we don't know." But we do know what we can control.

Jeremy Kassel is the owner/operator of Kassel Construction in Glenmont, N.Y., as well as the co-host of the House Calls Podcast. He can be found on Instagram @kasselconstruction.

Illustration: Tim Healey

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Prep Work Before Taping

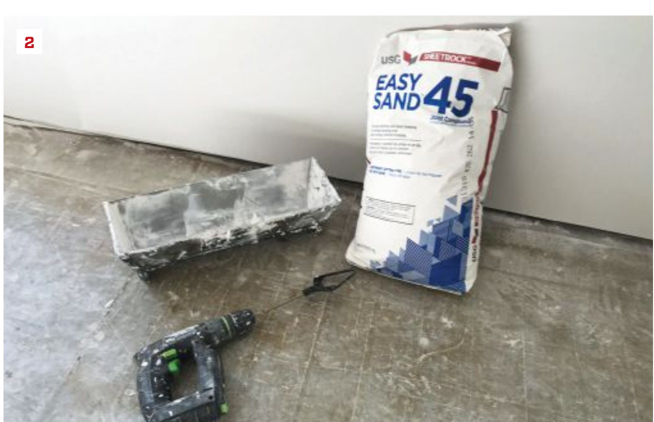
BY MYRON FERGUSON

One thing I have always liked about taping drywall is that it's fast-moving work. There is always a lot of energy in the air when we walk into a freshly hung job and get ready to start embedding the tape. Although we want to start taping as quickly as possible, we often need to address several details first so taping can proceed without interruption. These details include filling wide gaps between sheets, fixing poorly driven screws, and repairing any damaged edges.

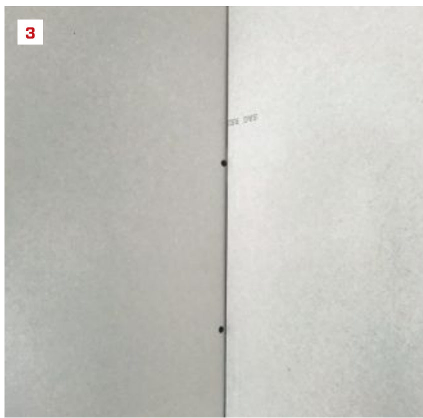
Prepping for the prep work. I have a set routine for addressing those issues. First, I gather up the tools and materials I'll need. I stick a utility knife with a fresh blade in my pocket and put a cordless drill with a screw-setting attachment on my belt. I also grab a handful of screws and put them in my pocket or tool pouch **(1)**.

I cut up some short pieces of mesh tape and stick them to my shirt. The tape pieces on my shirt won't win me any awards for best-dressed drywaller, but having short pieces of tape within easy reach rather than carrying the roll around and dispensing the tape as I go makes the job proceed much faster.

Setting compound. For the prep work I do before taping, I work out of a mud pan, using a 6-inch joint knife to dispense the compound. I mix up a full pan of setting compound **(2)**, making up small batches right in the mud pan. I always put water in the pan and then add the powder to the water. Because I'm mixing up small batches, I don't bother weighing or measuring the powder and water. A little



For the prep work, the author carries a utility knife, a screw gun, and a few screws in addition to a mud pan and a 6-inch taping knife **(1)**. He also sticks pieces of mesh tape to his shirt. The working time for setting compound is printed on the bag **(2)**.



The author fills any cracks wider than 1/8 inch between sheets with setting compound. These gaps include corners **(3)**, wall-to-ceiling joints **(4)**, and joints between sheets **(5)**. The tapers will follow, going over these cracks with mesh tape and compound.

Photos by Linda Ferguson

ROOFTOP TERROR

Who knows what evil lurks under those freshly nailed shingles?

Readers of JLC know they never have to look far to find stories about roofing issues.[1]

It's easy to see why. The crush of new roof builds, repairs, and replacement projects has many roofing contractors scrambling to keep pace, especially in today's tight labor market. Taking a shortcut or two around the chimney, dormers, skylights, roof/wall intersections, valleys, and other transition areas is woefully far too common.

Flashing right the first time is easy to say. However, it's not so easy to do when impatient owners are breathing down your neck or you're managing inexperienced help.

Brandon Wulf knows all about the dangers. "Remediation of an improperly installed roof is five times more expensive than doing it right the first time," he cautions.

"Wherever there's a transition, there's a natural weak point for leaks," says the veteran sales rep for GCP Applied Technologies, a leading manufacturer of residential roofing products. Wulf says shortchanging detailing has other consequences, too: 70% of all construction litigation is leak-related, damaging contractor bank accounts and reputations. "We've been in this business for over 40 years. There aren't many things we haven't seen. We know all the horror stories," Wulf says.

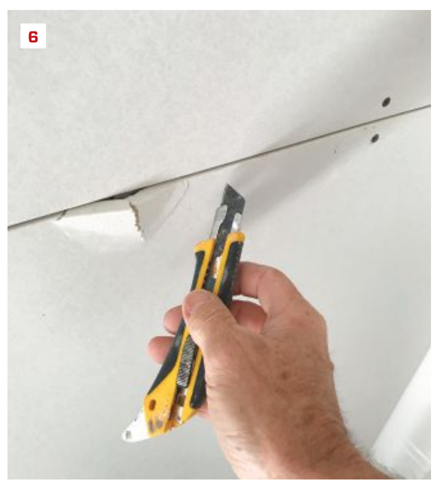
Wulf has a couple of ideas to help you avoid those horror stories:

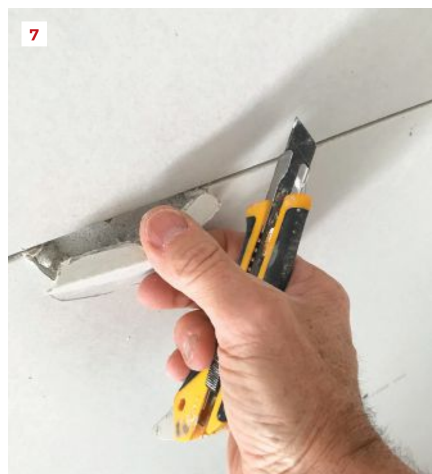
1. **Haste Makes Waste.** No project schedule, no matter how compressed, is worth risking a callback. "It seems like common sense to do it right the first time with the right materials with the right detailing. Unfortunately, it's not always done that way," Wulf says.
2. **Chimney Challenges.** "Chimney detail is one area that can be easily overlooked," Wulf says. "Make sure the membrane collar around the chimney isn't left permanently exposed. As it is, I get lots of calls about chimney conditions."
3. **Skylight SNAFUs.** Who doesn't like a nice bright, cheery bathroom? Some roofers may not have the same enthusiasm, given skylight leak history. "We work with several skylight companies that actually insist high-performance membrane products always be specified in order to avoid callbacks," reports Wulf.
4. **Underlayment Unease.** Wulf identifies characteristics contractors should look for in underlayment: 1) The product should stick to the substrate—"Nothing fancy, it's just common sense." 2) The membrane should stick to itself on the overlap. 3) The membrane self-seals around fasteners. Otherwise, "… you just punched a bunch of holes in your roof," he warns.
5. **Intersection Indigestion.** Make sure there are no membrane cuts where wall meets roof. Always leave a generous lap of at least 4 to 5 inches to help seal out moisture.
6. **Tech Talk.** In doubt about the details on a flashing application? Don't think twice. Immediately contact the underlayment manufacturer's technical rep. If they're like the ones at GCP Applied Technologies, you'll find their solved-it-all experience will reveal a quick, lasting solution.

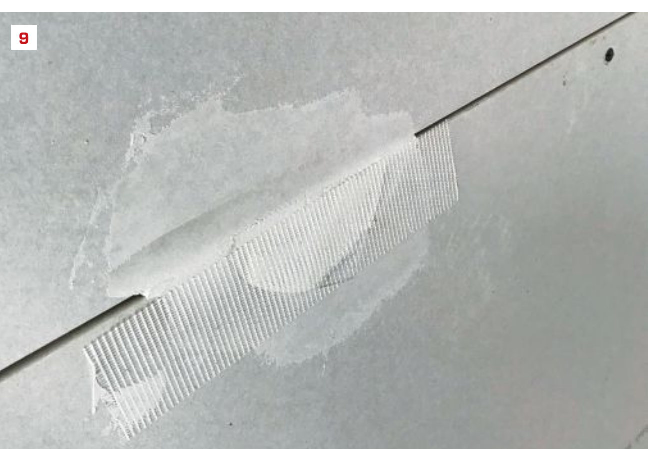
Nothing in the trade is worth a callback on a leaky new roof. Wulf says take the time to do it right the first time.

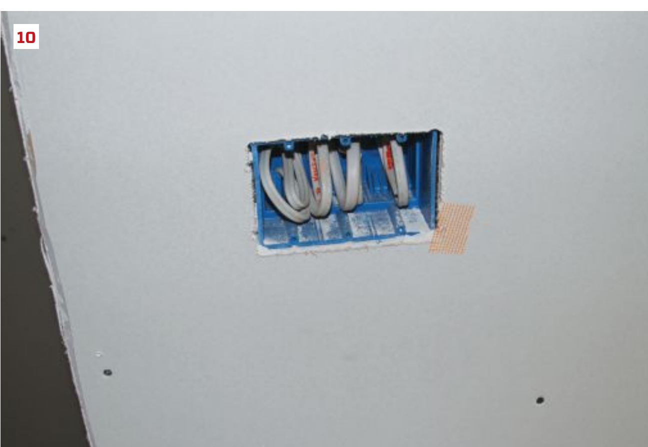
Learn more about how to avoid roofing callbacks: **www.gcpat.com.**

[1] Horgan, Doug. "Roofing Details That Work." Journal of Light Construction, Hanley Wood Media, Inc., 27 March 2019, https://www.jlconline.com/how-to/roofing/roofing-details-that-work_o.









Repairing a damaged edge begins with slicing the paper around the damage **(6)** and removing the debris **(7)**. The author then fills the hole **(8)** and covers it with mesh tape **(9)**. Damage from cutting around electrical boxes also needs to be repaired **(10)**.

experience can go a long way here in gauging the proper amounts.

Setting compounds are sold according to the working times for the compound. Depending on the scale of the job, I usually use 45 or 90. For smaller, quicker jobs, I sometimes use 5. When I'm ready to go, I let the taping crew know what room I will be starting in, and then I move from room to room in a clockwise direction.

Filling wide gaps. When I walk into a room, I first look for any gaps wider than 1/8 inch between drywall sheets. These are typically in corners **(3)**, between the wall and ceiling **(4)**, and along the seams between sheets **(5)**.

For gap filling, I quickly press the setting compound into the open space and smooth it out. Unlike other coats that the tapers will apply, I don't worry about making the surface perfectly smooth. I just try to keep the coat even, without high spots or ridges.

Damage control. Sheets with damaged edges are inevitable on almost every project. When I come across a damaged section, I cut away the damaged area or loose paper with a utility knife **(6)** and remove the damaged drywall **(7)**. Next, I apply a quick coat of setting compound over the damaged area **(8)** and then put mesh tape over the wet compound **(9)**.

I also look for areas where damage might not be noticed or easily covered by the tapers. One such area is where the crew hanging the drywall cuts out around electrical boxes. Most professional hangers cut out these areas with a drywall router, and it's common to see places where the bit has wandered. The cover plates may not hide these damaged areas, so I hit them with a quick dab of compound and a short piece of tape **(10)**.

Screw patrol. The last thing I check is the fasteners. I look for screws that might have missed the framing underneath. A telltale sign is a screw head that has not sunk properly below the surface of the sheet **(11)**. When in doubt, I try to sink the screw in deeper. If it spins, then it needs to be removed and replaced. If it's not obvious

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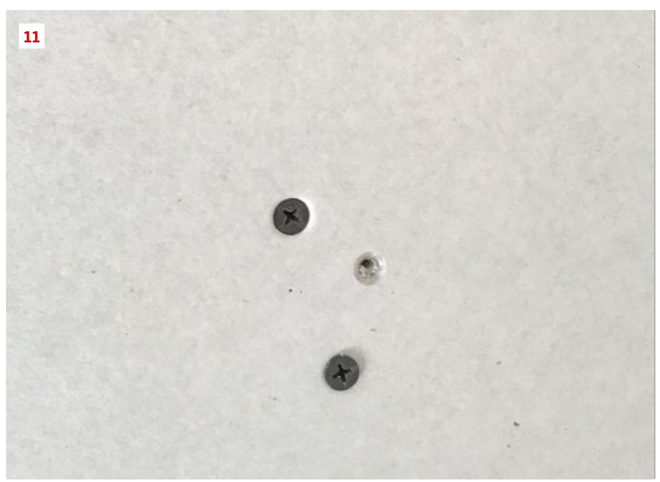

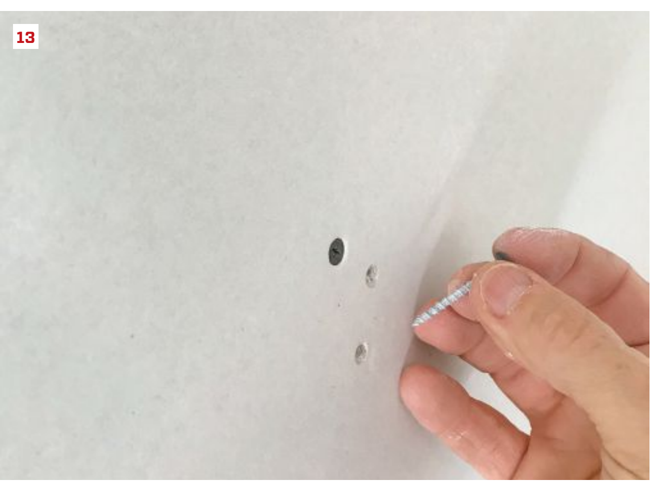

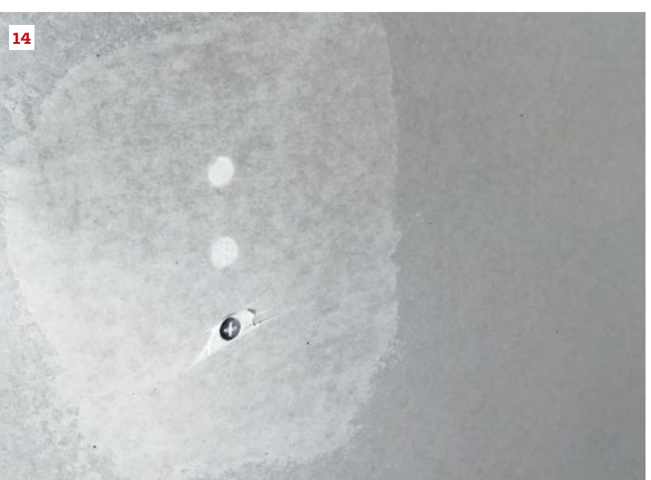

The heads of screws that miss the framing will be proud of the drywall surface, as illustrated by the lower screw in this photo **(11)**. A drill bit probe can be used to locate the framing **(12)**. When an errant screw won't back out with a screw gun, the author takes the screw out by hand **(13)**. Any screw not driven deep enough will show up at the coating stage **(14)**.

where framing is, I use a drill bit on my cordless drill to probe **(12)**, and set a screw into the framing to the proper depth.

If a screw has not hit the framing and it just spins, I may not be able to remove it with a drill. In those cases, I can usually grab the screw head with my fingertips and back the screw out by hand **(13)**.

A screw head that is not set to the proper depth will show up immediately when you are skim coating over the screws **(14)**. Likewise, screws that are driven too deep break the paper surface of the drywall and lose much of their holding power. If not fixed, they can cause screw pops later on.

When doing my prep rounds, I often find areas where screws are totally missing or not enough screws were used. If inside corners are missing screws, the corner line can end up crooked or cracks can form when baseboard or crown is installed.

Don't skip the prep. If I'm not on site to complete the prep work before taping, I make sure someone on the crew is in charge of doing the work. When crews decide that this prep work isn't important and skip over this step, it inevitably slows down the taping process and causes problems down the road.

I have found that prepping each room before taping actually increases productivity, by enabling the taping crew to proceed efficiently and without distraction. Even more importantly, this example of "working smarter not harder" has the benefit of increasing the quality and the durability of the drywall work.

Myron Ferguson is a drywall and home-performance contractor in Middle Grove, N.Y., and a presenter at JLC Live. See his website at thisisdrywall.com and follow him on Instagram @thatdrywallguy.

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Restoring a Gothic Porch

BY MARC BRAHANEY

I own and operate Lasley Brahaney Architecture and Construction. We specialize in custom design-build residential projects in and around Princeton, N.J. In late 2017, I began work on a major addition and exterior restoration project on my own home, a Gothic Revival built in the 1870s. The house definitely has a bit of character to it and is recognized as a landmark property in the Township where I live. Part of the project's scope was to restore the home's front entry porch to its original design (the previous owners had removed roughly half the porch because it had deteriorated, reducing it from two bays wide down to one).

Factory-milled Boral. From the outset, I knew replicating the porch's original moldings and trim would be a challenge; some of the Gothic-inspired shapes I needed were fairly large and chunky. Reproducing them from rot-resistant wood (plastic products were not an option) would be difficult and expensive, so I reached out to Keith Coleman of Duration Moulding & Millwork (durationmillwork.com). Duration specializes in milling exterior trim and siding from Boral stock (a poly-ash material resistant to both moisture and termites). In addition to milling common trim and siding profiles, Duration can fabricate large custom shapes out of laminated pieces of Boral stock at its facility in nearby Hamilton, N.J. After speaking with Keith, I concluded that milled Boral would be the best product to use, both for durability and to match the home's unique trim work.

Shop drawings. During demolition, our crew discovered vestiges of the porch's original dimensions and layout. I was able to design the new porch from these leftover signs, returning it to its original two-bay width and making it a little deeper (measured out from the house) to give it a more generous feel. I sent Duration detailed design drawings along with one of the salvaged

The author rebuilt the Gothic-style porch as part of a major addition and exterior restoration project **(1)**. A new factory-milled pilaster was installed a couple of feet beyond the previous pilaster location (due to the widening of the porch) **(2)**. The pilasters, columns, crown molding, trim stock, and brackets were all made from Boral (supplied by Duration) **(3)**. The only non-Boral material used was the beadboard ceiling.

Photos by Lasley Brahaney Architecture + Construction

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posts to use as a template to help make the new columns and pilasters. Within a few days, the company provided shop drawings of the new replacement pieces, which I reviewed and approved.

In the interim, we conventionally framed the porch deck and installed 5/4x4 T&G Douglas fir decking, which we painted later. The roof, which would be covered with new flat-seam copper, was framed to provide sloped contours pitched towards two downspouts at the roof's edge (a raised curb maintained a level height around the roof's perimeter). We temporarily braced and supported the roof and waited for our new moldings and trim to arrive on site.

Rot-resistant components. The columns furnished by Duration were comprised of a center pressure-treated post wrapped with Boral trim. At the factory, they were made in components: the trimmed-out portions (these came with three sides assembled and a separate fourth side); the column plinths (which wrapped the finished Boral columns at the base); and the PT posts. On site, our carpenters easily installed the posts and Boral pieces, securing them with Loctite PL Premium adhesive and stainless steel trim screws (countersinking them and applying an approved filler). Sealant was applied at all joints between components. The pilasters were installed similarly, though the Boral trim wrapped 2-by PT stock.

With the columns and pilasters in place, our crew trimmed out the beams and fascia with the milled Boral, securing it similarly to the columns. Then they installed the decorative brackets with larger screws.

As far as finishes, the only non-Boral materials used were the beadboard ceiling and fir decking. Looking at value engineering over the long haul, I believe the milled Boral was the most economical choice. I'm counting on it to hold up better than wood under the intense weather and sun exposure the porch will experience.

Marc Brahaney is a licensed architect and president of Lasley Brahaney Architecture + Construction in Princeton, N.J.

Editor's note: This article has been reprinted to correct a printer's error in the July 2019 issue.

At the fascia, Boral crown molding and dentil trim from Duration covered a raised perimeter curb needed for roof drainage **(4)**. Elsewhere on the home, new window sills and highly decorative trim for box gutters were also made from milled Boral. Finishing up, the porch trim is to be painted white, nicely offsetting the home's light yellow stucco cladding and the dark green (almost black) shutters **(5)**.

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BY GEOFF FERRELL

Ventilation That Works

I'm the chief technology officer for Mandalay Homes in Prescott, Ariz. We're a production home builder focusing on high-performance homes. One of the things that sets our homes apart is the airtight construction; we routinely achieve blower-door test results of around 0.6 ACH50 by sealing every house with AeroBarrier, the aerosol acrylic air-sealing system.

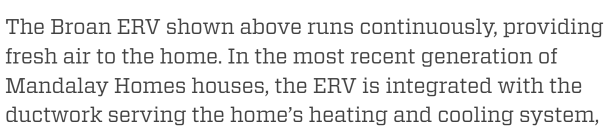
In a house that tight, we naturally need to provide mechanical ventilation. In fact, you don't need to build that tight before you'll need to ventilate the home. Ask any expert on healthy homes or ventilation, and they'll tell you that every house should have mechanical ventilation, whether that means a supply-only system, an exhaust-only system, or a balanced system like the setup we install in our homes.

Experts will also tell you that a house with three air changes per hour or less is a tight house. And in tight houses, balanced ventilation is the best choice. You can't count on natural air leakage to provide the fresh air you need. In the first place, it won't be enough fresh air; but beyond that, you need to control the source of the air that you're bringing in and filter the air. If you don't, the incoming air could bring in dust, smoke, and pollutants.

Mandalay Homes has been a fan of balanced ventilation for six years now. We accomplish our goals by installing an energy recovery ventilator (ERV). We use an ERV instead of a heat recovery ventilator (HRV) because ERVs exchange moisture as well as heat between the incoming and outgoing airstreams. In Arizona, we actually have a problem with the air being too dry. So an ERV helps us recover some of the humidity from the outgoing airstream to keep conditions inside the home comfortable for the homeowners.

In years past, we used to install single-stage heat pumps in our houses. If the system came on, it was blowing on the order of 800 cfm, or whatever the cfm rating was for that fan. It was either on or off. In those days, we didn't integrate the ERV with the heating and air conditioning system. The reason has to do with the way we run the ERVs: We like to keep the system operating 24/7, with the fan on a low speed. We figured that if we dumped 50 cfm of air into the cooling system's return when there wasn't a call for heating or cooling, it would tend to stay in the ductwork rather than being distributed equally around the house. Instead, we used a dedicated ERV with its own ductwork. We would distribute the incoming fresh air to the four corners of the house and then draw it back to a centrally located return.

Now, however, we've upgraded our heating and cooling systems to multi-stage equipment. Our current heat pump of choice is a Trane XR17 dual-stage unit, which has a SEER rating of 17 and



The Broan ERV shown above runs continuously, providing fresh air to the home. In the most recent generation of Mandalay Homes houses, the ERV is integrated with the ductwork serving the home's heating and cooling system, which continuously distributes air through the house.

Photos by Geoff Ferrell/Mandalay Homes

The home's HVAC duct system delivers conditioned fresh air to every room in the house. A centrally located return pulls stale air from the living space and exhausts it to the outdoors.

pairs with a variable-speed air handler. We program the air handler to run intermittently at a low speed, around the clock. Since we have that fan working all the time, we decided to take advantage of its power to distribute the incoming fresh air to every register in the home.

The ERV we use is the Broan ERV140TE, one of Broan's newer models that has been sold in Canada for a while and was recently introduced in the United States. It has intelligent controls and an ECM motor that allows fine-tuned control of the fan speed and operating time. We can dial in the amount of airflow that we are looking for, based on the square footage of the home, so that we're meeting ASHRAE requirements but we're not overventilating or underventilating. This way, we don't have to use a different ERV in every home; we can just program the Broan to precisely meet the requirements of any size home that we build.

We pair the Broan with the Trane by connecting the supply duct from the ERV to the return plenum for the heat-pump air handler. We dump the filtered incoming air to the return plenum, and then the Trane's fan moves it through the supply ductwork to every room in the house. We have a dedicated, centrally located return for the ERV that draws in stale air from the house and sends it out of the building.

Running the ERV continuously as we do enables us to control the air pressure in the house relative to the outdoors. When commissioning one of these ERVs, the pressures in the system must be balanced. We do this by measuring indoor and outdoor pressures with a manometer, and then we set up the system so it creates just a very small positive pressure in the house compared with the outdoors. It's a tiny difference—just one or two pascals—but it's enough to keep air from seeping in through any leak points. This helps the homeowners avoid pollutants from outside, like smoke, dust, and pollen. Indeed, our homeowners report that they see less dust and fewer pollutants in their houses.

Our homes do have ordinary exhaust vent fans in the bathrooms and the laundry room, and they have range hoods that exhaust to the outdoors too. For the range hoods, we provide makeup air: Our HVAC contractor installs a simple duct to the outdoors, equipped with a gravity damper that opens up any time the range-hood fan creates a negative pressure in the house. This ensures that the range hood can pull enough cfm to clear cooking odors and combustion products out of the house, without having to fight a vacuum.

Balanced mechanical ventilation using a combination of an ERV plus point exhaust fans with makeup air at particular locations is the best way we have found to provide fresh, healthy, filtered air continuously to a home and create the best environment for the homeowners.

Geoff Ferrell is the chief technology officer for Mandalay Homes in Prescott, Ariz.

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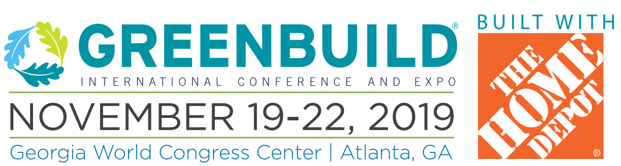
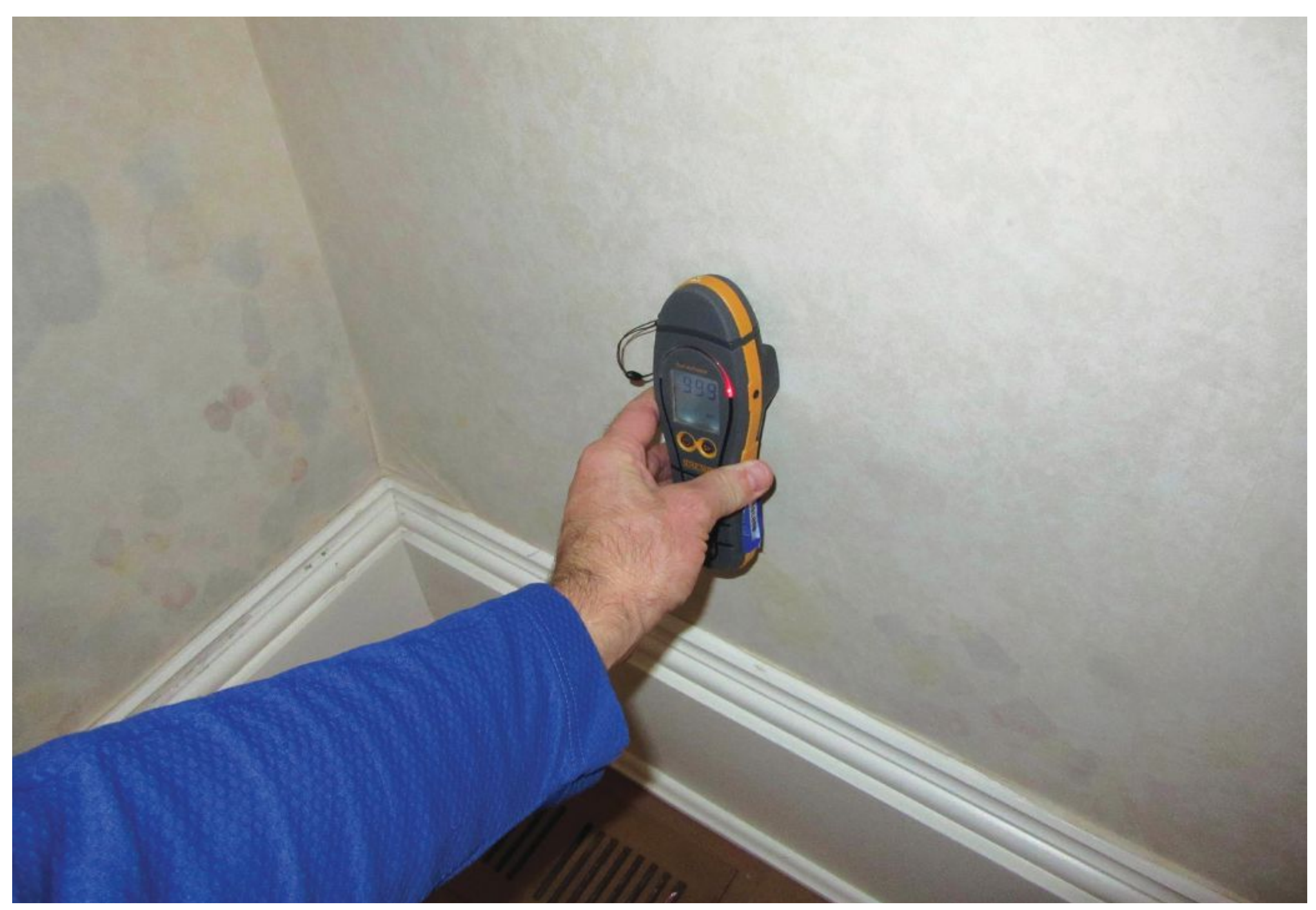




Summertime Moisture Problems

Troubleshooting condensation in hot, humid weather

BY DOUG HORGAN

I work in eastern Virginia, where summers are long, hot, and humid, and winters are relatively short and mild. When I was learning construction in the 1990s, I read a lot of articles about how to install a good vapor barrier on the inside face of walls and ceilings—describing how to wrap plastic around corners, connected in a vapor-tight manner, and so on. Those articles represented a northern-climate point of view: The concern was with wintertime vapor drive from the indoors out, rather than summertime vapor drive from the outdoors in. Eventually, however, building scientists started to realize that the practice of installing an interior vapor barrier was not appropriate to most climates in North America, and that, in fact, in many climates, putting plastic on the inside of a wall can cause serious problems.

That risk is becoming significant throughout the United States. In the past, summers in the northern tier of states generally weren't warm and humid enough to create problems with interior vapor barriers. But over time, I've watched my relatives in Vermont go from using no air conditioning to using one window-rattler a couple of weeks a year to using central air conditioning for weeks on end. Adding air conditioning to buildings with interior vapor barriers poses a serious risk of moisture problems, so my recommendation is to stop using Class 1 vapor barriers anywhere in the continental U.S. and learn about ways to control wintertime moisture that aren't as risky in humid summers.

Photos by Doug Horgan

Masonry mass walls like this stone wall **(1)** and this stucco-covered brick wall **(2)** can soak up and hold rainwater. When sun strikes these walls, moisture can be driven inward and condense if it is prevented from drying further inward by materials such as poly vapor barriers, vinyl wallpaper, or vapor-impermeable paint (see page 39).

UNDERSTANDING THE RISKS

Warm, moisture-laden outdoor air poses a risk of condensation when it encounters a cold surface in a building, and air-conditioned buildings have a number of surfaces that are at or below typical summertime dew points. The mid-Atlantic now experiences months of dew points above 65°F, weeks above 70°F, and a fair number of days above 75°F. If you work in the hot, humid South, you're familiar with these conditions. If you work in the northern states, this weather is headed your way as the planet warms.

Central air conditioners typically cool the air in the duct system by about 20 degrees below the thermostat set point. Most people set their thermostats between 72°F and 78°F in summer, so duct temperatures in the 50s are normal. This cold air is often blown directly on windows and exterior walls, and if runtime is long enough, those building-shell surfaces can drop below the outdoor dew point temperature.

If humid outdoor air hits those cold surfaces, moisture from the air will condense on them. When this occurs inside a building assembly, the moisture must be allowed to dry inward. Traditional Class 1 vapor barriers like sheet plastic or foil can block drying and result in a problematic accumulation of condensed water in the assembly.

Air leaks can also cause problems. A current of humid outdoor air hitting a cold surface inside will drop a lot of water quickly. This can be particularly problematic when moist outdoor air contacts cold ductwork. Ductwork outside a building shell must be designed with typical dew point temperatures in mind. Of course, it's best to avoid putting ductwork in attics and unconditioned basements and crawlspaces, but if ducts are in those spaces, they need to be wrapped to prevent condensation.

In addition, ductwork outside the envelope often leads to depressurizing the house. Most ductwork installed before the last few years was fairly leaky (testing was not required until the last few code cycles). Typical systems we see have short return ducts with few joints, and multiple long supply ducts with many joints. When the system runs, it blows much more air out through the supply leaks than it pulls in through return leaks, resulting in a net loss of air from the building. This air leaks back in through any hole it can find, driving many of the problems we see.

On some houses, a vicious cycle can drive serious issues. The more the air conditioner runs, the more humidity is sucked in and the less comfortable the clients become; they use the one control they have and set the temperature even lower, resulting in longer

The ceiling near this bath fan **(3)** had a persistent mildew problem. Diagnostic testing **(4)** indicated a pressure difference driving moist outdoor air into the room. An open joist bay **(5)** created a highway for moist air. To fix the problem, the author's crew sealed up the joist bay **(6)** with rigid foam board and canned foam sealant.

runs of air conditioning and even more leaking humid air, exacerbating any issues.

Over the years, my company has accumulated a lot of experience with complaints resulting from indoor condensation during a hot, humid summer. Some of these issues have been related to air leaks encountering cold indoor surfaces, and others involved vapor drive through wall assemblies. Here are a few examples that we've learned from.

MILDEW NEAR A BATH FAN

In one case, clients called us to say that their cleaning service had cleaned mildew off the ceiling in the main-level powder room several times, but mildew kept returning. This room was on the middle of three levels and at least 20 feet from the outside walls on the same level. As the formal powder room, it had no shower or bath and was used extremely rarely. The mildew pattern did not look like a leak from above either. So how else could moisture be getting into this interior room?

This issue appeared in summer, so there was plenty of available moisture in the outdoor air. The only relatively direct connection to outdoors from this room was via the bath vent fan. We used a pressure gauge to check whether pressure inside the fan was positive relative to the room (so air would move from the fan to the room) and if the room was negative relative to outdoors (so air would be sucked in from outside).

The pressure readings confirmed that both conditions existed, causing air to come in through the fan. Typical bath fan dampers are not airtight; a small amount of air can come through. If you depressurize a bathroom and pull air in through the bath fan duct over days and weeks, a fair amount of moisture can enter.

With the pressures we were measuring, air could leak in around the fan just as easily as through the fan duct. So we decided to

Air-conditioning ductwork in this garage **(7)** was a setup for moisture condensation. Infrared imaging detected cold spots on the ducts **(8)**. Uninsulated ducts were dripping with condensed moisture **(9)**. Inside the house, someone had tried to address the problem using XPS foam and packaging tape **(10)**.

check the joist bay around the bath fan, and sure enough, the joist bay seemed to connect to the outdoors too.

Our solution was to block off the joist bay with foam board and can foam and add another damper to the bath-fan duct. We first tried a fabric "sock"-style damper, but it didn't seal well under the low-flow conditions. So we installed a Fantech RSK spring-loaded butterfly backdraft damper, which did a better job.

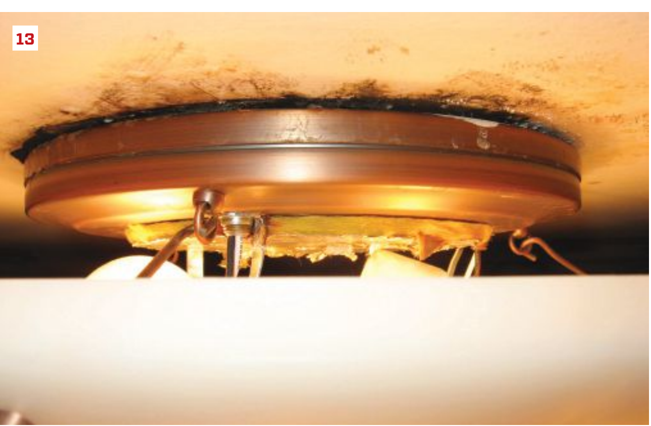
CONDENSATION ON DUCTWORK

"Our ducts are sweating! What do we do?" Our clients had bought a house in the autumn and had us renovate the kitchen and master bath before they moved in. Now it was summertime, and they asked us to figure out a previously unknown issue they were seeing for the first time.

The house was an unusual five-story townhouse, built in a commercial style with metal framing. The two areas where ducts were covered in drips of condensation were the attic and the garage. (That's right, they had an HVAC system mounted in the garage—a risky proposition considering the pollutants.) Condensation forms when a surface is colder than the dew point of the air, so the ducts must have been colder than the dew point of the air in those locations.

Checking the ductwork with a thermal camera, we found that it was cool: in the 40s and 50s. The outdoor dew point in summer in our area is usually above 50°F, and sometimes even above 70°F. If humid air leaks into the house and hits the ductwork, condensation will form, and other than water leaks, air leaks are the most common source of the moisture condensing on ducts.

The thermal camera showed some cold spots worth investigating. In fact, in the photos above, you can see that someone must have recognized the problem in the attic area because they tried to use XPS foam board and what looked like packaging tape to block the air coming in. We used a blower door to depressurize the house, which makes air leaks very easy to find (you can feel the air blowing in from the bad ones, and you can use the thermal camera to find the others). Sure enough, there were some serious



Moisture had soaked insulation above the poly vapor barrier of this wine room **(11)**. The author vacuumed up puddles of water from on top of the poly **(12)**. Bulk water was leaking into the room through a light fixture **(13)** and around a thermostat **(14)**.

leaks near the attic ducts: The bright yellow areas on the thermal pictures show warm temperatures where the hot summer air is leaking in.

Air leaks like these are easy to fix; in fact, even a homeowner with foam board and packaging tape can do an adequate job if they address the right areas. We use sheet materials, foams, tapes, and sealants that do a better job and last longer, but it's the same idea: Find the leaks and block the airflow with a combination of materials suited to the sizes of the gaps.

The garage was a different story. Garage doors are usually leaky when they're shut, and when they're open, they let in a lot of outdoor air. In this case, we added more insulation around more of the ductwork (there were some bare spots), and we tuned up the weatherstripping on the door as best we could. We also recommended a plug-in dehumidifier for the garage if the condensation continued to be an issue. Needless to say, ductwork and air handlers in garages are a bad idea, and no one should install such a setup in a new construction scenario.

WINE-CELLAR WEIRDNESS

We installed a refrigerated wine room in the middle of a slab-on-grade ranch house. The next summer, the clients called us to report some unusual things: brown drips from the thermostat and around the door, mildew on the ceiling near the light, and an unpleasant smell.

At first, I thought it was condensate leaking from the mini-split cooler head, but on looking more closely, I saw that the water in that area started higher up the wall. "Roof leak," I thought, so I ran up to the hot, humid attic. I found lots of water up there—so much that it was dripping off the batt insulation I moved to see the ceiling. The surrounding wood framing was soaked, and I had to vacuum water off the plastic sheeting we had carefully applied across the wine room ceiling.

We had installed that plastic because we followed the wine cellar cooler company's installation instructions. It's true that untold amounts of moisture had been blocked from entering the wine cellar by the plastic, which presumably was the idea. The problem is,

The author has seen more than one case of vapor drive through walls from the outside in. In one case, drywall screws were rusted by condensation **(15)**. In another, mildew formed on the painted walls of the room **(16)**.

since the plastic was on the cool side of the assembly, moisture condensed into liquid on the cold plastic and then couldn't dry anywhere. It just pooled up, then leaked into the walls and the ceiling light.

We applied a layer of closed-cell spray foam over the top of the wine room. This blocks moisture as well as the plastic did, but because of its insulating properties, the attic side of the foam stays close to the attic temperature and never gets cool enough for moisture to accumulate on it. Our standard spec now is for a layer of foam board or spray foam surrounding any wine room.

PICTURE-HANGER SURPRISE

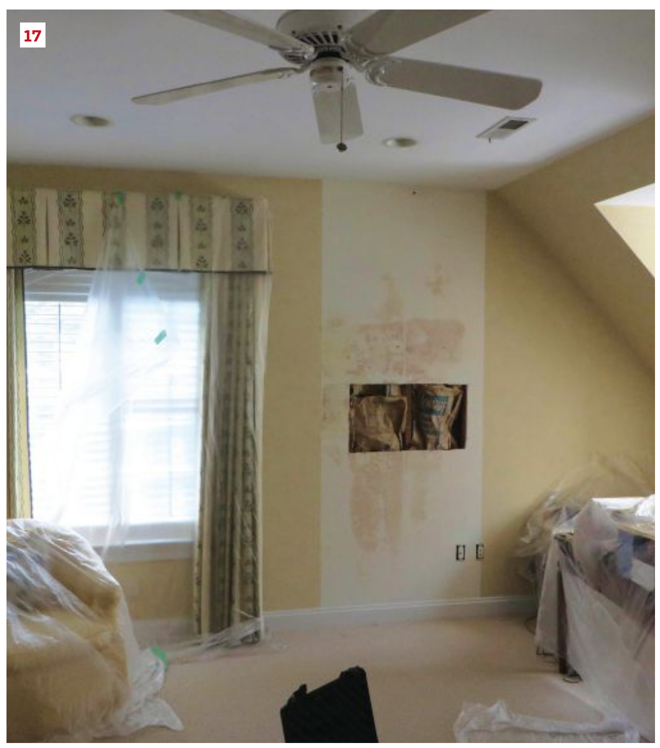
We had the opportunity to build a beautiful custom home, designed to look like an older farmhouse that has had additions and changes over time. There were some unusual details, including projecting window bucks that brought the windows nearly flush with the face of the 5-inch stone veneer.

A couple of summers later, the clients called to say they'd been awakened in the middle of the night by a picture crashing to the floor; on inspection in daylight, the hanger had pulled right out of the wall and taken a strip of the vinyl wallpaper with it. When I went by, the exposed drywall was very soft and felt cool. Out of curiosity, I put my moisture meter on the wall and was shocked to see it pinned at its max reading. It was decided to remove the drywall on the wall in question.

The drywall was still damp and had signs of mildew on the back. The kraft facing on the insulation also had some spots of moisture. The drywall screws and interior trim nails were rusty. But everything else was dry from there to the outside. The studs were clean (other than the very inside faces). The sheathing was dry and pristine. There was no water, staining, leaks, wet areas, nothing.

After lots of research, we identified the problem: A combination of rain wetting the stone exterior and sun heating it drove moisture into the walls, where, during air-conditioning season, the moisture condensed on the cold wallpaper. The accumulating moisture could not dry toward the interior.

Since that episode, I've run into this problem a few times. Often there's a localized area that's worse: where an air-conditioning vent blows directly on a wall, or below windows, where more water soaks into the masonry or stucco outside. I've seen it multiple times with vinyl wallpaper, but also with plastic interior vapor barrier, with a decorative painting technique that used several coats of oil paint, and even with large mirrors mounted directly to the drywall. Vinyl wallpaper, oil paint, and mirrored glass don't permit the passage of



This wall became damp when moisture was driven in from a stone exterior by sunshine and condensed on the back of the vinyl wallpaper **(17)**. Parts of the wall that were opened up were able to dry to the inside and were quite dry when the author checked them **(18)**. Removing the rest of the vinyl wallpaper addressed the problem satisfactorily.

moisture, so it accumulates behind them, when vapor drive is from outside in. This happens fastest when there's a "reservoir" material on the outside (something like masonry or stucco that can absorb water and hold it), direct sun on the wall, and air conditioning inside.

MYSTERIOUS MOLD

Neighbors of a client called us with a mystery their handyman couldn't figure out. Apparently, a bulletin board that had hung on the wall fell down spontaneously in late July one year. When the handyman removed the vinyl wallpaper from that part of the wall, he found stuff growing behind it and wet drywall. They cut out the drywall, removed the insulation, and waited for rain so they could figure out the leak source that must be there. But no leak came, no matter how hard the rain.

Sounds familiar, right? Coming into this diagnostic with another option besides "water leak" was pretty helpful. There was an air-conditioner register blowing right on this part of the wall. The parts of the wall that were opened up were quite dry by the time they brought us in, weeks after the vinyl wallpaper had been removed and the wall cut open. Obviously, a lot of drying can happen when there's no wall covering at all and the wall was no longer accumulating moisture from the sun hitting the stone veneer outside. The clients took our advice to remove the wallpaper, and the wall has been fine since.

MASS-WALL WETNESS

Another house started showing black spots in the wallpaper in the first summer after the clients renovated it. It started in a corner where an air-conditioner vent blasted cold air onto the wall, so originally we were hopeful that blocking half the vent would solve the issue by eliminating the cold spot. But as time went on, black spots started appearing in other locations—first below a window, and later all over the wall.

The house is a historic brick building covered with stucco. I know there are loads of these performing fine all over the country, but I do see a few with problems, and I sometimes think there's just not an easy fix. More precisely, I am not sure there's a way to guarantee water won't accumulate in the masonry under some conditions. If the building is air conditioned, it's much better to allow it to dry to the inside. So avoid impermeable coverings, and maybe consider paper-free drywall as an interior finish, so mold won't have an easy food source.

Doug Horgan is vice president for best practices at BOWA.

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Stone Veneer on a Concrete Foundation
Two approaches to dressing up a drab foundation

BY PETER AND THOMAS CHAPPELOW

As stone masons, we see a bare concrete foundation as a clean canvas waiting for us to work the magic of our craft. Stone veneer is a straightforward way to enhance the look of just about any home—regardless of its design.

Faux vs. real stone. At grade level, foundation veneer is apt to sustain damage from routine activities and wear and tear. With faux stone, the color is only on the surface, so abrasions, chipping, or cutting exposes the base color. Even so, until recently, manufactured (aka faux) stone was the material of choice for foundation veneer, because it was much less expensive than natural stone. Advances in cutting technology, however, have brought the cost of natural stone down to nearly that of faux stone, making it more affordable.

Two challenges. On this slab-on-grade home in northern Vermont, the garage foundation was plain concrete, while the rest of the foundation was insulated with rigid foam. We used two different approaches to applying the veneer (see Stone-Veneered Foundation, page 42). While stone readily adheres to bare concrete, the foam required metal lath with a scratch coat of Type-S mortar.

For a dry-laid look, we added black tint to the mortar, which made it less visible through the gaps between stones. A bluestone cap was added as a design element after we'd finished much of the veneer.

Brothers Peter and Thomas Chappelow own Half Moon Stone Works, a masonry business in western Vermont (halfmoonstone.works).

Photos and illustration by Tim Healey

Stone-Veneered Foundation

Garage Wall (Unheated Space)

Fiber-cement shingle siding

Drainable WRB membrane (blue line)

"J" flashing (red)

Boral water-course trim

"L" flashing (red)

Cap stone set in Type-S mortar, sloped to drain (typical)

Polymer-modified thinset mortar (tinted black)

Stone veneer (dry-stack pattern)

½" Zip System sheathing

2x6 exterior wall

12"-thick double stud wall with dense-pack cellulose and Majrex air barrier membrane (green line)

Concrete knee wall

Exterior Wall

"J" flashing (red)

Peel-and-stick flashing (orange)

Stone veneer (dry-stack pattern)

Polymer-modified thinset mortar (tinted black)

Type-S mortar scratch coat (tinted)

Expanded metal lath (attached with Tapcon screws)

1½" rigid XPS insulation (attached with plastic masonry fasteners in an enhanced grid pattern)

Drainable WRB (blue)

Zip sheathing

Boral trim

"L" flashing (red)

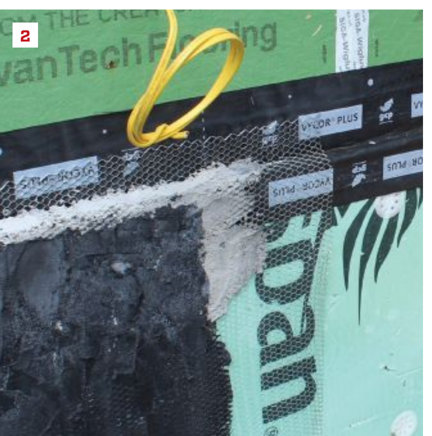
Cap stone set in mortar

Metal lath

Tinted thinset

Scratch coat (tinted)

A polymer-modified mortar is used to apply the stone veneer directly to the uninsulated areas of the foundation. Where rigid foam covers the foundation, expanded metal lath with a scratch coat of Type-S mortar creates the base layer.



Thin concrete block raises the stone shelf cast into the foundation closer to grade **(1)**. Flashing tape protects the bottom of the sheathing behind the metal lath **(2)**. The black scratch coat provides a dark background for the "dry-laid" stone **(3)**.

4

5

6

The masons use a heavy-duty wet saw to cut the stone veneer when needed. The saw has a tilting head for cutting miters **(4)**. To make the cut edges less visible, the crew installs them facing downward. To fine-tune the fit of a stone, a mason uses the chisel end of a masonry hammer to chip away unwanted material **(5)**. Because the crew works on small areas at a time, they hand-mix the mortar in small batches, adding concentrated masonry tint to the exterior-grade polymer-modified thinset to create the black mortar for adhering the stone veneer **(6)**.

7

8

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10

The blend of ledgestone and slightly larger ashlar stone comes with a nominal thickness of 1 1/2 inches. After trimming each stone to fit, the mason applies mortar to the bare concrete. He then butters the back of the stone **(7)** and presses it into place **(8)**. The crew uses the same process to apply stone to the scratch-coated areas **(9, 10)**.

The crew uses factory-cut corner pieces for the 90-degree corners **(11)**, installing the corner pieces first and then working back toward the field on either side **(12)**. The finished corner veneer looks like solid blocks of stone set in alternating directions on the corner **(13)**. To make the 45-degree corners, the crew cuts 22.5-degree miters from the same stones, again working from the corner outward during installation **(14)**. Cutting the miters from the same stone creates a sharp line with the grain of the stone continuing through the miter **(15)**, making the stone in the finished corner seem continuous through the break **(16)**.

The prefabricated Pennsylvania bluestone cap comes ripped to 2 3/4 inches wide **(17)**. The crew cuts the cap to length with a diamond wheel on a grinder **(18)**. The project designer opted for the cap after the project was started, so the crew put it in before finishing the field below **(19)**. Where they hadn't begun the veneer process, the crew installs temporary cleats to install the cap, which sits on top of the lath-covered rigid foam **(20)**. Where the foundation is not insulated, the crew installs the cap directly below the trim **(21)**. Corners are mitered, and excess lath above the cap is trimmed off after the cap is installed **(22)**.

To create a solid toekick below each door, the crew cuts slabs of Pennsylvania bluestone to fit each spot. They remove any chunks of mortar left behind from installing the veneer **(23)**, and then spread a layer of mortar on the foundation **(24)**. They wet down the back of the toekick to keep it from sucking moisture out of the mortar as it sets up **(25)**. A layer of mortar is spread on the back of the damp toekick **(26)**, and two crew members carefully lift the stone into place **(27)**. After pushing the stone tight against the door threshold, they slip in temporary wedges to hold the toekick in place until the mortar sets **(28)**.

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Photos by Ted Cushman

Air-Sealing the Lid

Spray foam and cellulose team up for a high performance solution

BY NICK LEHTO

I'm a second-generation homebuilder working in northeastern Connecticut, and I've been building net-zero energy homes for about 10 years. In my early years doing this, I experimented with structural insulated panels (SIPs) and other methods, but these days, I have settled down to a formula based on a cellulose-insulated double stud wall sheathed with plywood on the outside, and a flat attic with deep blown cellulose. I shoot for a HERS rating of about 40 without solar, and I get the rest of the way to a HERS zero rating by installing photovoltaics on the roof.

In 2010, I was trained and certified as a Passive House consultant, although I've never actually built a certified Passive House. Because of client budgets and performance expectations, I typically take a step back from Passive House in terms of insulation levels and window performance. This allows me more freedom to use a variety of building forms and gives customers more choice around things like window placement.

However, my company does routinely reach the Passive House metric for airtightness. We blower-door test all our houses for Energy Star certification, and they typically measure tighter than 0.6 ACH50—usually, somewhere between 0.3 and 0.5. One way we

Air-Sealing Details

Eaves Detail

Rafter vent channel
Loose-fill cellulose
Self-adhered water resistive air barrier (blue line)
Flash coat of high-density closed-cell polyurethane foam (1" to 2", typical). Outside edge of ceiling air-sealed with foam.
3/4" plywood gusset (glued to top plates)
Plywood sheathing
Double stud wall

Interior Partition
(Perpendicular to Framing)

Ceiling joist
20"-deep layer of loose-fill cellulose insulation (R-70)
2x blocking (shown beyond)
Partition top plate
All drywall corners air-sealed with spray foam

2x12 rafter
Loose-fill cellulose
2x8 ceiling joist
Can light

Lighting Penetration
(Perpendicular to Framing)

Tenmat mineral wool hat, protects can light. Air-sealed with a flash coat of spray foam.
Loose-fill cellulose
Drywall
Ceiling joist

Interior Partition

Loose-fill cellulose
Electric and plumbing rough-in air-sealed with spray foam
Ceiling joist (shown beyond)
Partition top plate
Drywall corners air-sealed

reach that level of airtightness is by focusing on the attic, including the critical juncture between the walls and the roof.

It starts with the double stud wall. As I mentioned, we sheathe the exterior walls with plywood. Then we cover the sheathing with Henry Blueskin to provide an airtight drainage plane. The outer stud wall and the inner stud wall are connected at the top with a continuous gusset of 3/4-inch plywood that is glued to the wall top plates. That stops any air leakage from outside those walls.

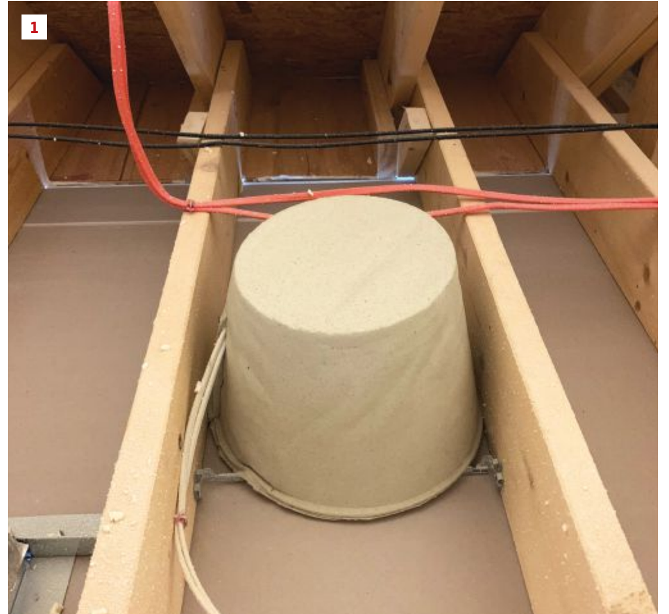
But this still leaves a leak point where the ceiling drywall butts up against the edge of the plywood gusset joining the wall plates. We address that joint from above. The spray-foam insulation contractor goes up into the attic and applies a flash coat of foam to that joint between the drywall and the exterior walls. He does the same thing at all the interior partitions.

We also spray-foam any penetrations in the ceiling. Where we have can lights, we install Tenmat mineral-wool hats over the lights (tenmatusa.com) and then cover the hats with spray foam. With all the joints and penetrations sealed with foam, we can now proceed to insulate the attic using 20 inches of loose-fill cellulose.

This method is simple but effective. I just received the finalized HERS rating for a house we completed a few months ago, built with the same methods I'm showing here. The house had a HERS score of -14 (37 before PV). The blower-door test came in at 0.53 ACH50.

Nick Lehto owns and manages Lehto Design/Build (lehtodesignbuild.com), based in Danielson, Conn.

Illustration: Tim Healey



The author protects can lights in the attic using Tenmat mineral-wool hats **(1)**. The spray-foam contractor then seals the hats down to the attic floor with a flash coat of high-density closed-cell polyurethane foam **(2)**. At the same time, the spray-foam contractor seals the gaps at the outside edge of the ceiling **(3)**. Partitions also create potential air leaks, both where the ceiling drywall butts to the wall and through wiring penetrations. So this location also gets a flash coat of spray foam **(4)**. When all the leak points have been sealed with spray foam, the author's crew installs 20 inches of blown-in cellulose insulation to complete the insulated attic assembly **(5)**.

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Products

BY SYMONE GARVETT

1. Wood-Look Aluminum Siding
Royal Building Products' Cedar Renditions aluminum siding is now available in the U.S. The premium aluminum siding boasts a modern aesthetic with a natural variegated plank look. Benefits of the siding include a thicker gauge, seamless overlapping notches to achieve longer lengths, and easy installation with a drop-in interlock system. The product is available in 4-inch and 6-inch profiles in three traditional woodgrain colors and two premium colors. Contact a local distributor for pricing. royalbuildingproducts.com

2. European Patio Door
Ply Gem's EuroSeries patio door is available in two-, three-, or four-panel configurations, with a maximum size of 21 feet by 9.5 feet. Despite the door's size, a proprietary EuroGlide allows for easy movement. The company says the door is High Velocity Hurricane Zone tested, and meets impact protection requirements for the Florida Building Code, including Miami-Dade County. Optional glass packages (with sound transmission class ratings) help reduce outdoor noise levels, and the vinyl frame can be customized in several two-tone finishes. Contact a local distributor for pricing. plygem.com

3. Two-Tone Molding
The new Haute 2-in-1 Moulding collection by Ornamental Mouldings & Millwork offers a two-tone decorative accent. It includes a white wood molding base, available in crown, baseboard, and chair railing, with a choice of a gold rope (shown) or silver pyramid crown-molding insert. For finishing, contractors remove the insert, paint the primed molding profile, then reinstall the insert using construction adhesive to affix the insert in the molding's cavity. Pricing ranges from $3 to $5 per linear foot. ornamental.com

4. Cabinet Storage Inserts
Omega Cabinetry's new line of matching storage and organization solutions includes cabinet interiors and drawer inserts compatible with its cabinetry lines. All pieces in the matching suite are finished in a flat metal gray. Cabinet interiors are full-access with no face frames, allowing for greater storage space, greater drawer volume, and access from any angle. Contact a local distributor for pricing. omegacabinetry.com

5. Light Bar
Federal Brace has expanded its Eco-Lucent lighting line with a new LED light bar system specifically for hardwired applications. Each light bar is installed in an extruded aluminum housing with a frosted cover, and provides 116 lumens of output at a warm white 3,000K color temperature. Pricing for the light bar starts around $47, and the installation kit retails for $176. federalbrace.com

6. New Generator Enclosure
Kohler now offers an aluminum enclosure for its 14kW and 20kW residential generators. For homes located in hurricane-prone areas, the enclosure is durable and corrosion-resistant and can withstand 181-mph winds, says the manufacturer. With its aluminum composition, an automatic standby generator can be installed as close as 18 inches from most structures. Designed for easy installation and maintenance, the enclosure features access panels that can be removed without tools. Pricing for generators with aluminum enclosures range from $3,830 to $5,250. kohlerpower.com

7. Water Monitoring Device
Flo Technologies has introduced a new, 1.25-inch version of its original Flo by Moen device, made for use in structures with 1.25-inch water pipes. Much like the standard Flo by Moen device, which is designed for use with .75-inch water pipes, the 1.25-inch devices attach to a home's main water line to monitor water pressure, flow rate, and temperature. The Flo's AI learning system allows it to learn a home's water-use habits, distinguish normal from abnormal use, and detect micro-leaks and vulnerabilities in the system. Pricing ranges from $500 to $900. meetflo.com

8. Dual-Use Boiler
Rinnai has expanded its condensing boiler lineup with the new I-Series of domestic condensing boilers. The boiler allows for simultaneous home heating and domestic-hot-water production and is available as either a combi or heat-only model. The unit runs at 95% AFUE efficiency and operates on natural gas as standard, with a propane conversion kit included. Maximum domestic hot water inputs range from 160,000 to 199,000 Btu/hour for the combi models, while domestic heat inputs range from 60,000 to 150,000 Btu/hour. A bypass servo valve provides precise control of the hot water's temperature. Contact a local distributor for pricing. rinnai.us

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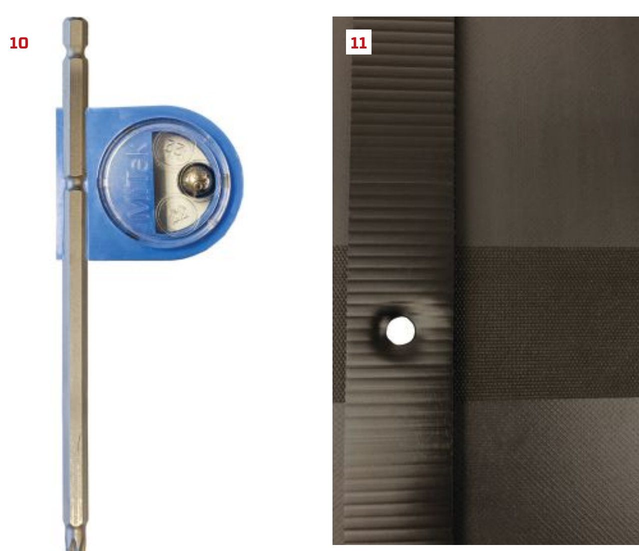

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9. Impact-Resistant Garage Doors

Haas Door has added four polycarbonate impact window glazing options to the American Tradition 900 series of steel garage doors. Doors are 2 inches thick overall and have a 26-gauge galvanized steel base, polyurethane exterior overlay boards, and CGC-free polyurethane insulation with a calculated R-value of 13.45. Together, the door and windows offer design pressures of +48.0/-52.0 for doors up to 10 feet 2 inches wide, and +31.3/-34.9 for doors between 10 feet 3 inches and 16 feet 2 inches wide. Contact a local distributor for pricing. haasdoor.com

10. Truss or Stud Screw

MiTek has released a new ProSeries fastener, the WSTS Truss/Stud Screw. MiTek says the WSTS screw provides uplift resistance and lateral load resistance for connections including truss-to-top-plate, rafter-to-top-plate, top-plate-to-stud, and stud-to-bottom-plate. Available in two lengths, $4\frac{1}{2}$ inches and 6 inches, the screw has a "reverse thread angle" on opposite ends for greater resistance to withdrawal and is fully threaded along its length. Pricing starts at $35 for a box of 50, which includes an installation angle tool. mitek-us.com

11. Open-Joint-Cladding System

Benjamin Obdyke's Open Joint Cladding System includes housewrap, flashing tape, and battens for use with open-joint cladding. InvisiWrap UV is a high-performance, black polyester nonwoven housewrap with a proprietary coating; HydroFlash UV+ can be used to flash penetrations and cover furring strips behind open joints; and Batten UV helps maintain a drainage opening. Pricing for InvisiWrap starts at $0.55 per square foot. HydroFlash is $33.50 per 82-foot roll and Batten is $119.50 per 64-piece box. buyobdyke.com

12. Noise-Reducing Ceiling Board

The Gold Bond brand SoundBreak XP Ceiling Board is the latest addition to National Gypsum's Purple noise-reducing drywall products. SoundBreak XP units consist of two pieces of gypsum board covered in specially designed purple paper and laminated together with a viscoelastic polymer. The boards measure 4 feet wide and $\frac{3}{4}$ inch thick, and come in standard lengths of 8 to 10 feet. The board provides Sound Transmission Class and Impact Insulation Class values above 60 in specific floor-ceiling assemblies, and meets maximum mold resistance standards, says the company. Contact a local distributor for pricing. nationalgypsum.com

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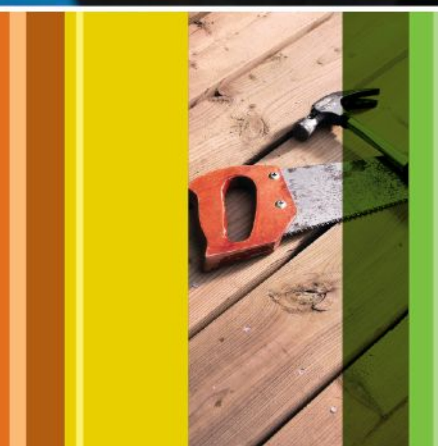

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Benchtop Pocket-Hole Cutter

BY NATHAN RINNE

Pocket-hole joinery has been a staple in cabinet shops for decades, and with good reason. Tests show pocket holes and screws to be superior to traditional joinery in 3/4-inch material. For example, a comparable mortise-and-tenon joint fails at about 450 pounds under a shear load, whereas a pocket-hole joint fails at around 700 pounds. With the portable jigs available everywhere these days, pocket-hole joints have become almost universal in the woodworking world.

My first pocket-hole jig was a clamp-on, two-hole style. I soon moved up to the manual benchtop model with which I subsequently cut thousands of pocket holes. As a result, I learned to be pretty proficient. However, I had my eye on an automatic benchtop model. Disappointed with the plastic homeowner-grade machines I was finding plenty of, I looked around for an alternative.

What I found was a company after my own heart. Castle has been making tools in the same Petaluma, Calif., plant since the 1980s, and all of its machines are painted John Deere green "as a nod to American ingenuity." Sold!

In addition, the machine is all steel and built like a tank. Castle is a company that hasn't succumbed to the temptation to move manufacturing overseas nor to join the race to the bottom by cheapening its products to pad its bottom line.

That part is important: This is the kind of company I want to reward with my dollars.

When my TSM-12 Benchtop Pocket-Hole Cutter arrived, it was shipped so well that it took a solid 10 minutes to cut away all the packing foam, shrink wrap, and tape from the individual parts. I mention this because I have received tools so poorly packaged for shipping that the mess of damaged parts that arrived was inevitable from the moment they were put in the box.

As I was putting the machine together, I admired how heavily built everything is. Even the U-bolt that holds the cutting router in place was overly large, which I like. The instructions, warranty info, and other miscellaneous literature came in a three-ring-binder folder, which seemed more personal than the typical mass-produced instructions I'm used to seeing.

A DIFFERENT WAY TO MAKE POCKET HOLES

The Castle pocket-hole cutter uses a unique setup to cut its pocket holes, using two Bosch routers. One cuts the pocket and one drills the pilot hole. You simply push the lever forward to cut the pocket and pull it back to drill the pilot hole. The whole process takes just a few seconds with repeatability that you can't get with a manual jig.

What I like best about this setup is, should a router ever fail, I can easily go to a big box and get a replacement that day. That, to me, is peace of mind I wouldn't get from a unit with a proprietary motor. In fact, given today's throwaway culture, I'd almost bet it would be cheaper to buy a new machine than to replace a motor on one of the other commercially available units.

If you're only used to the Kreg style of pocket holes, you'll find another feature to love about the Castle: The holes are cut at an angle less than half (6 degrees rather than 15 degrees) that of the Kreg. With that change, you not only are more in plane with your mating piece—lowering the chance of the two slipping apart when you're screwing them together—but you also leave more wood fiber surrounding the screw. This translates to a stronger joint. Castle

Photo: Nathan Rinne

The TSM-12 includes a Bosch 1617 Router, Bosch Colt Router, 9/64-inch premium drill bit, and 3/8-inch three-flute solid carbide router bit. While you can use other brands of pocket-hole screws, Castle also sells them (not included).

offers several styles of precut plugs for these holes, including an easily removable plastic plug that is actually quite attractive.

DUST COLLECTION

As shipped, the TSM-12 isn't ready for dust collection. The bottom is wide open, allowing access to the internals for setup. However—add a point in the cool column—the company sends a template to cut a base from plywood if you desire to do so. Once you have the bottom in place, there are two knockouts on the back of the machine for connecting either a shop vacuum or a 4-inch collection hose.

I have been pleased with my TSM-12 since it arrived. It increases my efficiency, which in turn increases my bottom line. Given how well it's built, I also enjoy the confidence of knowing I will get a lifetime of service from it, and that isn't something I can say about every tool I own.

The Castle TSM-12 Benchtop Pocket Hole Cutter retails for $1,170. castleusa.com

Nathan Rinne is the owner of Rinne Trimcraft in central Missouri. He specializes in on-site carpentry with an emphasis on ornamental built-ins. Follow him on Instagram @rinne_trimcraft and on Facebook at facebook.com/osagebeachcarpenter.

The TSM-12 bores a lower-angle (6 degrees) pocket (bottom, in photo) than other jigs (15 degrees, top, in photo). This enables the screw to bite into the receiver stock with a decreased tendency to shift that stock out of place.

Backpack Vacuum

BY CLIFF WOODMAN

Weighing in at 20 pounds—fully loaded with all the accessories and one M18 battery—the Milwaukee M-18 3-in-1 Backpack Vacuum is light.

It's also versatile: It can be used as a backpack, carried by the top-handle, hooked to a wall block or ladder with the built-in rafter hook, or even suspended by the attached strap. I used it in each configuration on the remodeling projects I do, and it was great.

If you primarily use the handle or need to fit in tight spaces, the shoulder harness can be removed. When you use it in the backpack configuration, the shoulder straps are wide and padded for a comfy fit.

The unit has a waist strap that keeps the unit centered on your back nicely when you are bending over or climbing ladders. The waist strap also houses locations for the additional attachment heads so you can change them on the fly without having to go find them. The two-position switch is conveniently located on the bottom left side of the unit within easy reach. At less than 75 decibels, it's quiet.

The 1-gallon debris canister is easy to remove with one hand with the push of a single button. Return air is filtered through a HEPA filter mounted in the top of the canister. Emptying the container is just as easy with the bottom door.

That's already a lot to like, and I'm not done.

I tested it with the optional 9-foot hose, though the factory-shipped 6-footer is more than adequate for an average-height person. The metal wand is easily adjusted to multiple lengths with convenient locking points. A cool feature is the "knuckle" on the hose. This plastic rotating knuckle prevents the hose from kinking up where it attaches to the canister. I used it in a bar remodel after replacing the bar top, and it worked great on heavy sawdust and larger chips. I also tested it with some drywall-dust cleanup; again, it performed well. The filter did require frequent cleaning, but they all do with drywall dust.

Now for the downside. I found that it did have a little trouble with heavier objects like nails and small pieces of plaster. But it is designed to be a portable, lightweight vacuum, and for that, its power-to-weight ratio is awesome. You can not expect the power of a corded floor-mounted vacuum in a small package.

I put it in the back seat of my truck and closed the door, not realizing the hose was against it when it shut. The structural support in the hose was crushed and took some finagling to restore it to a functional shape. This was my fault, but be aware that the hose isn't indestructible.

Bottom line, if you are in the market for a small, portable jobsite vacuum cleaner, I would encourage you to test drive the Milwaukee 0885-20 M18 Fuel 3-in-1. My wife cleans vacation rentals and I'm having trouble keeping the vacuum cleaner in my truck.

I give it 5 out of 5 Hammers. It retails for $300 (tool only). milwaukeetool.com

Cliff Woodman is a career carpenter and owner of Woodman Builders, in Saint Simon's Island, Ga. With more than 30 years experience in the construction industry, he has built and remodeled businesses and homes.

Photos: top, Nathan Rinne; bottom, Cliff Woodman

Trailer Theft Prevention

BY MARK CLEMENT

You know that feeling you get when you arrive at the jobsite and your tool trailer is gone? That couple of seconds it takes to process that something is really, really wrong.

"Wait. Did I move it to another job?" "Did I park it somewhere else?" "Did one of the guys ..." and the pit in your stomach sinks with the rising observation that you've just been ripped off.

Fun, right?

There's a way to prevent—or at the very least, minimize—the risk of that ever happening again. It's the contractor-invented TDS LockJaw Vault. This is a two-piece, 10-gauge, powder-coated, made-in-the-U.S. housing that isolates your jack handle and trailer tongue from anybody that doesn't have a key to the lock. One piece goes over the jack stand and one goes over the nose. They interlock and slot together, and once in position, they can be locked in place.

The Vault is designed so that once locked, accessing the lock with a grinder or bolt cutter is nearly impossible, so the weakest link—the lock itself—in most lock-up scenarios is further hardened.

If you look on the tdslockjaw.com installation page to see how this installs—it's easy—you can also see the serious mental gymnastics it took the inventor—Cliff Woodman of Woodman Builders in Saint Simon's Island, Ga.—to iron out before putting his design into production. Making complicated things seem simple is no mean feat.

The Vault is designed to work with other theft-deterrent systems (TDS), such as hitch/coupler locks. However, it does not work with all trailers. LockJaw says that the current model is designed for enclosed, cargo-style trailers with the jack stand centered behind the tongue.

The Vault has two holes for two locks. This was kind of a design accident with a plus-side consequence: It accepts a second lock, making it just that much more inconvenient and time consuming for a would-be burglar. (I think, by the way, we all feel that there's a special place in Hell for people who steal tools—tool thieves don't only steal stuff that can be replaced; they also steal our ability to feed our families.) You can also require two keys to open it, say, two lead carpenters. Or an owner and a project manager.

Finally, I appreciate how detailed the installation page is and how clearly and simply it shows you how to determine if the Vault will fit your trailer. A website by a carpenter, not a marketing department. Nice.

For approximately $200, the Vault comes with both pieces and a lock and is shipped to your door (continental U.S.). tdslockjaw.com

Mark Clement is editor of Tools of the Trade. *Follow him on Instagram @the_tools_show.*

The Vault doesn't fit all trailer types. To see if it will fit your trailer, check the installation page at the company's website.

The Vault isolates the tongue and the crank (jackstand handle) from tampering and from the power tools or bolt cutters of would-be thieves.

Photos: Cliff Woodman

“Conformity is the jailer of freedom and the enemy of growth.”

- John F. Kennedy

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BY JOHN CARROLL

Leave a Message

In November 1987, I was hired to take out an ancient and unsafe fireplace in a Hampton, N.H., home, and then build a new hearth and enclosure for a cast-iron wood-burning stove. As I removed the brick in the old hearth, I was surprised to find that the hearth was supported by a wide board (nowadays we use plywood) rather than by the more typical masonry base. But the biggest surprise was yet to come.

While brushing away the chips and dust, I discovered that the board supporting the hearth was signed and dated. In cursive that looked fancy and old-fashioned, the inscription read "May 4, 1860, R. Rollins, H. Rollins."

After carefully removing the board and giving it to the homeowners, I decided to write my own name along with the homeowners' names and the date in the wet concrete I poured above the fireplace nook. Since then, I have often left notes inside the structures of my jobs in the hope that someday far in the future someone will find them and be as thrilled as I was that November day.

Although I've occasionally written quick notes right on some part of the structures that I've built, I prefer putting together a time capsule. I always date the message, sign it, and invite members of the crew as well as the homeowners to sign it as well **(1)**. For the capsule, I use clear plastic containers with tight-fitting lids **(2)**. I figure the clear plastic will show the message and be less likely to be thrown away when a crew demolishes my work way in the future. I also select a location where the capsule is likely to stay dry and survive as long as the structure.

I sometimes give additional information, such as how long the job took and how much it cost. I always put in a handful of coins and sometimes include a statement to the effect that the finder of the capsule is entitled to the coins. I doubt that my unofficial bequest would hold up in court, but it can't hurt!

Earlier this year, I built a brick staircase (featured in the article "Layout for a Brick Staircase," Jun/19) and decided to leave one of my capsules. During construction, I wrote a note with the date and the names of the crew. I also had the owner, Dave Ruff, and his wife, Shelly, sign it. Before adding the usual handful of coins and setting the capsule in the structure, I took a picture of the note, and noticed that Shelly had also put a cross in the container as a statement of her faith to some unknown worker far in the future.

John Carroll, author of Working Alone, *is a builder who lives and works in Durham, N.C.*

Photos by Matthew Carroll Navey

On many of his projects, the author leaves a time capsule to be uncovered at some unknown future date by a contractor who is asked to tear out and replace his work. On a recent brick stair project, he left a note with the date and the names of the crew and clients **(1)**. He seals the note in a clear plastic container along with some coins and seals it into the structure **(2)**.

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