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ON THE COVER: Russell Points, owner of R.A. Points Jr. Construction, a subcontractor to Jackson Andrews Building+Design, installs the base rail for the glass railing of an interior balcony in a custom home in Virginia. See the story on page 41. Photo by Rick Mills.

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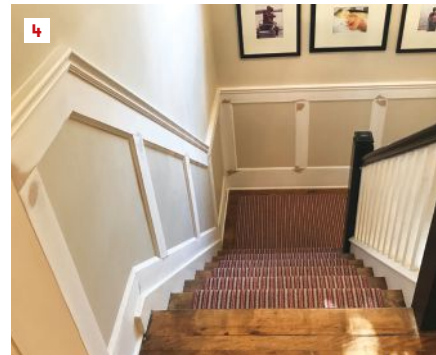
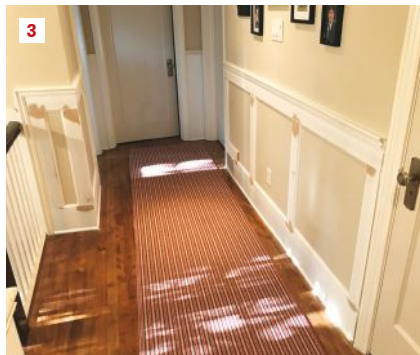
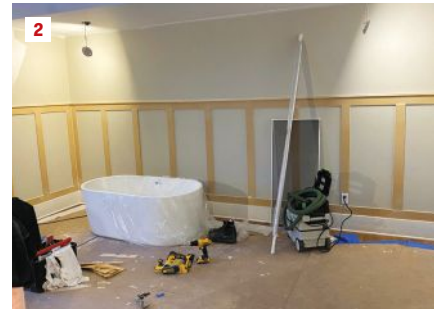
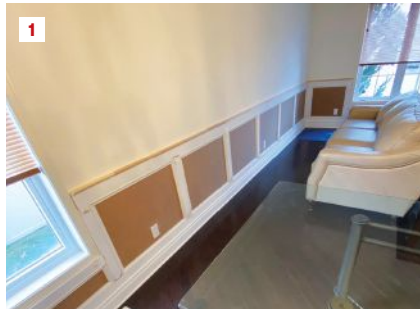
An Introduction to Wainscoting

by MARC FORGET

Wainscoting projects were always something that my partner and I looked forward to. In a relatively short amount of time, we could transform uninspired rooms, hallways, and stairwells into eye-catching spaces. The basics I was taught include molding (or chair rail) set horizontally at one-third of the wall height up from the floor and equally spaced panels or a sheet good such as a beadboard on the wall below the molding. While this is a common look, variations in materials, heights, and paint choices all fit under the general term of wainscoting and allow a great deal of design creativity.

I'll start by going over some basic approaches to installing wainscoting that apply to most applications, using a typical dining room as an example, then expand on the topic from there.

As with most carpentry, the first and most important step is layout. I make a pencil mark on one wall, usually between 32 and 36 inches from the floor, depending on ceiling height. This is a common layout but not the only option; shorter wainscoting will enhance the feeling of height in a room, while a taller setting will create the impression of a lower ceiling. Then I set up a laser level to check whether my mark is a consistent distance from the floor all around the room. Here, I am looking for variations in level in the floor. If the distance varies by more than an inch, I raise or lower the line so that the panel sizes are not too squat at one end or too tall at another; sometimes, I choose a happy middle. With decorative trim in general, I find that if it looks right, then it probably is.



On a raised-panel style of wainscoting, rails form boxes, and profiled trim tops hardboard panels (1). A taller but simpler design divides the wall space with applied stiles and rails (2). In a third example (3, 4), the material applied to the wall for the stiles and rails has a profiled edge on both sides. This provides the look of a raised panel but is faster than installing a secondary molding inside each of the “panel” spaces.

Using the level line from the laser, I mark the walls in a few places so that when I put up the chair rail, it is straight across the whole room. This is important because that line will be about eye level for anyone sitting in the room and any wave will stand out. At this time, I also mark where the studs are along the wall.

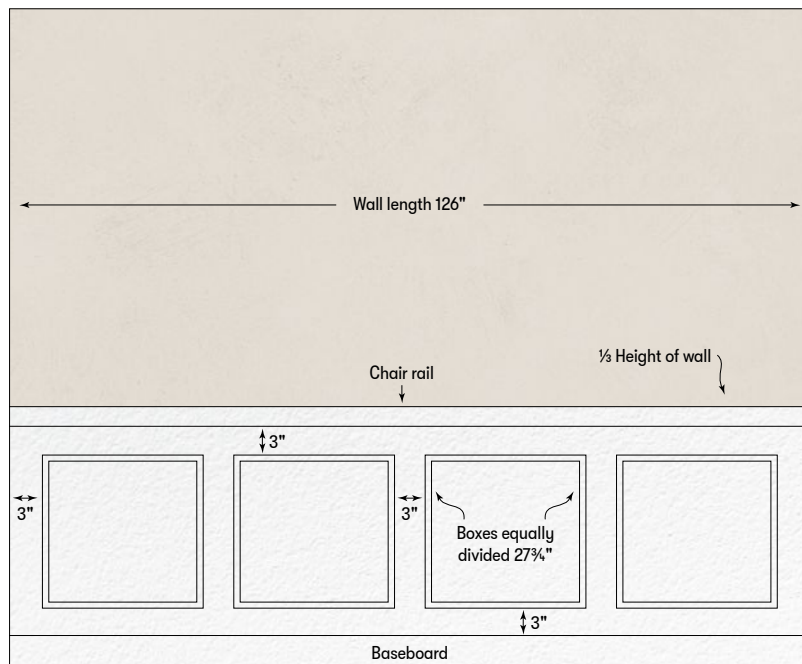
Next, I measure up the walls to lay out the panels, or boxes, starting with

the longest wall. For the applied molding shown in the illustration on the next page or in photo 8 on page 11, I measure the total length of the wall and then subtract 6 inches to allow for a 3-inch space (can be blank wall or a rail) out from the corners; I'll also allow 3 inches up from the baseboard and down from the chair rail.

A few factors help me decide on the number of boxes for any given space. I

PHOTOS BY TYLER HUBLEY AND MARC FORGET

Applied Molding Layout



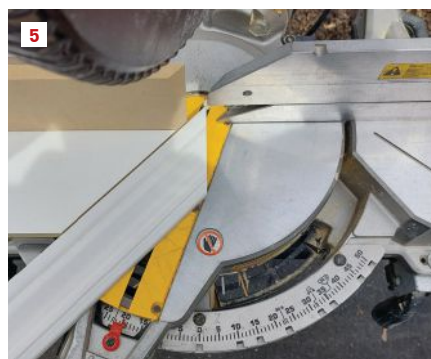
thing. If I go with four boxes, I need to account for the three spaces between them: 120 inches - (3 x 3 inches) = 111 inches. To find the width of each box, I divide 111 by 4, which equals 27¾ inches. The center of the space between the two middle boxes will be in the center of the wall. If I go with five boxes, each box will be 21⅝ inches wide and the middle box will be centered on the wall.

Now it comes down to a design choice. Taking quick measurements of the other walls, I see which box size would roughly work on them. The boxes don't have to all be the same size across the room, and probably won't be, but similar is better.

Another consideration is outlets and other service boxes; ideally, these should be inside a panel or in the middle of a stile. For applied molding projects like the one shown in photo 8, I refrain from "celebrating the switch" and don't wrap the molding around the outlet. The better option is to stop and start the molding on each side of the outlet or adjust the layout so that the outlet lands completely in a box or completely between boxes.

With my layout chosen, I draw the final layout lines on the wall while my partner batch-cuts the moldings. As the boxes are the same size for each section, stops can be set on the miter saw to speed up production. I found that having one person cut and the other person lay out and install was efficient and maintained consistency.

Installation for photo 8 begins with the chair rail and, in photos 1 to 4 and 7, it starts with the top rail; in all cases, apply a bead of adhesive on the back of the rail, hold it on the level lines, and nail at the stud markings. For adhesive, ordinary latex caulking is sufficient and cost effective. Whether you use caulking or a heavy-duty construction adhesive, the bond is going to be able to pull the paper off the drywall. I'd rather not spend more on unnecessary



The illustration (top) shows a simple wall layout for applied molding. This same layout could be used with raised panels with added layers of trim elements. A site-built jig to cut angles above 45 degrees is affixed to the saw fence. Cutting a 45 on the end of the board first (5) makes getting sharper miters (6) easier.

don't want the boxes to be too narrow, as that gets busy visually and makes it difficult to avoid outlets. Large boxes can work, but the look will differ from what most people picture as wainscoting.

Let's say the wall is 126 inches

long, and I subtract 6 inches for spacing from each corner. With 120 inches left, four or five boxes will divide the space well. Before I start putting more lines on the walls, I usually draw the layout on paper so I don't miss any-

strength while inviting a more challenging cleanup of any squeeze-out. With the boxes or panels, you won't hit studs for much of the installation, so the adhesive is important.

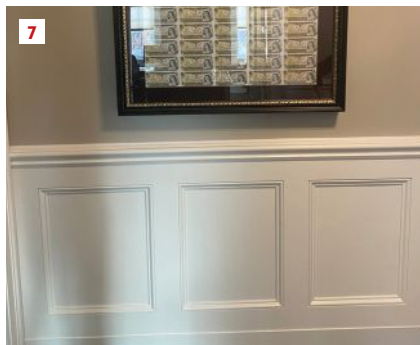
For nails, more and longer is not better. This is trim, not structural framing; use enough nails to hold it in place while the caulking sets. A 23-gauge nailer often works well for the panels, especially for thin moldings.

I keep a 3-inch-wide block of wood in my pouch to use as a spacer between panels and down from the chair rail as I nail, while also checking for plumb with a level. Consistent spacing is more important between the panels and the chair rail than between the panels and baseboard. A variation in the floor rising or falling by $\frac{1}{2}$ inch isn't noticeable between the panels and baseboard, but the lines between the panels and the chair rail need to be spot on.

Stairways

A room or a hallway is a straightforward project, while stairways involve a bit more planning. Curved walls, elevation changes, and the like add to complexity but also have a much larger impact visually. The layout basics remain the same, with setting the chair rail to start and then working out the panel spacing and sizes, but some different methods must be used.

For chair rail height, I use a story pole with the desired height marked on it to transfer marks to the wall. That height may be different from the other horizontal runs to allow for handrail mounts to land centered on a stile or rail or within a panel. Holding the stick plumb with a level, I make a series of marks that represent the top edge of the chair rail. Each mark consists of a vertical plumb line and a line at the desired height. Another method is to put masking tape on a level and mark that at the length you want to set your marks. In either case, the vertical

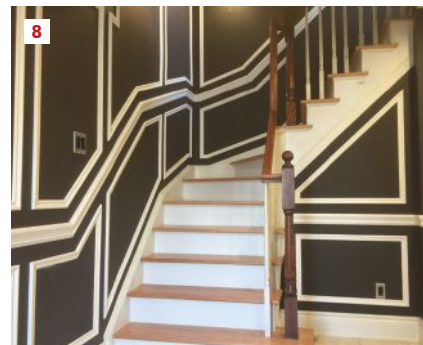


White paint finishes a traditional raised-panel wainscoting (7). Applied molding can look complicated, especially with a high-contrast palette, but most of the layout here was created using a 3-inch block along the chair rail, baseboard, and ceiling. Then we filled in the vertical lines at the desired spacing (8).

height is measured from the top of the exposed stringer or, if that is not present, off the nosing of the stair treads. The marks are then connected with a straightedge or, if the wall is curved, used as reference points that the molding needs to touch as you install the chair rail.

Determining box size uses the same method of measuring length and dividing as discussed earlier. Taking measurements can be tricky on curved walls and usually needs two people to keep the tape on the walls. With stairs, we took extra time to draw out the boxes. Often, we used masking tape to represent what the finished product would look like and to confirm the layout with the homeowner or designer. As an added benefit, it helped us double-check our calculations.

Many of the angles will be greater than what most miter saws can cut normally. In photos 3 and 4, I'm using a jig mounted to the saw to create these sharper angles. The jig is at 45 degrees, but by holding the molding to it and adjusting the miter angle on the saw, I can cut angles greater than 45. Let's say the miter needed is 65 degrees. Subtracting 45 (the set angle of the jig) from 65, we get 20. Set the saw to a 20-degree miter while holding the



molding tight to the jig, and you are left with a 65-degree cut. There are commercially available versions of this setup, but I just use my own.

For installation of moldings on stairways, as with any room, careful nailing to framing where possible and the use of adhesive are important. Issues with stairs include handrails and light switches. While running lines for the chair rail or panels, be prepared to adjust heights or sizes to avoid running into those features.

As you can see in the photos, not all of these projects are traditional wainscoting. There is a wide range of layout styles and molding choices. At the core of any decorative molding project, time and attention to the small details make a difference. Allow yourself the time to properly lay out the design. All miters should be glued, joints patched and sanded, and nailing limited to only what is necessary. The carpenter should always have an eye toward ensuring the best base for the painter to work from. With those steps done correctly and consistently, you will be left with satisfied customers who will be happy to show off their transformed space to your future clients.

Marc Forget is an associate editor at JLC.

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Q I am framing a house, and my local lumberyard has structural grade and stud grade 2x6s. Does it matter which I use to frame a window header?

A Jeff Easterling, president of the Northeastern Lumber Manufacturers Association (NELMA), responds: Before I address the differences between those two grades, here's a bit about the organization I represent. NELMA is the regional grading authority for lumber species in the Northeast and Great Lakes area for lumber mills operating there. We provide the training for the graders at the mills and for the computer experts for the grading machines. We also visit and make sure they are continuing to meet the specifications, which in this case is the national grading rule, or NGR. We do these checks at least once a month.

The short answer to the question is that it depends. There are a lot of factors that we need to know: how long the span is, what the loads above the window are, and so forth. Once those are known, carpenters can consult a span book, or discuss with an architect or structural engineer what the parameters are and see how they fit with the different grades of lumber.

I am assuming that the person asking the question is looking at the noticeable differences in price and appearance between the two grades mentioned. The description of stud grade says that it is rated for use in vertical applications or, in other words, repetitive installation in wall framing. It is the lowest lumber grade in terms of appearance—it has the most knots and allows for the most visual defects. It's designated that way because it's intended to be used where it won't be seen, behind drywall or sheathing. It is fine for that application, just not as pretty, and it is less expensive. Structural grade, on the other hand, is the highest grade and has the least number of defects. It's used for its strength and durability, and it costs more than stud grade. It's designated for use in ceiling joists, rafters, trusses, and headers.

Another factor is that different species of lum-

ber (for example, Douglas fir, spruce, southern yellow pine) have different structural properties. This is also marked on the grade stamp. While it may not come up often that a building spec requires one species over another, it's good information for carpenters to be aware of.

The full answer for the reader is that for this application (window header), they should be looking at a structural grade and not stud grade. Then, depending on the load factors, they can determine whether they need the highest classification in select structural or No. 1, 2, or 3.

For more information on grading, visit NELMA's website at nelma.org, or go to youtube.com/nelmatv, where you can find a number of short videos on the topic.



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Railings for Waterproof Patios

by DOUG HORGAN

Metal railings surrounding masonry patios can create a problem we've seen often enough that we now take steps to prevent it.

The standard installation method for metal posts in any masonry patio where we work in Virginia is to drill an oversized hole about 6 inches deep into the masonry, then set the railing in place and pour a small amount of patching cement around the post to anchor it in the masonry.

This usually works for a while in a stone patio on a slab-on-grade substrate or on a masonry landscaping wall. After 15 or 20 years, the steel (often called iron or wrought iron when made into decorative rails) starts to rust and expand, and the cement material used to anchor the steel also seems to have a limited lifespan—measured in years, not decades—so these anchor points require rework or heavy maintenance before too long. The expansion can also create cracks in the masonry.

But another problem happens much sooner when a metal rail is installed on a masonry patio over living space. These deck areas have a waterproofing layer in the assembly to keep rain out, and experienced readers may quickly see the potential problem: The watertight layer must stay intact to keep water out, but drilling large, deep holes for the railing pierces the waterproofing and often allows water to leak in.

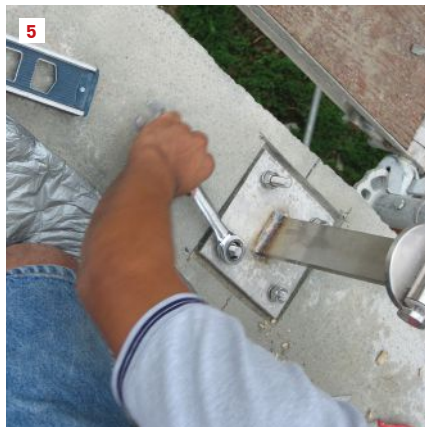
We've probably fixed a couple dozen leaks caused by rail posts in waterproofed surfaces. Water movement through the multilayer systems can be complicated and difficult to find. The house shown in the photos at right is one example of what we've encountered. When scoping out that job, we found efflorescence—a clear sign of



Efflorescence—white mineral deposits leaching out of stone and concrete (1)—is a clear sign of moisture moving through masonry, and its presence is helpful for identifying where a waterproofing layer has failed. The culprits here were the holes drilled through the waterproofing layer for the railing posts (2). To remedy this, the author's company removed the edge stone and waterproofed around the post bases (3).

PHOTOS BY DOUG HORGAN

On the Job / Railings for Waterproof Patios



Preinstalled posts. The bases of these posts for glass railings needed to be bolted to the masonry deck (4, 5). The bases were waterproofed (6) and finished with stone and round escutcheon plates (7).



Preset sleeves. On this job, the guardrail posts drop into sleeves welded to the steel substructure (8). The sleeves are then waterproofed (9) and will be topped with a setting bed and limestone walk surface.

moisture moving through the masonry below the rail posts.

When I ask steel-railing folks about these problems, few respond with a solution. Rail folks are usually welders or artists who don't dwell on the nuances between a stone patio on grade and one with layers and layers of waterproofing. In our experience, managing water on these patios is up to us, the general contractors. We have learned that the best approach is to grab hold of the process, eliminate the hole drilling altogether, and use entirely different methods for installing the rail posts.

Preinstalled Posts

Railings don't have to be installed into holes drilled at the end of construction. Glass-panel railings, for example, aren't usually installed with drilled holes. On most of the ones we've built, the posts are permanently installed in their final locations many weeks before the completion of the patio deck. This allows some lead time for the glass panels to be fabricated to fit their intended locations and spacing exactly.

The first couple of these were a learning curve, but now we know to bring the rail folks in early, long before the waterproofing and masonry crews. When they set the posts early, we can run the patio waterproofing right over the post bases and create a durable, complete seal around each post, with no post-waterproofing drilling to mess it all up.

Typically, when the posts are installed on top of the patio, they have large square bases welded to them, with four holes used to anchor the post to the substrate.

We've also used a similar technique with mounting plates that allow for fasteners driven horizontally into the side of the building.

Preset Sleeves

The second method we've been using is to work with the rail subs to get preset hardware in place that the

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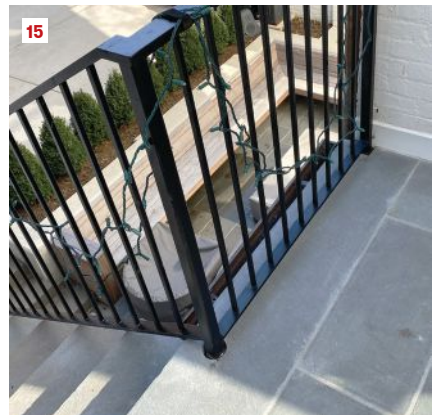
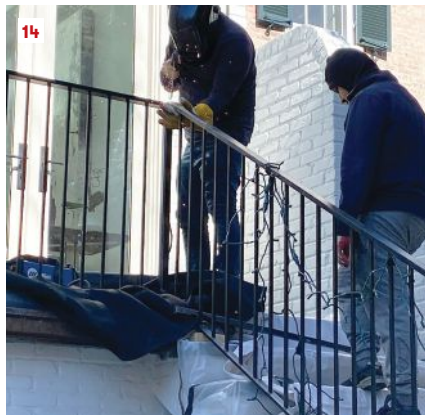
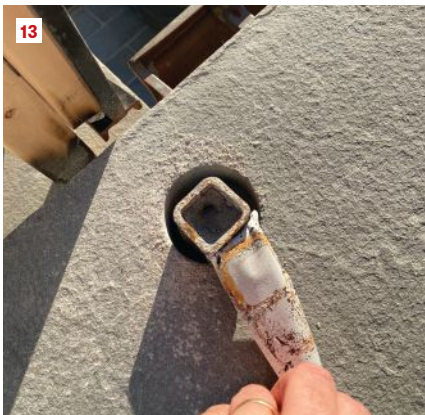
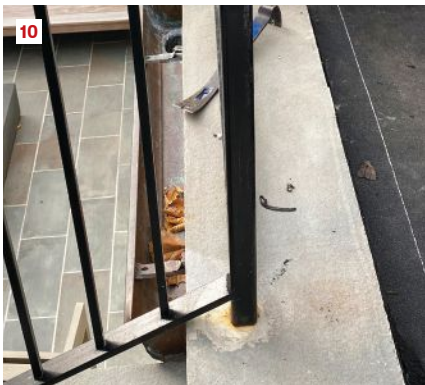


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Splines. To repair an existing railing (10), the posts were cut just below the bottom of the balusters (11). The author's crew found square stock that fit inside the remaining post base (12). Once new stone was installed on the deck (13), a welder reattached the railing (14), resulting in a clean and solid repair (15).

waterproofing folks can seal and that the railings are mounted to later.

The first one like this that we did required sleeves that the future railing would drop into. We had a welder attach the sleeves to the steel structure before we poured the concrete terrace slab. We knew the cut limestone walking surface, setting bed, and water drainage layer would add about 2 inches, so the sleeves were set that much higher than the top of slab.

Once the slab-top waterproofing and the finishes were installed, the railing contractor dropped the steel posts into the sleeves and filled the gap with the same leaky cement they use elsewhere—but in this case, the water

went where we directed it, instead of dripping into a room below.

Splines

On a subsequent job, which involved repairing the damage our own railing subcontractor had done by drilling through the waterproofing, we landed on a third method: using short steel splines that fit into the hollow steel posts. We first cut off the posts as high as we could, removed the railings, and lifted the patio stone off. Then the roofers waterproofed the remaining stub posts, and we used steel splines to marry the posts back to the bases. For these splines, we had to find steel bar stock that matched the dimensions of the inside of the posts.

The two posts were made with different thicknesses of steel, so we needed two different bars and additional material for shims. We test-fit the railings, repaired the waterproofing, and reset the stone, then had a welder come put the steel back together.

This method can be used in new construction by installing the splines before applying waterproofing. After installing a finished surface, we can drop the railing posts onto the splines to secure the posts to the deck.

Doug Horgan is vice president of best practices at BOWA, a design/build remodeling company in McLean and Middleburg, Va.



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Renewing a Tired Garage

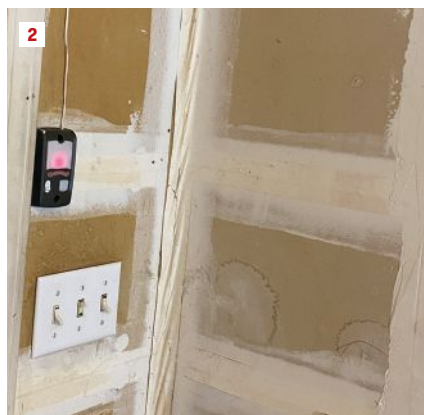
by MYRON FERGUSON

The garage is often the first part of a house people see when they arrive and the last part they see when they leave. But when the walls are yellowed and stained with drywall tape separating or falling off and no paint hiding screws and joints, it's just ugly. As a drywall contractor, I don't understand why we accept this look in garages when we would never allow it anywhere else in our homes. Most local building codes require that an attached garage be drywalled with all seams and joints taped. Typically, this one coat and done is called "fire taping," and the 2024 IRC R302.6 lays out the required thickness of the drywall and where it needs to be installed to act as a fire break for the rest of the house. That's why it's drywalled, but does it have to look so bad?

Let's analyze some situations that can cause the garage to look this way and see what we can do to fix it. For example, in a large garage, those big walls and ceiling can be subject to expansion and contraction that can cause cracks and seam separation. In that case, you may need to add a control joint if one isn't already present. Any uninterrupted wall or ceiling 30 lineal feet or more should have one.

Next, check the attic for insulation. Lack of insulation allows extreme temperature fluctuations that can particularly affect ceilings but can cause walls to shrink and expand too. This will again cause separation at the seams and failure of the tape, along with screw pops.

Another common problem is moisture, particularly in winter. Heat from a car's motor will melt any snow the car brings into the closed space. Rain, too, adds moisture that has nowhere to go other than into the unsealed



Garage walls yellowed from time and light and marred by water stains, dirt, and failing tape joints are a too common sight for the author (1, 2). To fix the surfaces, he starts by sanding them to clean and prepare the drywall for the next steps (3).

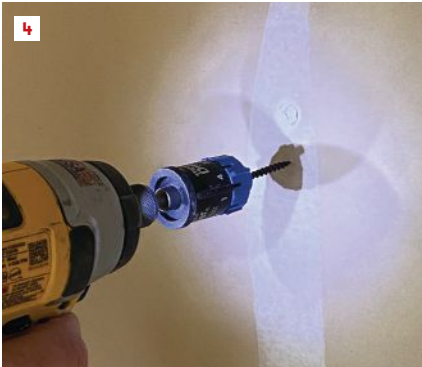
(unprimed and unpainted) walls and ceiling. This causes stains and movement in the drywall that in turn creates cracks. Finally, drywall left unpainted or not even primed will yellow over time, especially if occasionally exposed to direct sunlight. The combination of moisture, temperature fluctuations, movement, and lack of paint protecting the drywall results in yellowed and difficult-to-seal walls and ceilings and too many ugly garages.

How do you fix this without tearing down the existing drywall? The first

step I took in the garage shown here was to peel away all the loose tape and compound, which came off easily, as much of it had already fallen off. I then sanded every surface using 220 grit on a vacuum-attached power sander. The sanding does two things: Most garages have never been cleaned, so it gets rid of dirt and spiderwebs, and it removes some of the yellowed paper while scoring what's left to be better able to take paint and compound.

I want to seal the surfaces before I start taping so that any stains do not

PHOTOS BY MYRON FERGUSON



Many screws needed to be reset and some added to secure the drywall again (4). This garage was actively used for storage, which resulted in many dents and holes in the walls. All of them needed to be properly repaired before proceeding (5).



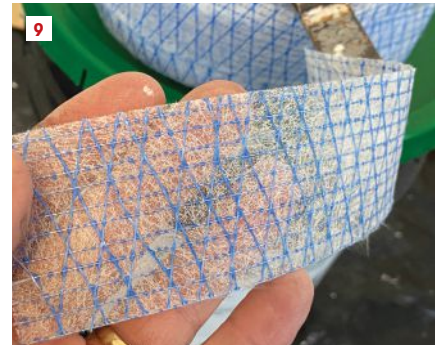
get pulled through the compound. For this, I use an oil-based stain blocking primer instead of latex; I feel, when I tape, I will be adding even more moisture to the drywall and pulling those stains back to the surface, and in past experiences using latex primer on heavy stains, they were drawn through the compound. The primer I used here seemed to work well as this job progressed, with no stains bleeding through. Oil-based primer is harder to apply as it is thick and sticky, so be prepared to take some extra time with it.

Once the stain blocker had fully dried, it was time to start taping. I wanted to strengthen the seams and the corners as much as I could, so I used an all-purpose heavyweight compound and the strongest tape I could find, FibaFuse Max. A lightweight compound wouldn't have the strength or adhesion level needed to embed the tape. Another option would have been a setting compound, but while it has enough strength, I find that it does not have the adhesion of the all-purpose heavyweight compound. With this job, adhesion was important. The FibaFuse Max is a bit stronger than standard mesh tape and does a good job with difficult seams. I went with paper tape for the inside corners; for

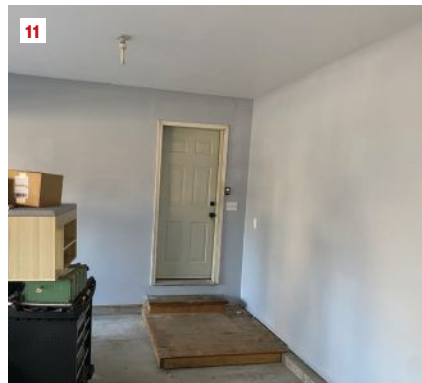
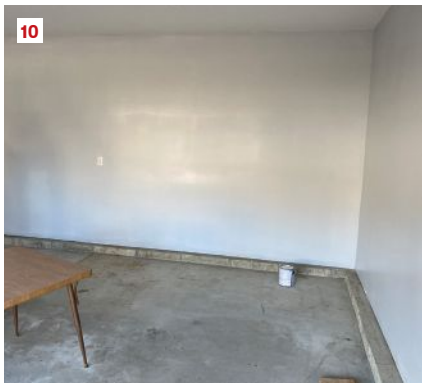


While an oil-based stain blocker (7) is more difficult to spread than latex, in the author's experience, it performs better on stains this heavy and extensive (6).

On the Job / Renewing a Tired Garage



A garage is a dynamic place when it comes to moisture and temperature. For this reason, the author finds using a stronger tape and embedding compound vital (8, 9). Choosing materials carefully and installing them properly, the author made an eyesore into a clean, finished space—without having to fill a dumpster with old drywall and purchase and install new drywall (10, 11).



that application, paper tape is strong enough when properly embedded.

For the remaining coats of mud, I used a lightweight joint compound. It has better workability, and the strength of the heavyweight compound was needed only to embed the tape. Quite often in a garage, I have found the drywall install to not be the highest quality, and it can often take four coats of compound to get the surfaces looking right. The properties of the lightweight compound make it easier to apply, helping with these challenges.

After sanding all my work, I primed the walls again with two coats of a latex stain-blocking primer/sealer. I made sure to allow each coat to dry thoroughly so that built-up moisture would not have a chance to pull stains through. The latex primer is easier to apply than the oil, and with plenty of dry time, no stains came through. This second round of primer/sealer is there to protect the mud and tape from future moisture spikes. With the primer done and the surface fully covered, I was able to paint the garage

with just one coat of finish paint. For this, I used a light gray, as I find the gray covers better than white, and I like the finish look better too.

My goal with this garage was to fix everything. I went over all the screw pops and repaired, reset, and replaced them. There were also numerous dents and holes that I added mesh tape and compound to. This project also gave the homeowners an opportunity to go through all the things in the garage that they didn't need but had been holding onto. I did not care whether the homeowners were going to put shelves back up or hang their garden tools. I wanted to leave them with a fresh start that looked as good as the drywall in the house and that would last. Now, when they pull their car in or out, they are left with a great impression of their home.

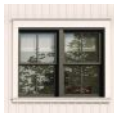
Myron Ferguson is a drywall and home-performance contractor in Saratoga Springs, N.Y., and a presenter at JLC Live. See his website (thisisdrywall.com) and follow him on Instagram @thatdrywallguy.



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Escalation Clauses: Buffering Sudden Price Increases

by GARY RANSONE

We've seen this before. The COVID pandemic taught the building industry just how quickly construction material prices can fluctuate wildly, up to and including the \$10 2x4s we saw for a brief period in my area of northern California—yikes, no builder saw that coming! Some current economic and political indicators strongly suggest that builders may be headed for another bumpy material-price-fluctuation ride in 2025 as a result of new tariffs being placed on lumber, steel, goods, and construction-related raw materials and products being imported into the U.S. from other countries.

During COVID, many builders with a signed fixed-price contract wondered what they could and should do when they placed a lumber order and found out that the bid they had received several months earlier went up by 100% or 200%. Who would pay that extra cost, the homeowner? The contractor? Would they split it?

Many disputes and financial losses arose out of that unanticipated spike in prices. Many a builder had sleepless nights and difficult conversations with homeowners about who should pay for these unforeseen significant material price increases, and some builders ended up losing a good percentage of their profit on certain jobs by being forced to absorb the increases.

Flash forward a few years to the present and ask yourself if we are possibly headed for a repeat of sudden and significant construction material price spikes this year as a result of new tar-

iffs or other economic factors? Lumber suppliers have certainly learned how to deal with sudden price increases and pass them on to the builder and consumer; the question is, have we builders? Are we prepared to deal with unanticipated price increases with our customers and in our construction agreements so we don't have to absorb a major financial hit?

Hello Tariff-Related Price Spikes

What will happen to the builder in 2025 who is relying on a material estimate that is several months old—and part of a signed, fixed-price contract—when they are caught in the crosshairs of sudden, significant material price increases caused by tariffs, and they're forced to absorb these increases? The outcome and the losses for many builders who have not taken preventative contractual steps are fairly predictable and may well be reminiscent of the losses many builders suffered because of spiked material costs during the COVID pandemic.

Rebar, structural steel, piping, and duct work have already been facing significant price volatility since the beginning of 2025. Mexico, Canada,

and China are facing steep new tariffs. Prices on gypsum used in drywall (about 72% of imports coming into the U.S. come from Mexico), softwood lumber (about 74% of U.S. imports come from Canada), and various other goods and materials, especially if being imported from Canada, Mexico and China, are expected to rise sharply this year.

Lumber production in the U.S. is supposed to rise, but how quickly will existing U.S. lumber mills be able to handle the increased milling? Will they be able to get enough milled lumber to the U.S. market on time in 2025 to remove the need for imported lumber? Or will builders still have to pay for the higher priced tariff-laden lumber this year and in the foreseeable near future?

As of this writing, the National Association of Home Builders (NAHB) has estimated that tariffs could raise the cost of imported building materials by over \$3 billion and the cost of building a single-family home by \$7,500 to \$10,000. The imposition of new and substantial tariffs as a result of executive orders has been a dizzying on-again, off-again proposition so

Are you prepared to deal with unanticipated price increases so you don't have to absorb a major financial hit?

far this year. Many material prices, including steel, aluminum, and the lumber futures market, already started to go up earlier in the year.

Perhaps prices will or won't spike right after you sign your next big fixed-price contract for that new project, but exact timing and extent of price increases is impossible to predict. One thing that is fairly easy to predict is that uncertain times like these are more likely to bring volatile price fluctuations (mostly increases).

So, what can a builder do when putting together fixed-price contracts that incorporate material pricing that may be several months old by the time the materials or products get ordered?

Pros and Cons of an Escalation Clause

First, let's consider the pros and cons of attempting to insulate against significant price increases with an escalation clause in the construction agreement. An escalation clause (see sample clause, above right) calls for an increase in the price charged for certain materials or labor if the builder's costs suddenly increase because of tariffs, supply chain disruptions, or other significant unforeseen economic forces that have come down the pike since the owner and contractor signed the construction agreement.

The escalation clause is an attempt to transfer the risk of sudden increased material and possibly certain subcontractor costs to the homeowner after the contract has been signed. Why the owner? The goal is that in times of pricing uncertainty—like the pandemic, tariffs, major supply chain disruptions, and the like—the builder is not forced to absorb sudden increased costs or to buffer their fixed-price contract amounts with “SWAG” contingency guesses about how much certain materials might spiral in cost by the time materials are ordered.

From the builder's perspective, the

Sample Escalation Clause

“Material/Subcontract Price Escalation: The contract price for this Agreement has been calculated based on prices for the component building materials and subcontractors at the time the project was bid. However, the market for building materials and subcontractors has been volatile and sudden price increases could occur due to tariffs, supply chain disruptions and other factors beyond Contractor's control. The Contractor agrees to use best efforts to obtain competitive prices from available building material suppliers and subcontractors during the project, but should there be a sudden increase in the prices of building materials or subcontractor work that are purchased after execution of contract, the Owner agrees to pay that cost increase to the Contractor. Any claim by the Contractor for payment of a material or subcontractor cost increase shall require Contractor's written notice to Owner along with full documentation showing the price bid, the price paid at time of ordering, price difference, including copies of backup documentation such as estimates, invoices, subcontract agreements, etc. As a gesture of goodwill, Contractor shall not mark up any price increase triggered by this clause with profit and overhead.”

need and justification for an escalation clause in a construction contract is similar in many ways to the need and justification for a concealed conditions clause. In both cases, the builder wants contract language that ideally protects them from having to absorb possible job costs not known about and therefore not factored into the construction agreement at the time it is signed by the owner.

The escalation clause typically calls for the builder to document and show the owner what the builder has to pay for the materials when ordered compared with what the line-item bid cost of the materials was so that the owner can be charged for the increased material cost. The builder may also want to include certain subcontractors, like

electrical and drywall, in the clause in case their bids and pricing are not honored because their material prices also suddenly spiked since they issued their bid. Some builders, in an effort to be fair and not have the escalation clause rejected by the owner, may also want to pass any price decreases in specific material costs on to the owner to balance the risk more fairly between the owner and builder.

The escalation clause may be especially useful where the time span between issuing the contract and ordering the materials is many, many months, which often happens with bigger projects. Some larger projects can easily take 12 to 18 months, a near eternity when it comes to forecasting the future prices of things such as

lumber, drywall, steel, and concrete. With price stability in the local market, this time span makes little difference in the bid vs. the actual cost of materials, but with tariffs on the horizon, the time span may make a huge difference between the bid and the actual cost of materials.

How is an escalation clause triggered? That depends on how it is written and how the builder wants to manage the risk of increased material costs. Many builders may want to have the trigger be simply the difference between the bid price and the actual cost when materials are ordered. Or the triggering event can be a percentage difference that is something like 2% or 4% above the estimated material cost or subcontractor bid amount or whatever the builder and owner agree to as the threshold for when the escalation clause will become effective.

There are many ways to write an escalation clause. Be sure to review any escalation clause you want to use with your attorney before inserting one into your construction agreement.

The Importance of Documentation

Proper and transparent documentation of material bid costs and actual material costs is essential if you plan on submitting an invoice to the owner for additional costs based on the escalation clause. If subcontractors are included in the escalation clause, showing the original subcontractor estimate and the revised subcontractor estimate with a justification from the subcontractor about how the materials spiked since the original estimate was given is important.

A builder may or may not want to waive markup on the increased cost, as is done in the sample escalation clause shown on the previous page. An argument in favor of waiving markup is that it may help encourage the owner to sign a construction agreement that includes an escalation clause.

Sample Allowance Clause

“ALLOWANCE WORK: Payment for work designated in the Agreement as ALLOWANCE work has been factored into the Lump Sum Price of this Agreement and any Payment Schedule set forth in this Agreement. If the final amount of the ALLOWANCE work exceeds the line item ALLOWANCE amount in this Agreement, the difference between the final amount of the ALLOWANCE item and the line item ALLOWANCE amount stated in the Agreement will be treated as Additional Work and this difference is subject to Contractor’s profit and overhead at the rate of ___%. If the final amount of the ALLOWANCE work is less than the ALLOWANCE line item amount listed in the Agreement, a credit will be issued to Owner for this difference after all billings related to this particular line item ALLOWANCE item have been received by Contractor.”

Also, the more the builder can limit the clause to lumber or to lumber and a few other areas or subcontractors, the more willing the owner may be to sign the agreement. Keep in mind that if copper or drywall prices spike and the electrician or drywall subcontractor refuses to honor its original estimate, including subcontractors in the escalation clause (as in the sample) may protect the builder from absorbing the higher price of a replacement subcontractor.

Some owners may have a hard time understanding or accepting an escalation clause in a construction agreement, and the escalation clause may become a point of negotiation for the owner or the owner’s attorney. The owner may assume, or prefer, that the risk of all material price increases should fall on the builder. But is this fair or a risk the builder is willing to assume in times like these? The escalation clause, if not written well, understood by both parties, and administered well by the builder, may even lead to arguments

and eventual legal disputes when the bill for additional costs is submitted to the owner.

Some builders may not like the escalation clause because the language may seem a little confusing. Some owners may feel taken advantage of by the few sentences in the escalation clause that could lead to a very large, unexpected price increase even though that increase has nothing to do with the builder and is not going into the builder’s pocket.

Alternatives to Escalation Clauses

Alternatives to the escalation clause include such things as using allowances for specific materials and subcontracts where pricing stability or information is in question. Or the builder can consider including an increased material cost contingency in the contract.

Allowances (see the sample clause, above) are easy to define and may be more familiar to many owners than the escalation clause.

Sample Force Majeure Clause

"FORCE MAJEURE EVENTS: *The Contractor shall not be liable or responsible to the Owner, nor be deemed to have defaulted under or breached any portion of this Agreement for any failure or delay in fulfilling or performing any term of this Agreement when and to the extent such failure or delay is caused by or results from acts beyond the Subcontractor's control, including, but not limited to, Force Majeure events such as: (a) acts of God; (b) a natural disaster (c) epidemic or pandemic; (d) action by any governmental authority; (e) national or regional emergency; (f) strikes, labor stoppages, supply chain problems or shutdowns or other supply chain or work site disturbances caused by or related to the foregoing Force Majeure events."*

Line-item contingency for increased material cost. The builder may also consider inserting a line item contingency in the contract for potential increased material costs. It may initially be factored into the lump-sum contract amount. However, it may be difficult to know what amount to factor in and doing so may make the builder's contract price less competitive with builders who don't factor in this contingency.

Force majeure clause. The builder may also try to recoup sudden unforeseen increased material prices under a force majeure clause (see sample clause, above). In the absence of other clauses, this can be attempted but may not always be successful, because it is less specific than the escalation clause or allowances.

Last-minute price verification. It almost goes without saying that another thing the builder can do to minimize risk is to double-check with material vendors and subcontractors just be-

fore giving the owner the fixed-price contract to make sure the builder has up-to-date pricing. There's no sense relying on and incorporating into the construction agreement a four-month-old lumber package bid if prices have already gone up.

Lessons Learned?

With lessons learned from the soaring price of lumber, copper wire, steel, and the like during the COVID era, a combination of allowances, an escalation clause, and a force majeure clause may be something to consider having in your construction agreement. These clauses all attempt to contractually shift the risk of sudden price increases to the owner when they were unforeseen and couldn't reasonably have been factored into the builder's fixed-price contract amount at the time the contract was prepared and signed by the parties.

Allowances have long been successfully used in construction agreements. Post-COVID, escalation clauses and

the more general force majeure clause are becoming more common in construction agreements. If you decide to incorporate an escalation clause into the construction agreement, don't forget it will require detailed recordkeeping and open-book transparency in regard to the items encompassed by the escalation clause. The devil is in the details when tracking increased costs and making a claim for those costs using an escalation clause or an allowance clause.

Trust Is the Best Currency

Trust is often a builder's most valuable currency with the owner. Good, upfront communication with the owner about the escalation clause and allowances, along with proper administration of the documentation for them, is critical to maintaining that trust between the owner and the builder/remodeler. Good communication and trust also make presenting the owner with an invoice for increased material or subcontractor costs under an escalation clause or an allowance clause a little bit less likely to turn into a dispute over the bill.

Implementing one or more of the types of clauses above may help to mitigate financial losses in a period of material price instability and help the builder to avoid many arguments over who should absorb sudden and significant unanticipated tariff-driven material price increases in 2025. Again, consult with your own attorney before relying on the information herein or incorporating clauses into your construction agreement.

Gary Ransone has worked for the past 35 years as an attorney focused on construction law. He has also worked in the trenches as a laborer, carpenter, general contractor, home builder, and remodeler. He is the author of The Contractor's Legal Kit, including the digital updated version at TheContractorsLegalKit.com.

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On Site With TimberHP

by NATHAN SHIRAI

It's been a long time since we've used wood for insulation in the U.S. If you're a remodeler, you may have encountered balsam-wool batts, which were made from borax-treated wood pulp encased in kraft paper and can still be found in some pre-1950s homes. If you're like me, you probably have an "oh no" moment when faced with handling this dusty, messy product.

Now, some 80 years later, the folks at TimberHP (timberhp.com) have brought the manufacturing of wood-fiber insulation back to U.S. soil, but there's no comparison between what this company is making and the old balsam-wool product. The modern products are akin to those developed and trusted in Europe over the last few decades. The manufacturer's product tree has three branches: TimberFill, a loose-fill product released in fall 2023; TimberBatt, released shortly thereafter; and TimberBoard, a rigid board slated for release later this year. TimberHP operates out of a single production facility, a revitalized paper

mill located in Maine, but distributes its products nationwide.

As an insulation contractor operating in a southeastern market ruled by fiberglass and spray foam, I was excited to learn about these new products and try them out on the job.

TimberFill

So far, we've had the opportunity to dense-pack with TimberFill on three jobs: a high-performance new build, a garage-conversion project, and a historical renovation that also involved some open-blow.

TimberFill acts a lot like cellulose. It comes packaged in 25-pound cubed bags and can be dense-packed or open-blown. It's nearly identical to cellulose in characteristics such as bag coverage, dense-pack cavity R-value, flame and pest resistance (from borate additives), carbon profile, and hygric buffering (ability to absorb water).

So why pick wood fiber over cellulose? Having worked with both materials, we favor TimberFill and highly

encourage it as an alternative whenever a client requests cellulose, because we find it to be more installer friendly without meaningful differences in cost, outcome, or in-place performance.

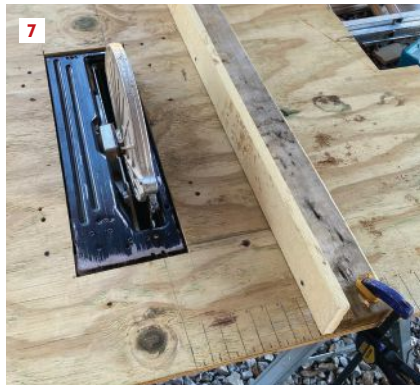
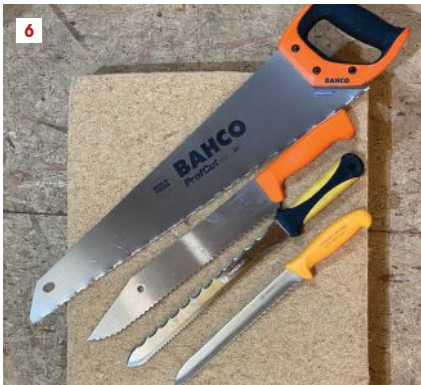
For our first dense-packing project, we began with a lower material-feed gate setting than we'd use with cellulose, on the advice of the manufacturer. This is because TimberFill's post-manufacturer wood fiber is thicker and chunkier than cellulose's more processed post-consumer fiber, and it tends to lock together more quickly. When you are getting a feel for your production, it's important to start slow and gradually dial up to a higher material flow to avoid hose clogs. While this slowed us down at first, it didn't take long to find the best setting.

TimberFill comes tightly packed and requires a bit of pre-conditioning when being loaded into a smaller electric machine, whose agitator may lack the torque and blade count of a larger PTO (power take-off) driven machine. This prep consists of peeling chunks



TimberFill. To avoid bulging bays when dense-packing walls, the author "lip-stitches" the membrane on the stud faces to pull it extra tight (1). On a different job, insulated mostly with batts, the crew needed to staple the membrane over odd cavities unsuited to batts (2) prior to dense packing them (3).

PHOTOS BY NATHAN SHIRAI



TimberBatts in a standard-size cavity yield a confident friction fit (4) but require precision cutting—cut it any more than ¼ inch wider than its intended cavity and it fights you (5). Serrated cutting tools (6) work better than knife blades. The author rigged a 16-inch beam saw on a plywood cutting station (7) to rip batts, which sped up the process of fitting batts in I-joint cavities.

out of the bag and breaking them down a bit with a stick, not unlike breaking up ground beef in a pan. For larger machines, most bags can be thrown in whole, but TimberHP advises paying attention to the material and breaking just the harder-packed bags into chunks first.

Once the material's flowing, things get good. We appreciate how pure it is—there's nothing but consistently sized wood fiber in the bag. In contrast, the brand of cellulose sold in our market often contains foreign matter that causes problems; one particularly bad batch had so much junk in it that it broke one

of our machines. We had to finish that job by hand-feeding a borrowed machine one fistful at a time, meticulously pulling out and casting aside pieces of plastic bag, strap, and rope. We don't have to worry about such contamination with TimberFill, giving us peace of mind on the job.

Next is the dust. Dense-packing with TimberHP is not dust-free, but it doesn't create much dust, and the chunkier nature of the fiber makes heavier particles, which fall out of the air more quickly than cellulose particles do. In an open-blow scenario, there's more airborne dust, but it still doesn't build up

into the impenetrable, blinding cloud that we can get with cellulose. We've also experienced a stinging sensation in the eyes after a few hours of exposure to the adhesive powder contained in the cellulose brand sold in our market, so we always use a full-face respirator with robust filter cartridges when installing it. Even with the fancy respirator, we'll still get that newsprint taste in the mouth after a while. TimberFill doesn't do any of this to us but rather fills the air with the aroma of sawdust as we install it wearing our more comfortable N95 dust masks.

Once in the cavity, the material builds density readily and locks together quickly. The material becomes self-supporting near the same density as cellulose at 3½ pounds per cubic foot. TimberFill feels more forgiving when building density in the corners of the cavity and at the point of hose extraction, common weak spots for new installers with cellulose. Bulging, overly dense cavities can be harder to roll back behind the drywall plane than cellulose, but we mitigate this by "lip-stitching" the membranes over every cavity and paying close attention to fill rate.

There's more airborne dust in an open-blow application, but otherwise installation doesn't differ meaningfully from a cellulose job. If you're used to blowing fiberglass, you will find TimberFill much dustier and slower to install, requiring more of a downward blow trajectory compared with the outward trajectory for fiberglass.

TimberBatt

Our main TimberBatt project was a 1,100-square-foot ADU (accessory dwelling unit) above a detached garage, including a vaulted ceiling, exterior walls, and floor system, plus some interior walls for sound attenuation. The clients were interested in a product with higher performance values than fiberglass, but they also highly prioritized environmental impact and allergen

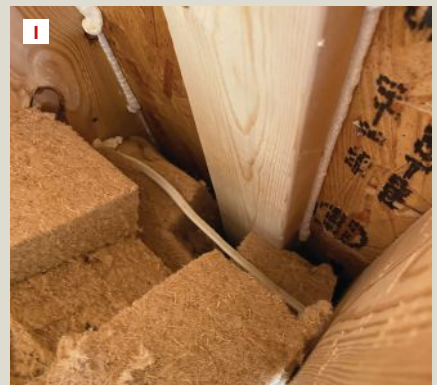
Insulating Around Electrical Wiring



A mid-depth kerf cut (A) is sufficient to fit around an electrical wire crossing a stud bay. Alternatively, the installer can split the batt, fitting one piece behind the wire (B) before finishing off with the other piece (C).



Electrical boxes are easily hogged out by notching the negative space out of the batt (D) and slicing the cutout to depth to slip behind the box (E) before inserting the rest of the batt around it, leaving behind only a box-sized piece of scrap (F).



The integrity of the fibers in TimberBatts allows for a high degree of precision sculpting. In this case, the author's crew cut a channel for a flat-framed 2x4 (G, H). This bay also had a cross wire that required an additional kerf cut. With all the carving, the batt still held together well when fit into place (I).



The resilience and consistency of TimberBatts allow you to sculpt them around the curves and angles of pipes (9, 10) with satisfying precision. The integrity of the fibers affords a high degree of precision fitting into odd-shaped framing cavities, such as this ceiling bay (11), but all this artistry comes at the cost of time.

friendliness. They were excited to select TimberBatt when we told them about its thermal resistance, negative carbon profile, flame and pest resistance (owing to its nontoxic borate additive), and relatively benign polyolefin-based binding agent. We were also secretly pining to try it out.

In our jurisdiction, located on the edge of climate zones 3 and 4, building departments require R-38 in ceilings, R-19 in floor systems, and a full cavity in exterior walls. For this project, TimberHP's R-22 TimberBatt, at 5½ inches thick, was the only product we ordered for the thermal envelope. A single layer met the requirement for the floor system and exterior walls, and a double layer in the vaulted ceiling gave us compliance there (combining the R-22 batt with TimberHP's other thermal batt, an R-14 at 3½ inches thick, would have left us just short).

We used roughly 3,600 square feet of material to insulate all these surfaces. At only 20 square feet of coverage per bag in the R-22 format, this amounted to about 15 pallets drop-shipped to the site and unloaded using the general contractor's rented telehandler. By contrast, the same amount of

fiberglass would have fit into our single-axle 12-foot box truck with room to spare, while mineral fiber might have taken two loads in that truck. The three-bay garage space under the ADU proved to be a critically important staging area, allowing the material to stay in the dry without obstructing the working area above.

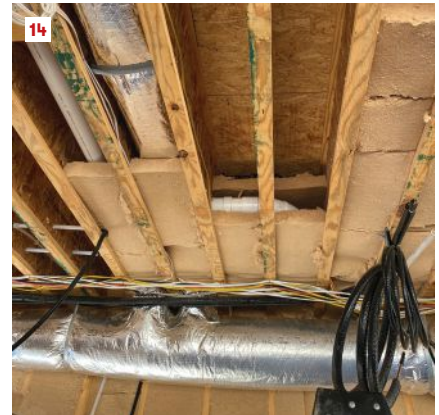
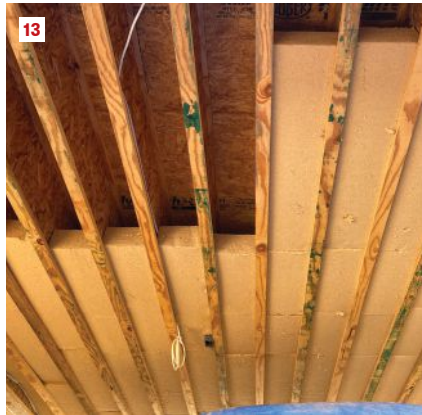
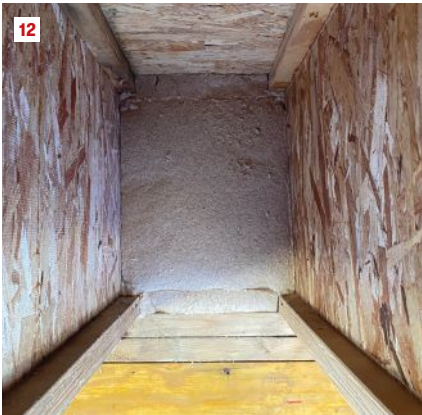
This brings up the biggest practical difference separating TimberBatt from other materials: It is the least compressible batt we've ever used (even after TimberHP reformulated it to make it squishier than the first iteration). This characteristic touches on staging space, material handling, cutting, and installation.

Pulling that first batt off the stack gives a seasoned insulator a fresh feeling. It's firm and consistent, conveying stability. Once handled, cut, and installed, it felt friendlier to the body than other materials do. Being wood, the airborne fibers generated during work feel more like sawdust and don't work their way into the skin like fiberglass or mineral fibers do. The way the dust drops out of the air and smells of pine makes the working environment feel healthier than with fiberglass (one

should still wear a dust mask, though).

Inserting the batt into a clear cavity framed on a good layout is a smooth, satisfying experience yielding a confident friction fit. Slightly narrow or wide cavities present a challenge. A more compressible product yields more forgiveness for how oversized a batt can be when we're balancing ease of installation against friction fit. TimberBatt demands to be cut precisely straight and square and no more than ⅛ to ¼ inch wider than its intended cavity—any wider and it fights you. Cutting and notching the material around electrical and plumbing obstructions is familiar to those accustomed to mineral-fiber insulation, but if your background is fiberglass, you may find it slow and tedious. Sawing with a serrated knife is required, as opposed to slicing with a straight blade as you would with fiberglass—and tolerances are tighter.

Wires are easy enough to let into the back of the batt with a mid-depth kerf cut. Electrical boxes are easily hogged out by notching the negative space out of the batt and slicing the cutout to depth to slip behind the box before inserting the rest of the batt around it.



Using up scraps for the narrow insulation pieces adjacent to the top and bottom chords of I-joists, the crew production-cut the three-piece inserts along the band joist area of the floor (12). The author opted to establish the thermal boundary in the lower part of the floor (13) to avoid the large number of electrical and plumbing obstructions in the upper half of much of the floor diaphragm (14).

The material's resilience and consistency allow you to sculpt it around the curves and angles of pipes with all the grace of Michaelangelo much more readily than a softer material would, but such artistry comes at the cost of time. Subtracting the right amount of material front-to-back is critical, as leaving too much in the cavity results in a bulge that can overcome the stiffness of the drywall and leave a wave in the wall. There's almost no forgiveness here. If the insulation doesn't lay flat over mid-cavity obstructions naturally, it will not be persuaded with pressure.

We were glad to have a variety of knives for different uses. A Bahco stone wool saw was best for long, straight rip cuts and crosscuts, with a Hultafors insulation knife running a close second. TimberHP's private-label serrated knife was best for the detail cuts around electrical and plumbing. A Mora stone-wool knife, my personal favorite for mineral fiber, did not perform well with TimberBatt.

The vaulted ceiling and the floor system both required hundreds of production rips. The structural vault rafters were furred down to deepen the cavity using $\frac{3}{4}$ -inch-thick subfloor scrap

as gussets in the first and last 4 feet of each run, requiring us to subtract about 1 inch from the batts' 15-inch width—a challenging hand cut with a knife. The floor system was framed with TJIs on 12-inch centers, creating an average cavity width of 11½ inches. To maximize efficiency with all these repetitive rips, I let the shoe of a 16-inch beam saw into a piece of $\frac{3}{4}$ -inch plywood, mounted it upside down on sawhorses, and put a receptacle and switch between it and the power source, creating a makeshift jumbo table saw able to slice the batts' entire 5½-inch thickness in a single pass. With scrap 2-by material and clamps acting as a fence, we could make perfect rip cuts quickly—a great relief to production time and forearms.

The I-joist profile gave us an opportunity to use up scrap cutoffs as vertical insulation along the floor system perimeter. We had dozens of slices whose width matched the height of the joist chords, and others that matched the height of the web. Production crosscuts of these slices made pieces we could quickly insert into the ends of each joist bay, reducing waste and bringing the thermal layer down to the bottom of the floor system, which

is where we elected to run the floor insulation to avoid numerous electrical and plumbing obstructions in the upper half of the floor diaphragm.

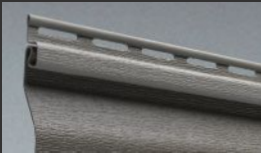
A handful of cavities were inaccessible for this stiff batt product, such as rafter and floor cavities mostly above wall plates and only open from below by a few inches. We had to dense-pack those cavities, which is important to note for anyone considering using TimberBatt who may not have access to insulation blowing equipment—and no, the rental equipment available at the box stores is not sufficient for dense-packing.

At the end of the project, the payoff is an extremely pleasing sight of matte khaki-toned insulation perfectly flush to framing edges, warmly hugging the objects sharing space in the cavity. Embracing the stiffness of TimberBatt is key to success—use it as your ally in achieving an incredible-looking Grade 1 job, and you'll see how the TimberHP products deserve strong consideration for a premium, high-performance insulation package.

Nathan Shirai is principal of Insulation Unlimited, based in Chattanooga, Tenn.



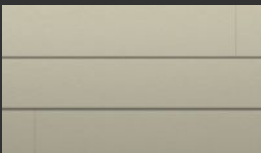
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INTERIORS



Installing Glass Balcony Rails

A project manager navigates through a raft of new and unfamiliar details

by RICK MILLS

IN MY COMPANY, WE NOT ONLY ENJOY figuring out how to do things that we haven't done before, but we also thrive on it. On a recent project, the plans called for glass railings on the house's interior and exterior balconies and interior stairs. The architects' renderings showed glass panels that seemed to emerge out of the hardwood flooring, capped with what appeared to be a sleek wood or metal top rail. While this was a cool detail, it was also intimidating be-

cause we had no experience installing glass railings. In this article, I'll walk through the steps we took to acquire the knowledge needed and implement what proved to be a dramatic design element on a large custom home we have been working on for the last several years.

Initial Research

To learn how we might achieve the architects' vision, we began by reaching out to a few trade partners, start-

ing with our regular metal fabricator, who had done a few projects with glass railings and metal posts. He in turn recommended a commercial glass installer that he had collaborated with. I reached out, and they were happy to do a site visit and share some preliminary pricing, but the pricing model they use for their commercial projects would have blown the budget.

Next, I called our shower-glass installers, who have a lot of resources

INSTALLING GLASS BALCONY RAILS



The heavy aluminum bottom rail that the crew is clamping flush to the subfloor will eventually hold panels for a glass railing (1), while the short steel angles they're clamping below the rail will provide additional support (2). Once these are set, a welder secures the steel angles to the steel I-beam that supports the second-story balcony (3).

through their suppliers. At the same time, I researched the website of one of the big suppliers of glass parts (CR Laurence) that I had become familiar with over the years from looking at glass pulls, hinges, and finishes. No surprise, as a glass hardware supplier, it had everything we needed for glass rails. On the site were numerous styles of glass railings: post to post, post-mounted, face-mounted, etc. We also saw some with a bottom “track,” or channel, about 4 inches tall, like you might see at a mall or other commercial space. This style would meet our needs but left us asking if the client wanted to see a visible bottom channel since the renderings did not include one.

Tricky Detail

Meanwhile, we were still having weekly client meetings, which gave us a chance to check in with the clients' expectations. After looking at numerous photos of glass railing styles, they confirmed that they preferred the look in the renderings.

Scouring Pinterest and Instagram, we found photos of railings with the glass coming straight out of the floor and hardwood flooring installed tight

to either side of it. This meant the channel for the bottom mount had to be installed below the hardwood. If this were the case, though, how would we replace the glass if something went wrong? (Whenever we install a product—especially one new to us—we always consider possible future maintenance issues.)

We went back to our glazers and quizzed them on installing the glass panels into the channels. They explained that the glass is placed in the channel on plastic spacers. Two overlapping plastic shims (called Taper-Locs) are slipped between the channel and the glass; then, using a special tool provided in the installation kit, the installer squeezes the shims together to lock in the glass panel and hold it rigid. The glazers explained that this same tool can be used to adjust the panel placement or remove the shims if a panel needs to be replaced but only with full access to the top of the channel. Consequently, if we were to cover the channel with hardwood flooring and there was a problem with the glass, the hardwood would have to be removed to address it. This was a concern.

Our team discussed the problems around ripping out hardwood flooring if the glass somehow was damaged

during the remainder of construction or by some kind of accident after move-in. Because the railing wrapped around corners, the hardwood floorboards would run parallel to some railing sections and perpendicular to others. Removing a board parallel to the railing would be feasible, but where the flooring was perpendicular to the rail, every board would have to come out. An alternative might be to install a “lock board” or “picture frame” board on both sides of the glass, so only two boards would need to be removed in any location.

At our next client meeting, we presented what we had discovered about the potential need for access to the channel and our solution to the problem. The clients were comfortable with the picture-frame flooring option, even if it might require removing some flooring to repair the panels in the future. We've found that when we're open with the client about what the expectations should be if things do go wrong, they are usually receptive. It at least gives them the opportunity to say no, and if an issue arises, they are already aware of what it takes to resolve it. This can go a long way toward preventing client frustration.



Once the rail supports are fixed to the I-beam (4), the crew frames out blocking and straps the ceiling below the balcony (5) and finishes the beam with plywood (6). To secure a glass panel in its aluminum channel, an installer uses a ratchet to tighten Taper-Loc shims, which had been inserted between the glass and the channel (7).

Preparing for the Install

With most of the “how” figured out, we could get started on the doing.

Our next move was to order the glass channel. This product can be selected with a fascia mount (holes in the side), a surface mount (holes in the bottom), or an undrilled track. A fascia mount worked best for us. The lag screws would go right into the 2-by that capped the steel beams that ran the perimeter of the balcony locations.

We couldn’t move forward with the hardwood flooring until we installed

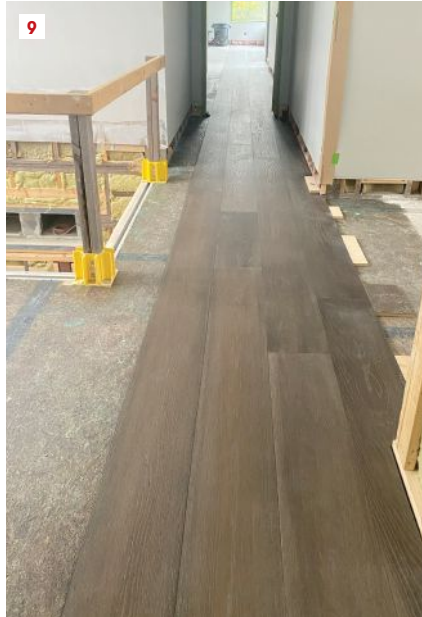
the glass. We had already been planning to set the doors and trim on the finished floor, so this accelerated our timetable for the glass installation. This also meant having to protect the glass for the remainder of the project.

Being unfamiliar with glass railings, we consulted with our structural engineer about the mounting location. After he reviewed the CR Laurence specs, he confirmed that using the track with the ½-inch-thick tempered glass and aluminum rail would meet the lateral requirements for

guardrails. But with a single mechanical fastener in the fascia mount vertically (they were spaced 12 inches on-center running horizontally), we were still concerned that the assembly could create a hinge point and allow more flex in the glass than we would like. We brainstormed with our framer and steel fabricator on ways to reinforce this connection, hoping to take advantage of some steel I-beams beneath the channel location. Because the glass channel was aluminum, we couldn’t simply weld it to the steel beams, so (after running it by the engineer) we settled on welding pieces of steel angle to the beams directly under the channel to lock it in place.

Once we had the glass channel in hand, we tasked the carpenters on site with installing it. Precision would be key when it came to the placement of the heavy aluminum bottom rail. The lead framer came up with the idea of

INSTALLING GLASS BALCONY RAILS



With the glass rail in place (8), the crew began installing finish flooring (9). Plastic shims helped maintain an even $\frac{1}{16}$ -inch gap between the glass and the flooring (10). In case a glass panel ever needs to be replaced, the crew picture-framed the flooring at the perimeter so only two boards would need to be removed for access (11).

fastening 2x4 scrap blocking to the top of the subfloor extending out over the balcony. This would allow them to push the channel up tight knowing it would be flush with the subfloor. Once they installed the blocking, the framers used large C-clamps to hold the channel pieces in place, making minor adjustments with shims as needed. We cut the channel on a 12-inch miter saw with a Diablo non-ferrous blade, slow and steady.

The welders followed suit, using the C-clamps to sandwich the channel between some scrap steel above and their small pieces of $\frac{1}{4}$ -inch steel below, welding them in place. It was cool to watch as the carpenters and welders worked together to set the channel and steel angles. They were able to knock out the main balcony in just about one day.

With all the steel and glass channels in place, the carpenters boxed out around the steel beams to prepare them for wallboard. At the same time, we worked with the glazers to create an equivalent panel layout for any area that would take more than two panels. The panels would all be around 48 to 60 inches to keep their fabrication and installation manageable. We also planned for about a $\frac{1}{4}$ -inch gap between panels and at each wall or column termination.

We progressed through the plaster walls and ceilings in these spaces until the glass arrived, and the glazers could set all the panels. This process went smoothly and set us up to start on the hardwood flooring. Since we had established a plan for the hardwood flooring adjacent to the glass, we were ready to go.

We started the hardwood on the long hallway upstairs, which was also the longest run of glass. This would allow us to establish parallel lines between the glass and hardwood. One other detail we discussed with the hardwood flooring installers was how much space to leave between the glass and the wood to allow for expansion and contraction throughout seasonal swings in humidity. With the $\frac{1}{8}$ -inch gap the flooring installers wanted, the aluminum track would be visible, which was not the look our team was going for. On a modern project like this, tolerances are often tight, and since there aren't a lot of ways to hide imperfections, we compromised and agreed on a $\frac{1}{16}$ -inch space between the glass and wood to maintain the appearance of a tight fit. To keep the spacing consistent, we used some flat plastic shims that our window installers had turned us on to; they come in $\frac{1}{16}$ -inch increments and are super handy.

Working Out Details

While we were working through the details of the spacing between the glass and the wood, we realized that the raw edge of the wood would be visible when you stood back and looked

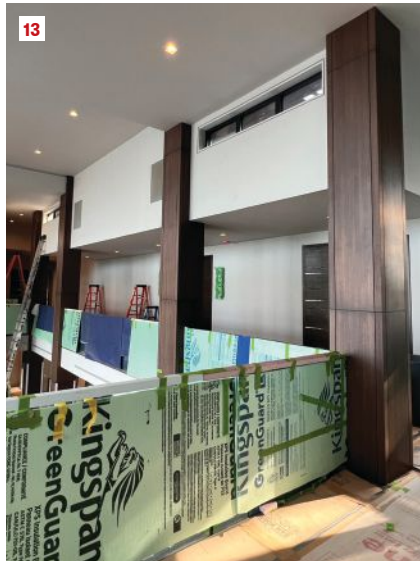
down at the base of the glass. The floor manufacturer, Carlisle Wide Plank Flooring, provided us with some additional stain for touch-ups. After cutting their pieces, the installers applied the stain with a rag, gave it a few minutes to dry, and then installed them. The main goal was to darken the wood behind the glass; we all agreed that no finish was necessary.

During one of our weekly client meetings, we were reviewing a white oak top rail that the clients had previously approved. The clients informed us that they wanted to eliminate the top cap and instead install a no-top railing, glass panels only. This was a surprise, as the plans and renderings had always shown a small top rail, not to mention that we were counting on the top rail to bring all the glass panels in plane with each other. A top rail would also have added some rigidity to the glass panels.

With clients, our answer is always yes; we might not know how we are going to do it, but we figure it out. We went back to the glass hardware supplier and found some stainless steel clips that would fit between glass panels and at any terminations to help stiffen things up. We proceeded to order a few samples to show the client. Once those came in, we mocked them up between some of the already installed glass panels, and the clients gave us the green light to use them everywhere.

Site Protection

Once all the glass was installed, there was still a lot of construction to complete for the project and protecting the glass was critical. We placed sheets of 1/2-inch rigid foam on both sides of the panels and capped the vulnerable top edge with 2 inches of rigid foam. We also opted to drop moving blankets over the foam, to minimize wear and tear and add a layer of protection. The foam was removed numerous times as the project went on, to allow for measuring and installing of column facades, plaster work, painting, and such. We took special care to keep the foam clean when it was off. Any foam



that took on significant debris, we would replace, to prevent scratching the glass.

Removing the protection from the glass was one of the last things to happen as the job wrapped up. At that time, we installed all the hardware spacer clips. The pieces almost disappear, giving the client the ultra-modern, clean install they were after.

Rick Mills is a senior project manager for Jackson Andrews Building + Design, in Virginia Beach, Va. Follow him on Instagram at @rick.jacksonandrews building and @jacksonandrewsbuilding.

Rigid foam protects the glass during the rest of the construction (12, 13). Once all the finishes were completed, the crew uncovered the glass and installed clips that help secure the panels where they intersect walls and columns (14, 15).



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BUILDING PERFORMANCE



High Performance on a Limited Budget

Uniting a tight building enclosure with an ultra-efficient HVAC system

by JOHN SIEGENTHALER

MY FAMILY AND I ATTEND BETHEL Baptist Church in Prospect, N.Y. When the church was organized in 1976, the founding members had a 24-by-48-foot double-wide mobile home installed to provide a parsonage for the church's pastor and his family. That mobile home underwent many alterations, repairs, and "mishaps." After 45 years, it had reached a condition where routine problems gave way to major ones, including water leakage, mold, and high energy costs, on top of pending structur-

al issues. The one feature of the parsonage that aged without problems was a full basement constructed with 12 courses of concrete blocks and a smooth, flat concrete floor.

After investigating several options for dealing with the building's deterioration, the membership approved a proposal to remove everything above the foundation and reconstruct a new home on that foundation. I took on the role of designer and construction manager. The task before me was to

design a new structure that could be built quickly on a limited budget, reuse much of the existing foundation, minimize future maintenance, be energy efficient, and provide year-round comfort for a family of six. This project is presented here as a case study for building a high-performance home on a reasonable budget.

Structure and Enclosure

The original 24x48 basement and a later 24x24 addition are outlined in blue

HIGH PERFORMANCE ON A LIMITED BUDGET



Before. The 45-year-old double-wide mobile home had undergone several alterations and additions, eventually reaching a condition where major repairs were required. Everything shown (1, 2) was demolished and only the block foundation, which was in good shape, was kept.

in the floor plan on page 49. We cut a Bilco entryway into the existing basement wall and added two small slab-on-grade “appendices”—one to extend the width of the main foundation out to 32 feet, and the other to support a small entry vestibule. Both appendices were constructed using a shallow frost-protected foundation system, as shown in the illustration and photos on page 50.

The bottom of the footings are 24 inches below finish grade, and 2-inch-thick extruded polystyrene insulation extends outward from the top of the footings to act as a frost barrier. After the stem walls were constructed, we filled the enclosed area with granular soil, compacted it, and covered it with a 6-mil poly vapor barrier and 2 inches of

extruded polystyrene. Tubing for floor heating was fastened to the 6x6 WWF (welded wire fabric) reinforcement, and a 4-inch concrete slab was poured flush with the top of the stem walls.

Framing. The 24-inch in-line framing we used for the floor deck and walls reduced the quantity of materials needed and sped up construction without sacrificing strength. Raised-heel attic trusses with 8/12 pitches and 24-inch overhangs were installed directly in line with wall framing. The trusses provided a 16-foot-wide Cape-style upper-floor space that would eventually become two bedrooms and a full bathroom.

Thermal envelope. We considered insulating the inside of the basement walls but eventually dismissed the idea

because of the estimated cost and the possibility of the block walls becoming much colder than they had in the past, which could lead to frost damage. To meet code requirements, 6-inch mineral-wool batts were installed between the 2x12 floor joists. Reinforced nylon strapping holds the batts in place, while roofing nails attach the 2-inch-wide strapping to the bottom of the joists every 24 inches.

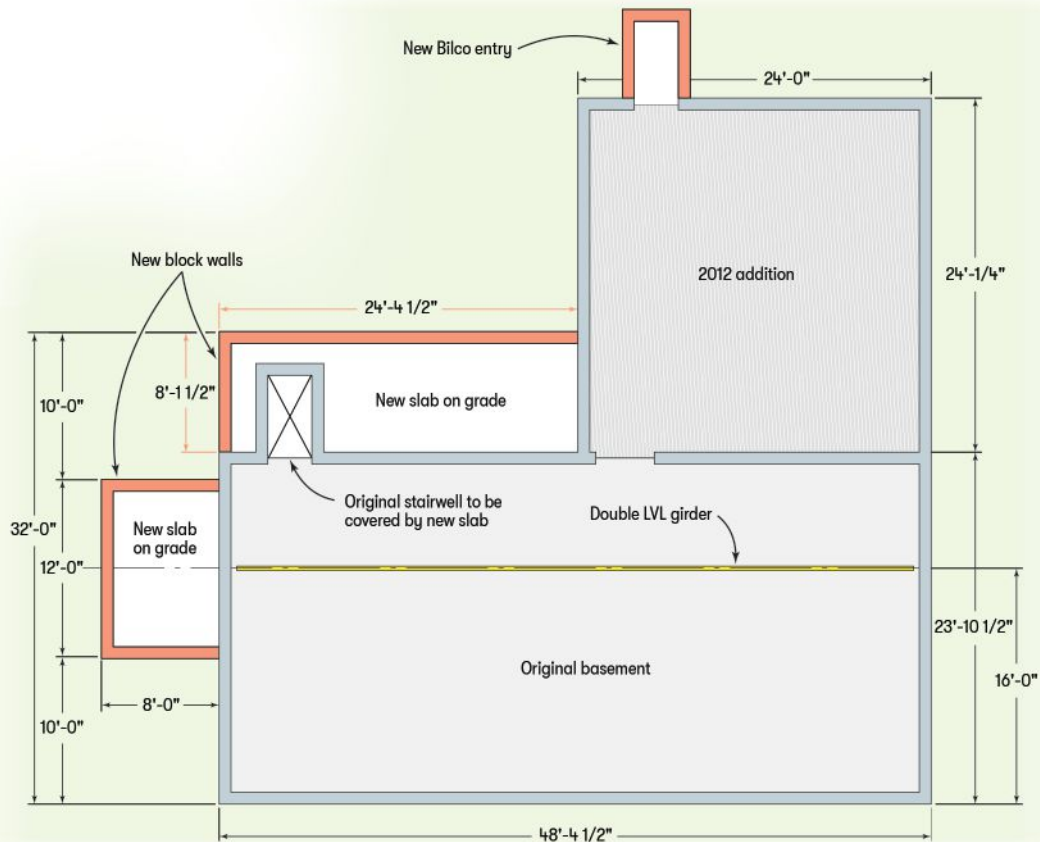
All exterior framed walls were insulated with 4 inches (R-28) of spray polyurethane foam. The cavities between the upper cords of the attic trusses were insulated with 7 inches (R-49) of spray polyurethane foam directly against the roof sheathing. This allowed ducting to run through the unfinished space in the trusses and remain within the thermal envelope.

Keeping It Warm

We planned for the project’s HVAC system to be all-electric. A SpacePak iLAHP air-to-water heat pump with a nominal 4-ton (48,000 Btu/hr) heating capacity is the primary heat source, and a 9-kilowatt (30,700 Btu/hr) Electro Industries electric boiler provides supplemental and backup heating.

The heat pump maintains the water temperature between 100°F and 110°F within a Thermo 2000 TurboMax reverse indirect water heater tank. This tank—described later—also serves as a buffer tank for a highly zoned hydronic distribution system consisting

Floor Plan



of 10 Myson T6 panel radiators and two small areas of floor slab heating.

The panel radiators and two floor heating circuits are each equipped with a thermostatic radiator valve that allows heat output to be individually adjusted. These non-electric valves automatically regulate heat output by adjusting the flow rate through each heat emitter. In effect, the system has 12 independently controlled heating zones. In this setup, each heat emitter can compensate for individual preferences or internal heat gains from sunlight, people, or other sources.

The diagram and photo 8 on page 52 show one of the panel radiators. The knob of the thermostatic radiator valve is at the upper right corner of the radiator, and the 1/2-inch PEX-AL-PEX supply and return tubes are at the

bottom center. The two floor heating circuits use a thermostatic valve body connected to a wall-mounted setting dial via a capillary tube.

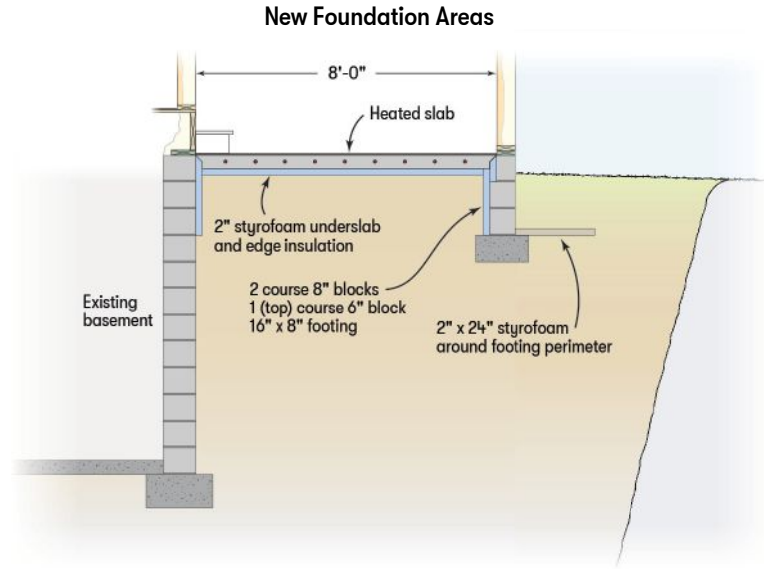
We sized the panel radiators and floor heating circuits to provide design-load heat output when supplied with water at 120°F. However, operating experience with the system has shown that it can meet design load using an average supply-water temperature of 105°F. At this low water temperature, the heat pump operates at higher coefficients of performance (COPs).

The diagram (see again page 52) shows a portion of the piping layout. The air-to-water heat pump is piped in parallel with the electric boiler. Either one can serve as the system's sole heat source, or both can operate simultaneously if the water temperature in the

TurboMax tank drops 5°F below its normal cycling range. The heat pump and boiler are turned on and off using a Tekmar 152 two-stage temperature setpoint controller that continually monitors the tank temperature. This controller prioritizes the heat pump as the "lead" heat source.

The entire hydronic system operates with a 30% solution of ChemFrost inhibited propylene glycol antifreeze. Antifreeze is required to protect the heat pump from freezing. It also protects the entire system from freezing during a prolonged power outage and costs less than installing a properly sized heat exchanger between the heat pump and the rest of the system. And the COP of the heat pump is higher when there's no heat exchanger between it and the remainder of the system.

HIGH PERFORMANCE ON A LIMITED BUDGET



Shallow foundation. The new slab-on-grade additions were constructed with shallow frost-protected foundations.

The distribution piping is a variation on “home run” piping, in which a set of ½-inch PEX or PEX-AL-PEX tubes are routed to each heat emitter from a common manifold station. The 1-inch copper piping from the TurboMax tank connects to ¾-inch copper headers that run in opposite directions along the home’s main LVL center girder. The ½-inch PEX-AL-PEX tubing tees into the ¾-inch headers, as shown in photo 9 on page 54. These headers take the place of a traditional manifold station. With 12 heat emitters widely spread out in the building, this approach saved several

hundred feet of ½-inch tubing and many holes that would otherwise be required through floor joists if all the home-run circuits were routed back to a manifold station.

After pressure testing was done, we insulated all the copper tubing as required by code in an unconditioned basement. For this, we used pre-slit ArmaCell elastomeric foam insulation with a ½-inch wall thickness.

We routed the ½-inch PEX-AL-PEX tubing above the floor insulation and, as such, it did not require insulation. We fastened it to the joists using Genova CPVC C-clips.

The tubes rise through the subfloor, 2 inches on-center and directly under the centerline of each radiator. They connect to dual isolation valves, as shown in the photos on page 54. These valves allow each radiator to be isolated from the remainder of the system and even disconnected if ever necessary. A split escutcheon plate snaps in place over the piping penetrations.

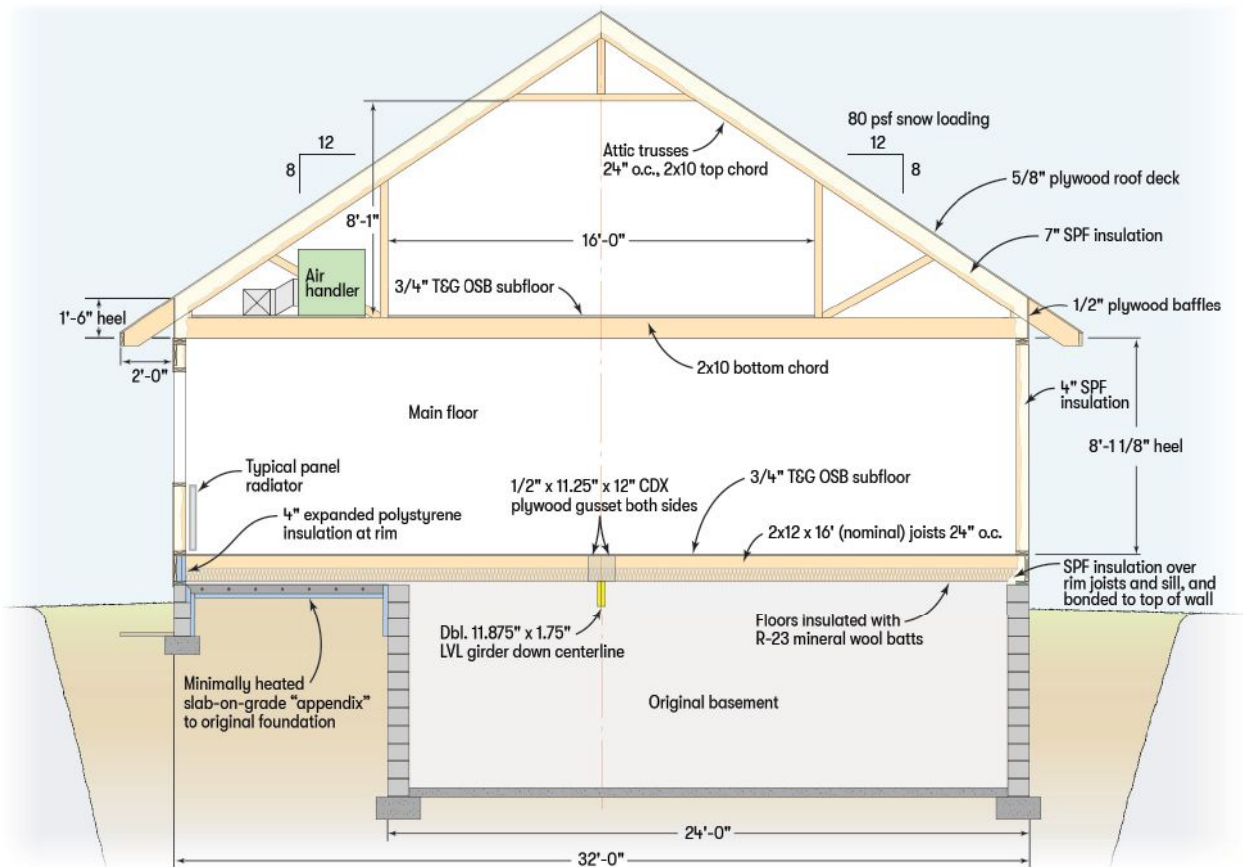
A single, high-efficiency Taco 0018e circulator handles flow through the entire heating distribution system. This circulator automatically varies its speed to maintain constant differential pressure as the thermostatic radiator valves regulate flow. It comes equipped with Bluetooth communication, allowing its input power, flow rate, and differential pressure to be monitored on a smartphone. At full speed, it draws 44 watts. Under typical system operation, input power ranges between 20 and 30 watts. This circulator can operate 24/7 on approximately \$0.13 worth of electricity per day at current local rates. With such a low energy consumption, there’s no reason to turn the circulator on and off during the heating season.

Domestic Duty

The partial schematic of the system on page 53 shows how domestic water is heated. The TurboMax tank has several internal copper coils through which cold domestic water passes whenever hot water is drawn at a fixture.

In this system, these coils can pre-heat cold domestic water to about 95°F or 100°F. Water exiting the coils passes into a heat pump water heater that had been installed in the original parsonage. That unit boosts the pre-heated water to 120°F. An insulated DHW recirculation system provides immediate hot-water delivery to any fixture in the home. This arrangement allows the air-to-water heat pump to provide the majority of the water’s temperature lift at a relatively high coefficient of performance (COP), especially during warm weather. The heat pump water heater keeps the basement cool and dry during summer and

Structural Section



provides a DHW backup to the main heat pump, if ever necessary.

Keeping It Cool

The air-to-water heat pump also supplies chilled water for cooling. That water is delivered to a hydronic air handler located within conditioned space between attic trusses. The diagram at the bottom of page 53 shows the cooling portion of the system.

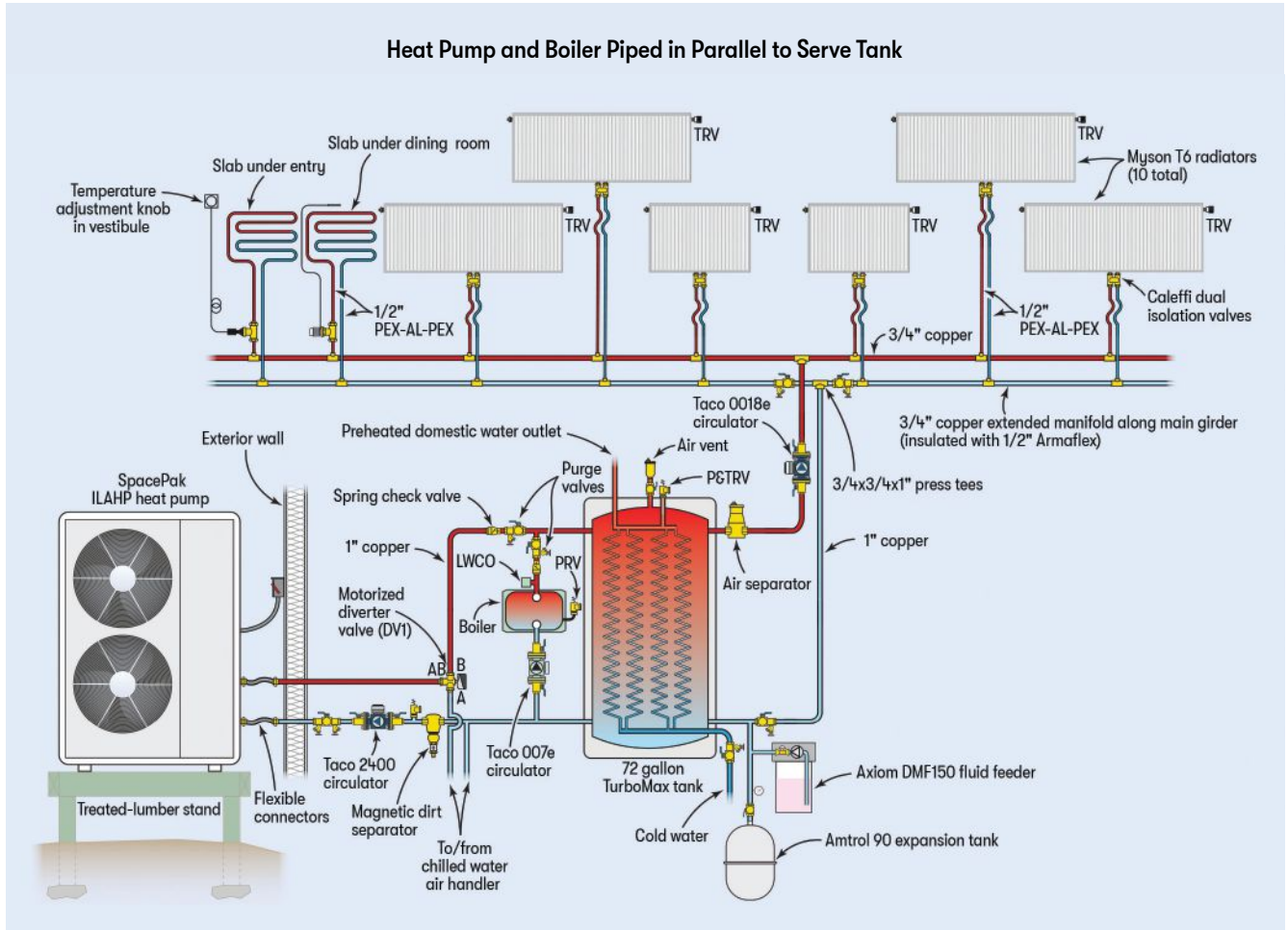
In cooling mode, a motorized diverter valve directs flow from the heat pump to the coil in the air handler. The heat pump adjusts its compressor speed to maintain a supply temperature of 50°F to the coil.

It's critically important that all piping and components conveying chilled water are insulated and vapor-sealed. We used pre-insulated 1-inch barrier PEX tubing from Uponor to carry



Fast framing. The walls were framed 24 inches on-center. Along with the raised-heel attic trusses, this framing strategy enabled fast construction.

HIGH PERFORMANCE ON A LIMITED BUDGET



A SpacePak iLAHP cold climate air-to-water heat pump (6) is the home's primary heat source and also supplies chilled water for cooling. A 9-kilowatt electric boiler provides supplemental and backup heat (7). All Myson T6 panel radiators (8) have thermostatic control valves (in photo at upper right).

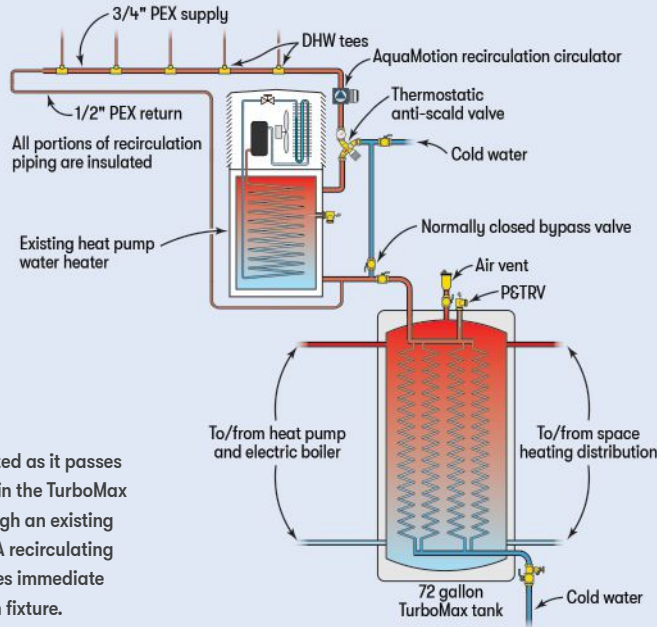
chilled water from the mechanical room to the air handler. It installs quickly and can be connected to rigid piping using cold expansion fittings. For insulating copper tubing, elastomeric foam insulation such as ArmaCell's

Armaflex is ideal. It comes pre-slit to fit over the piping and includes pressure-sensitive tape to bond the longitudinal seams. All butt joints should be glued with rubber contact cement. We wrapped odd-shaped components, like

circulator volutes and air separators, with elastomeric foam tape. The goal is to prevent any contact between chilled surfaces and surrounding air.

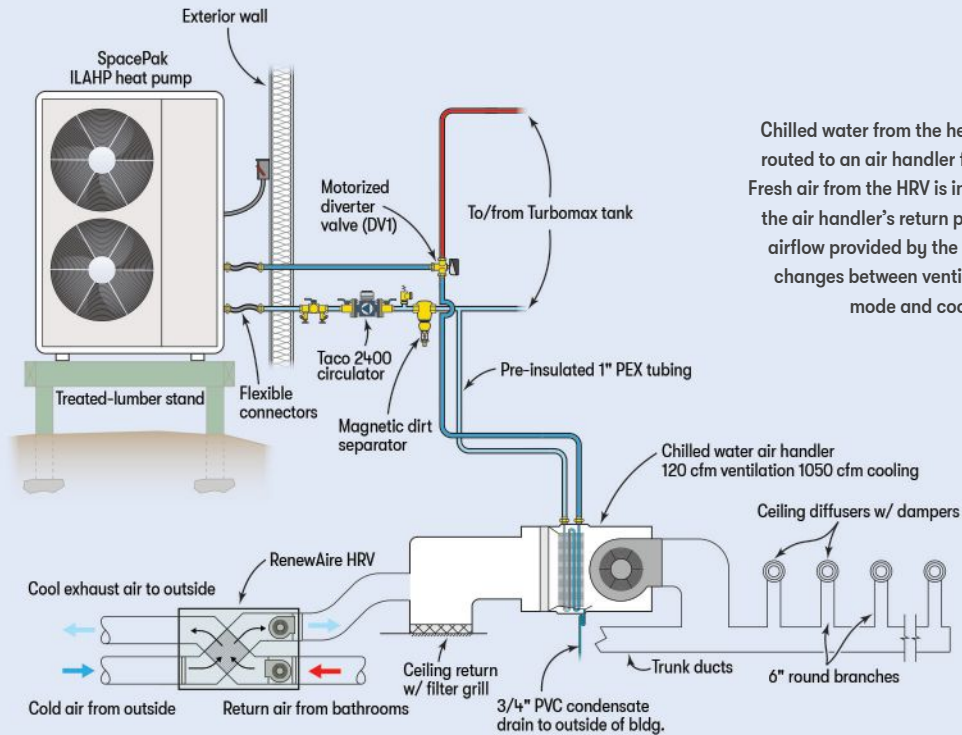
During a humid summer day, several gallons of condensate will form on the

Domestic Hot Water System



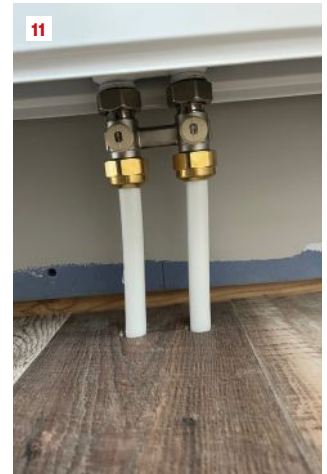
Domestic water is preheated as it passes through copper coils within the TurboMax tank before passing through an existing heat pump water heater. A recirculating distribution system ensures immediate hot water delivery at each fixture.

Cooling System



Chilled water from the heat pump is routed to an air handler for cooling. Fresh air from the HRV is injected into the air handler's return plenum. The airflow provided by the air handler changes between ventilation-only mode and cooling mode.

HIGH PERFORMANCE ON A LIMITED BUDGET



PEX-AL-PEX tube sets for each heat emitter connect to $\frac{3}{4}$ -inch copper headers routed along the home's main girder (9). (All copper piping was insulated after pressure testing.) The $\frac{1}{2}$ -inch PEX-AL-PEX supply and return tubes pass up through the floor (10) and connect to a dual isolation valve under each radiator (11). Trunk ducts (12) insulated with bubble foil wrap to prevent condensation transition to 6-inch round branch ducts routed through the spaces between lower truss cords. Return air grilles in bedroom doors (13) allow return airflow from all rooms while attenuating sound and light transmission.

air handler's coil and fall into its drip pan. We used $\frac{3}{4}$ -inch PVC piping along with a trap to carry this condensate outside the building. Since we installed the air handler above a finished ceiling, we also installed a secondary drain pan to capture any potential long-term leakage from the air handler's drip pan.

Rectangular trunk ducting from the air handler runs along the top of the lower truss cords. Multiple 6-inch round galvanized branch ducts connect to the trunk and run out through the spaces between the 2x10 bottom truss cords. They transition to ceiling diffusers with adjustable dampers; the elbows making the transition are shown in photo 12, above. All air de-

livery is from the ceiling on the main floor and low wall registers in the spaces formed by the attic trusses.

All air supplied through the ducting system returns to a single filter grille located on the hallway ceiling and almost directly under the air handler. When interior doors are closed, return air passes through grilles (made by Tamarack Technologies) that we installed into the bottom of the interior doors. These grilles attenuate light and sound transmission while greatly reducing room air pressurization. This allows for balanced airflow without the complication and cost of dedicated return air ducting.

A RenewAire heat recovery ventilator (HRV) interfaces to the return

side of the air handler. When only ventilation airflow is required, the air handler is wired to run at approximately 120 cfm to match the airflow rate through the HRV. When the system operates in cooling mode, the air handler increases airflow to 1,050 cfm. The HRV draws return air from each of the three bathrooms.

The completed build has five bedrooms and three full baths. Like any project, it had its challenges, but with God's help this home will serve the church for decades to come.

John Siegenthaler, P.E. operates Appropriate Designs, a building systems engineering firm in Holland Patent, N.Y.

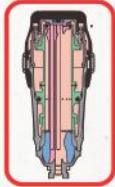
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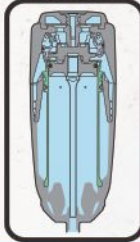
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A woman with dark hair tied back, wearing safety glasses and a maroon t-shirt, is focused on her work. She is using a yellow power drill to secure a wooden railing. The background shows a marina with several white boats docked, suggesting an outdoor construction project in a waterfront setting.

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by VINCENT SALANDRO

1. Exterior Wood Stain

Flood Easy Seal Premium Oil-Based Stain and Sealer can deliver a seamless finish to outdoor wooden surfaces in just a single coat, according to its manufacturer. The company promises a streak-free performance without runs or laps, allowing professionals to finish projects without back brushing. The UV-blocking, water-resistant stain and sealer is available in eight ready-mixed, semi-transparent colors. Online, we found a gallon for \$48. pppaints.com/flood-wood-finishes



2. Durable Masonry Screws

Confast 410 stainless steel Hex Washer Head Masonry Screws are available in 3/16- and 1/4-inch diameters with lengths ranging from 1 1/4 to 6 inches. The maker claims the “Hi-Lo” thread design reduces torque, making the screws faster and easier to drive. Holding values in 2,000-psi concrete for 3/16-inch screws are 360 pounds for pull-out and 432 pounds for shear; for 1/4-inch screws, values are 750 pounds for pull-out and 900 pounds for shear. Finished with a Silver Rust-pert coating, the screws are recommended for moist environments. A box of 50 3/16-by-1 1/4-inch screws costs about \$24. confast.com



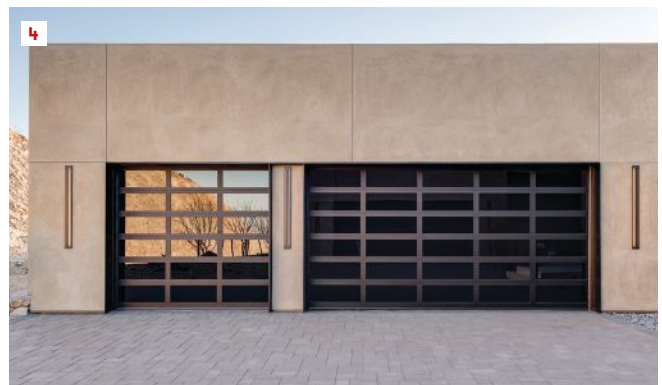
3. Lightweight Fire-Resistant Drywall

FireLite Type X Lightweight Drywall Panel from CertainTeed consists of a noncombustible, fire-resistant Type X gypsum core enclosed in 100% recycled face and back paper. CertainTeed says the panel offers fire resistance of up to four hours in various wall assemblies and claims it weighs 10% less than standard 5/8-inch Type X drywall options. Long edges are slightly tapered for cleaner joints. The panels are also GreenGuard Gold certified. certainteed.com



4. Low-Profile Aluminum Garage Door

As Clopay VertiStack Avante garage doors open, their horizontal sections stack neatly on the inside wall above the garage opening—without overhead tracks, exposed hinges, or cables. The doors sport glass panels, which can be customized for privacy and light control, and polyurethane-insulated stiles and rails that carry a 3.8 R-value. Some models can be reinforced for high-wind-load applications; check with a local dealer for options. clopaydoor.com



Products



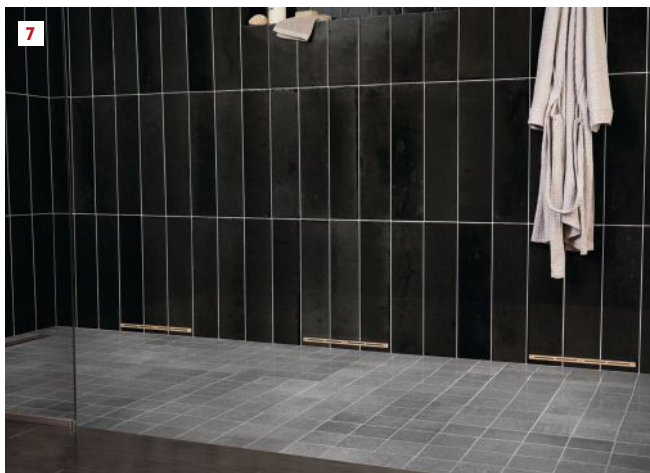
5. In-Duct Air Purifier for HVAC Systems

Aerapy's PAH Series whole-house air purification system harnesses short-wavelength UV-C light to kill or inactivate pathogens including bacteria, viruses, and mold. According to Aerapy, when installed in new or existing HVAC indoor split systems, the unit treats both the coil surface and the air that passes through the system, keeping the coil, drain pan, plenums, and ducts clean, as well as improving indoor air quality. The series offers two options—a unit with one UV-C lamp and a unit with two UV-C lamps for enhanced coverage. aerapy.com



6. Versatile Fresh-Air-Supply Fan

The Delta BreezFresh FRS200HT fresh-air-supply fan with humidity sensor is rated for 30 to 200 cfm. The new fan features a digital control panel to show airflow, runtime, temperature, and humidity limits. Used with the included MERV 13 filter, the unit reduces pollutants, allergens, odors, and disease spread while maintaining a supply of fresh air, according to Delta. The UL/cUL and Energy Star-listed fan can be ceiling-, wall-, or attic-mounted and is suitable for single-family, multifamily, and commercial applications. deltabreez.com



7. Quick-Drying Shower

The AirJet Shower Drying System from Airmada delivers air into the shower to remove moisture from surfaces, minimizing the risk of slippery floors and discouraging mold growth. Located out of sight, a blower generates a stream of air to a manifold that evenly distributes the air to nozzles in the shower. The linear nozzle trim (shown) is installed flush and is recommended along the bottom of the wall for traditional showers and additionally along the ceiling for those with steam capabilities. airmadadry.com



8. Fire-Rated Fiberglass Doors

ODL now offers 20-minute fire-rated fiberglass doors, certified with the Warnock Hersey Mark and designed to meet most national and local fire code requirements. Tested to withstand fire exposure at temperatures exceeding 1,400°F, the doors also feature a Category B positive pressure rating without a hose stream. The doors are built with an enhanced 4-inch full-length engineered lumber lock stile and are available in standard 6-foot-8-inch heights. odl.com

9. Durable Structural Screws

Spax PowerLags structural screws are heat treated for strength and durability and require no pre-drilling for $\frac{1}{4}$ - and $\frac{5}{16}$ -inch diameters. According to the manufacturer, the thread serrations require less driving torque than those of similar screws. The built-on washer head eliminates the cost of a separate washer while the fastener-length stamp on the head provides convenient identification without measuring and aids on-site inspections. PowerLags come in hex and T-star head styles with zinc, yellow zinc, and HCR coatings. A 500-count pail of $\frac{1}{4}$ -by-2 $\frac{1}{2}$ -inch T-star washer head HCR PowerLags costs about \$95. spax.us

10. All-Electric-Ready Panel

The Span Panel MLO 48 offers two key improvements over traditional service panels for all-electric homes: First, the new panel provides 48 slots that fit standard electrical breakers to allow for the additional circuits required to run an entire all-electric home. Second, its PowerUp software allows users to monitor electrical use of individual circuits and prioritize specific loads in the event of a power outage or off-grid applications. The software can deactivate nonessential circuits, letting users control which circuits are powered to extend battery backups. span.io

11. Brass Bathroom Fixtures

Isenberg by Flusso's Serie 240 primary bath ensemble includes brush bronze finishes for a range of fixtures, including sink faucets, tub fillers, and shower valves. The fixtures are crafted from premium solid brass and fitted with ceramic cartridges, offering longevity and performance benefits. List price for a hand shower set, for example, is \$365. isenbergfaucets.com

12. Wildfire Sprinkler System

The Frontline Wildfire Defense System, a sprinkler system activated by the company's fire-tracking software, turns on automatically when fire is within 7 miles, more than 100 times faster than traditional sensor-based systems, according to the manufacturer. Once active, eaves and roof sprinklers saturate the property with water and biodegradable, nontoxic firefighting foam to mitigate risk from wind-borne embers. A wall-mounted controller allows for remote operation of the sprinklers via WiFi, cellular, and satellite connectivity. frontlinewildfire.com



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DeWalt Cordless Framing Nailer

by **ROB CORBO**

In tight urban spaces, where I do a lot of work, compressors and hoses for pneumatic tools can be difficult to maneuver and even hazardous. So, I was excited to test the DeWalt DCN920 cordless framing nailer, a 20-volt, brushless, 21-degree gun weighing 10 pounds (with battery) that drives plastic collated stick nails from 2 to 3½ inches. Our kit contained the gun, a 5-Ah battery, charger, belt hook, no-mar tip, and kit bag (it's also available gun only). We loved that the battery and charger are interchangeable with our other DeWalt 20-volt tools. DeWalt also offers the DCN930, a 30-degree, paper-tape cordless unit.

A month after receiving the nailer, we started a renovation on a four-story attached home in a high-density city neighborhood. The project included an addition off the back that required a variety of framing tasks, including walls, joists, rafters, roof decking, and subfloors—a perfect trial for the gun. The crew was used to pneumatics, but the DeWalt scored points right out of our truck: Grabbing one bag versus grabbing a gun, compressor, and hose was a pleasure in a town where parking spots in front of the job are rare.

Of course, the real test was using the gun. We ran a pneumatic nailer and the DeWalt cordless side by side. Our familiar pneumatics—which we've used for decades—felt better balanced and more productive from the start. But the DeWalt was picked up more frequently as the job progressed and we negotiated tight spaces and locations the compressor couldn't reach without being moved, as well as subfloors and scaffold,

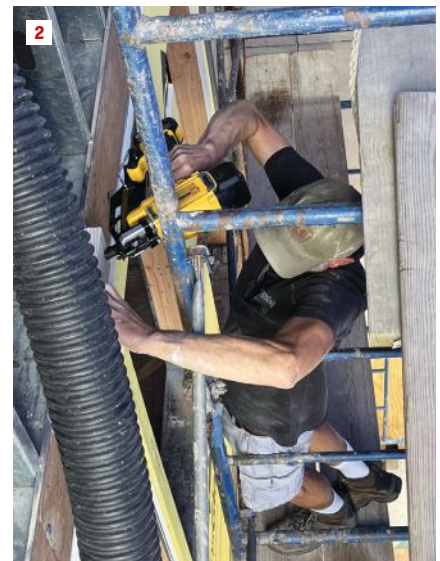
where a hose would get under foot, and the roof, where locating a compressor, hose, and gun for nailing down decking would have been a drag. Will the DeWalt replace our pneumatics? No. Does it complement them? Absolutely.

The DCN920 has plenty of power to drive nails to required depth in both sequential (single fire) and bump (rapid fire) modes, regardless of the material—natural or engineered. Both modes have impressive recovery times thanks to improvements to the flywheel design over previous models; the faster flywheel speed produces a no-wait nailing sequence that increases efficiency and performance. Framing performance can be improved further by removing the no-mar tip cover used for finer materials and uncovering a claw tip that minimizes slippage when toenailing.

We had only two gun jams in a month of use. A trigger lock-off button that prevents the gun from firing should be used when the user is making adjustments or when the unit is not being used.

The gun's magazine holds one strip of nails (36 nails), which doesn't take long to exhaust. In addition, since a dry-fire lockout restricts the gun from firing when five to eight nails remain, an extended magazine (sold separately) that holds a second strip is an attractive upgrade. So, figure an additional \$90 into your budget. The nailer retails as a stand-alone tool for approximately \$375 and as a kit for \$475. dewalt.com

Rob Corbo is a building contractor based in Elizabeth, N.J., specializing in high-quality renovations.



The author found the DCN920 ideal for situations where hoses and compressors would be a nuisance (1, 2).

PHOTOS BY ROB CORBO

Makita Cordless Tile Saw

by JOHN CARROLL

Handheld grinders have served as tough, little workhorses on my jobs for decades. I keep two 4½-inch grinders on hand and, to save time, I leave one set up with a metal cutting blade and the other with a diamond masonry blade. With the work I do, my masonry grinder gets the most use. It works great to cut tile, bricks, blocks, stone, concrete, and mortar, but there are two persistent problems. The first is dust. The diamond blade doesn't cut; it grinds. That produces a cloud of pulverized minerals that makes an unholy mess, presents a long-term health hazard, and creates miserable conditions to work in. The second problem is that controlling the depth of the cut is difficult. Unlike circular saws, standard handheld grinders don't have a table. Without one, users can't lock in the depth of the blade and must regulate it by eye.

The Makita XCC01Z 18v LXT Cordless Masonry Saw solves both of

those problems. To keep dust down, it has two systems for running water over the spinning blade. The first is a simple gravity system that employs a small, 12-ounce tank attached to the top of the blade guard (1). Water flows from the tank into a tube and over the edge of the blade. By rotating a lever on the blade guard, you can control the rate of flow or cut it off completely between cuts. This system works well, with only one drawback: The tank must be refilled frequently. So, Makita provides an optional hose that can be attached in place of the tank and connected to a garden hose or, with an adapter (not included), to a sink faucet.

To regulate the depth of cut, the tool is configured like a standard circular saw with a table that can be locked in place or tilted for beveled cuts (2). A built-in LED makes the cut line easier to see. The saw has a 5-inch diamond blade and a maximum depth of cut of

1¾ inches at 90 degrees. The saw can cut right through granite slabs, brick, and concrete pavers. It goes through batteries quickly, however, so it's best to have at least two batteries and a charger handy.

The only limitation I found is that the cutter can't be used on vertical surfaces. Makita makes this clear in the instruction manual in all capital letters: CAUTION: THIS TOOL SHOULD ONLY BE USED ON HORIZONTAL SURFACES. This restriction makes the Makita cordless cutter a poor choice for surgical demolition on a tile wall or grinding out the mortar joints in a brick wall for tuck pointing. But, if you need to cut almost any masonry material on a workbench, it's a great tool to have. The bare tool costs \$255. makitatools.com

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



A 12-ounce bottle provides adjustable water flow to keep down dust (1). For constant water feed, a hose attachment can be used instead. Depth of cut on the compact, 6.6-pound Makita XCC01Z can be set with its adjustable baseplate (2).

PHOTOS: MATT NANFAY

Mafell Crosscutting System

by NATHANIEL CARLSEN

Having repeatedly hauled a miter saw and table saw in and out of a van, I wanted one saw that could make 90% of the cuts I need on a remodeling job. That's a lot to ask, but after using Mafell's KSS40 saw, I think I found it.

If ordered as a kit (\$1,715), the KSS40 comes in a Systainer with a crosscut track, batteries, charger, dust bag, rip fence, and a rolled-up Flexi-Guide—a flexible, spring-steel guide rail that unfurls to 55 inches long. I used the saw on the Flexi-Guide and on my Bosch tracks; both work, though the Flexi-Guide is needed for bevel rips, and the cut quality, at least on veneer ply, seemed better with the Bosch tracks. I ripped extension jambs, diced up ¾-inch plywood, and trimmed doors; at no point did the saw lack power. The dust collection is excellent with the dust bag, and when we made long rips with the saw hooked up to a vacuum, the collection exceeded that of other track saws I've used.

The saw also plunge cuts, but rather than hinging the entire saw down,

you lower it down two rails with a lever. This setup gave me additional control; I cut the head stock of jack miters with ease, plunging the saw until my cut line ended right where I wanted it.

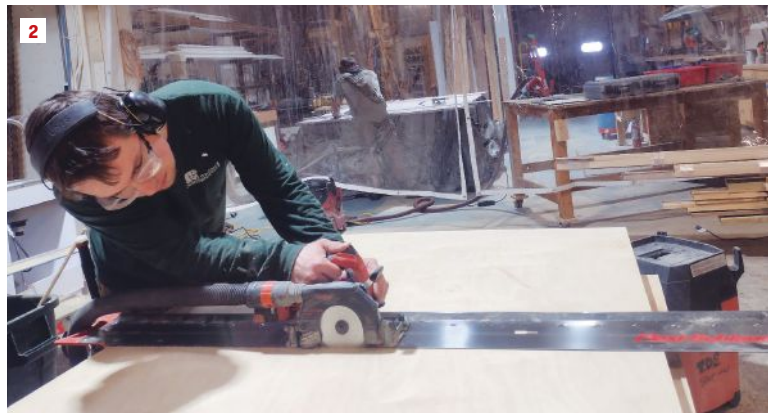
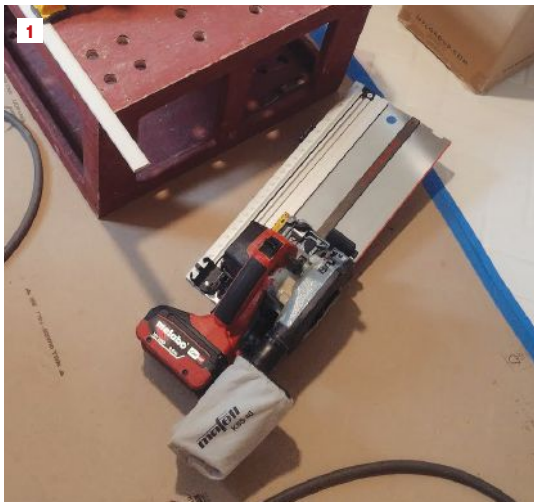
For straight crosscuts less than 13 inches, the KSS40 clips onto a self-retracting shorter guide rail. A knob on the rail's left side adjusts to any angle from 0 to 60 degrees to the left and 0 to 45 degrees to the right. With the saw at the cut's starting point, I pivot the saw and track until the adjusted angle stop contacts the edge of the workpiece, then I make the cut. Maximum depth of cut is 1⅞ inches at 90 degrees and 1⅞ inches at a 45-degree bevel, allowing the saw to handle most tasks despite its 4¼-inch blade. I mitered casing, cut scribe molding, and cut 2-by PT stringers and, in every case, the saw was up to the task. In fact, the saw is more precise with unknown angles than my miter saw. Mark an unknown angle on a workpiece and slide the KSS40's adjustment knob along until the splinter guard follows the mark, with micro

adjustments of 0.25 degree. My only gripe is that the retraction from the cut is spotty, but this hasn't been a significant hindrance.

The KSS40 has become my go-to for many tasks, and while not a replacement for a miter saw on a big trim job due to its limited ability to handle small pieces and profiled trim, it makes an excellent companion. With it, I can square off the ends of lumber in the pile with minimal lifting, slide along the floor to cut baseboard as I install it, or take it 20 feet up in a lift to cut exterior trim.

On the down side, the KSS40 has a limited cutting depth and a proprietary blade, and it's expensive. Still, the saw was worth the cost for one primary reason: its size. The KSS40 is nimble and controllable, more suited to detail work than any other circular saw I've used. The Mafell KSS 40 (bare tool) costs \$1,115 at timberwolftools.com.

Nathaniel Carlsen is a carpenter with TDS Custom Construction in Madison, Wis.



Attached to its crosscut track, the Mafell KSS40 is still light and portable (1). When used with Mafell's 55-inch flexible track, the saw can break down sheet goods or scribe fillers (2).

PHOTOS: NATHANIEL CARLSEN

Classical Proportions Revisited

by CLAYTON DEKORNE

While working with Marc Forget on his *Training the Trades* article “An Introduction to Wainscoting” (see page 9), I balked at the $\frac{1}{3}$ rule he was taught. Having been steeped in the classical orders as a carpenter, I had been taught that wainscoting visually functions like the pedestal under a column. The wall above the wainscoting would be the column; the chair rail would be the cornice at the top of the pedestal; the baseboard would be the plinth on which the pedestal sits; and the wainscoting—the panels between the baseboard and chair rail—would be the “dado” section of the pedestal.

Carpenter and writer Gary Katz masterfully explains the classical orders to carpenters in “Rules for Proportion” at ThisIsCarpentry.com, which includes his YouTube video “Understanding Classical Proportions.” This is a must-read/must-see for all carpenters.

The differences between the classical orders (for example, Ionic or Doric) are realized in variations of the column diameters. For each order, the diameter of the column serves as a unit of measurement for all the sizes and placements of all parts of the pedestal, column, and entablature. Several historical architect/builders codified the rules that define these orders into pattern books for carpenters and, depending on which one you read, the proportion of the wainscoting (pedestal) to the wall (column + entablature) varies, but all work out to roughly $\frac{1}{3}$ or slightly less. By this measure, the wainscoting in a room with 8-foot ceilings would be around 20 inches tall, with 9-foot ceilings, about 22 inches, and with 10-foot ceilings, 24 inches. While we certainly see wainscoting this low in colonial and neoclassical homes, it’s rarely this low in modern homes, begging the questions: Should we be comparing it with a column pedestal? Do classical proportions always apply? Do they really look best?

There is another school of thought on wainscoting. Speaking to a humbler aspect of wainscoting, the late author and illustrator Eric Sloane wrote in *A Reverence for Wood*, one of his many illustrated works on early American life: “Wainscoting means any wooden wall-lining, whether it be sheathing or paneling, horizontal or vertical, floor-to-ceiling or chair-rail height.” In the illustration accompanying this definition (see image, above right), he asserts “Wainscoting was cottage wall Sheathing.” The word wainscot, Sloane notes, stems from the Middle German “waghenschot.” While it’s plausible this relates to “wagon” + “cottage,” as Sloane’s

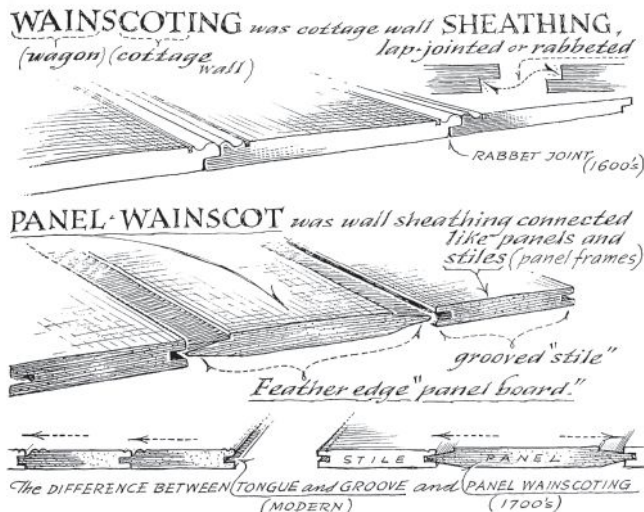


Illustration from Eric Sloane’s *A Reverence for Wood* (original edition copyright 1965; republished 1974).

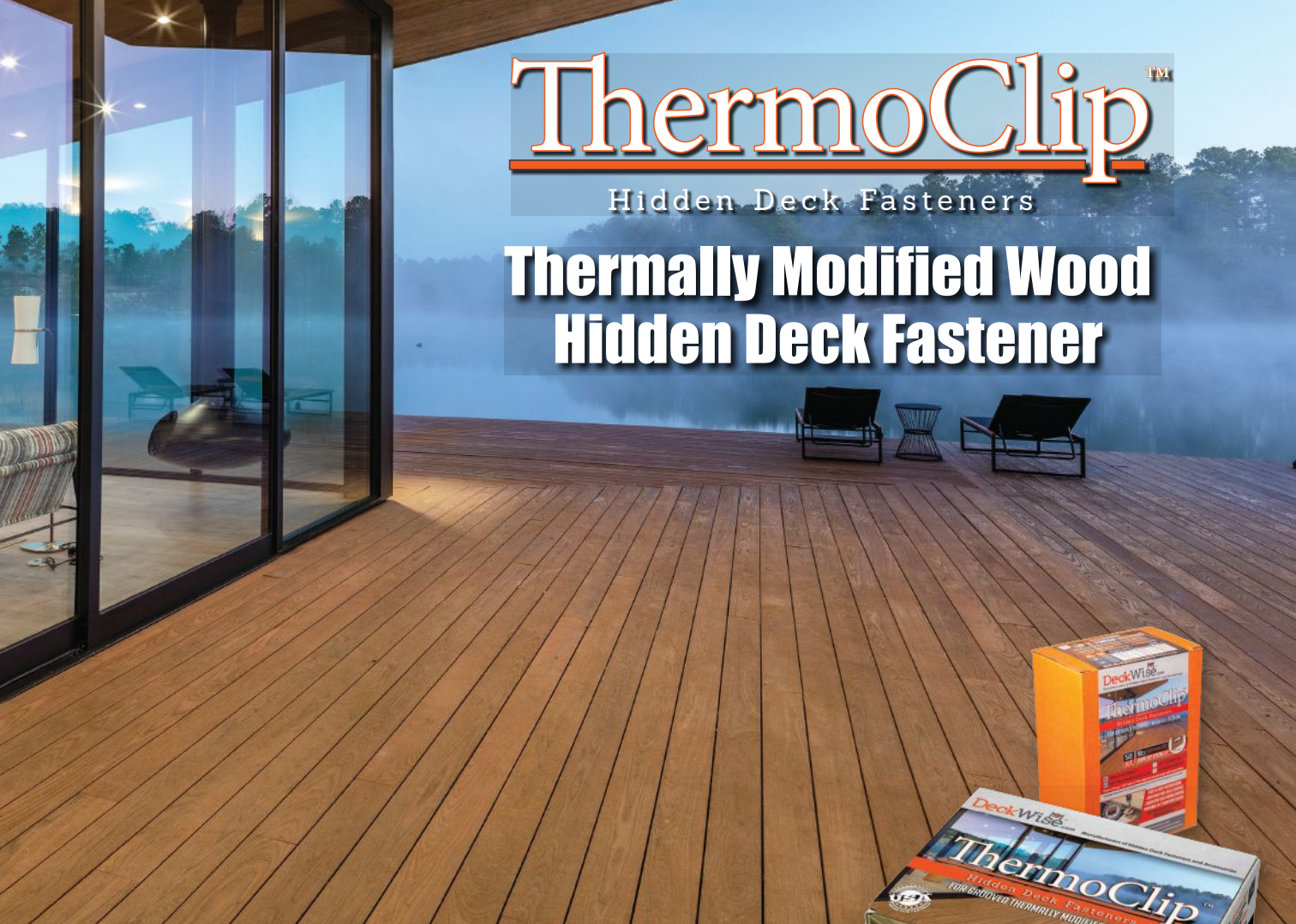
illustration suggests, the *Oxford English Dictionary* (OED) provides alternative interpretations: Variants of the word include the Flemish “waeghe,” wave, referring to “the undulation in the grain of wood.” This helps explain some of the earliest citations, beginning in the early 1300s, for “waghenschot” in the OED as a type of oak, specifically a “superior quality of foreign oak ... used for fine panel work.” “Waeghe” is also an alteration of Middle Dutch “weeg” or Old English “wah” (wall). The second part, “schot,” derives from the Middle Dutch for “partition,” “barrier,” or “bulwark” (the side of a ship above the deck), suggesting a screen to dress up and shield residents from rough-hewn wood or damp stone walls.

There are no fixed rules for beauty. In a home with tall ceilings and a full range of trim from base to crown, designing wainscoting to serve as a “pedestal”—a visual base for a composition of trim elements—seems “correct.” While in a simpler home, wainscoting that covers the bottom third of the wall or aligns with the dividing rail of double-hung windows (or some other element in the room) may look coherent and pleasing. It will still, as Forget says, transform the space, and perhaps serve a practical purpose as well.

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