Replacing a Wooden Gutter

A bowed, sagging wall complicated this custom repair

BY KYLE DIAMOND

Photos: Kyle Diamond

Late last fall, my company was asked to repair the roof on an older home—portions dated back to the mid- to late-18th century—that was an interesting mix of Federal style with Italianate influences. The clients had known when they purchased the house a couple of years earlier that the roof was in need of repair and that the built-in gutter on the main house was sagging and starting to pull away from the wall. During a pre-construction walk-through, they informed me that there had been large ice dams the previous winter and the gutter had pretty much ceased to drain properly over the spring and summer. Water stains were starting to appear on the inside walls on the main floor. It was time to act.

TEAR-OFF

With winter fast approaching, we decided to fix only the problematic gutter and adjoining roof on the front side of the main house and to postpone repairing the remaining roofs and gutters until the following spring. The existing roof had three layers of asphalt shingles over a bottom layer of cedar shakes, so a complete tear-off was in order, though we planned to salvage the existing brackets, frieze, trim, and siding as best we could. The roof deck consisted of 1x10 boards spaced an inch or so apart to act as skip sheathing for the shakes **(1)**. When we ripped off the layers of leaded tin, tar, and aluminum coil stock that lined the existing fir gutter, we found

that the original wood trough had deteriorated; where the gutter was sagging the most, it was cracked and severely rotted **(2)**. The gutter was big—8 inches deep, 12 inches wide, and 39 feet long—so we cut it into manageable pieces with a chain saw to safely get it to the ground **(3)**.

The clients mentioned that the second-floor bedrooms in the front of the house were drafty and difficult to heat, and I suspected that the splayed ceilings in these rooms had little or no insulation. So I proposed sealing the rafter bays with spray foam from the outside while the roof was open. The clients agreed, and we removed the bottom five sheathing boards and sprayed closed-cell foam using Touch 'n Seal's CPDS Series 2 portable two-part sprayer. We were able to spray, cure, and trim the foam to the top of the rafters in one day **(4)**.

BRACKET REPAIR

While removing the gutter, we managed to salvage most of the Italianate-style brackets, although the outer pendant profile snapped off a few of them. Also, we noticed that the brackets had pulled away from the frieze and that the subsequent gaps had been repeatedly caulked and painted over the years, which accounted for a fair amount of the gutter's outward bowing.

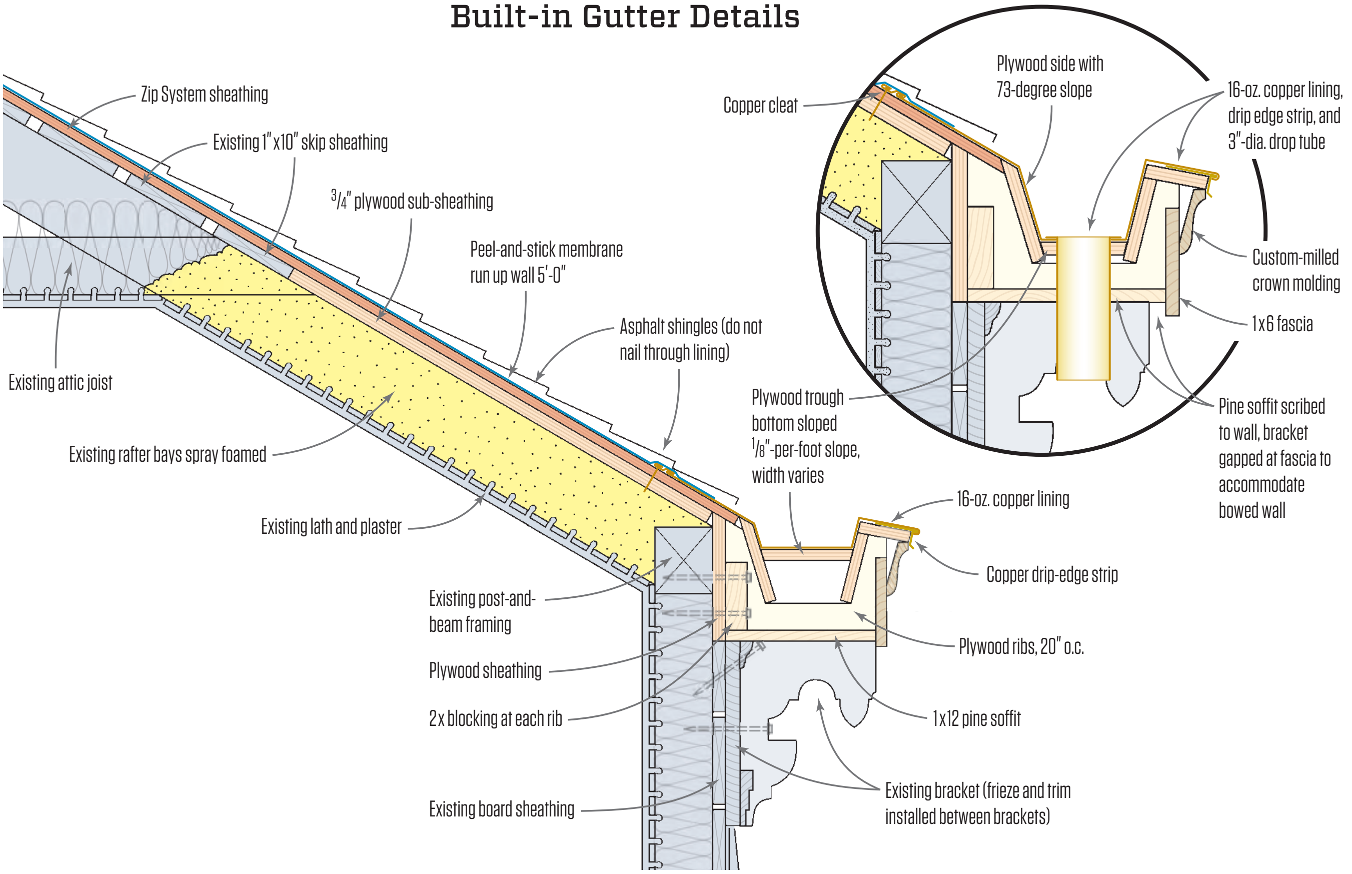
We decided to remove and properly reattach the brackets, with an eye toward leveling them as well. They had been fastened to the existing board sheathing, which was in fairly good shape, and the frieze and associated trim had been installed between them **(5)**. In a few locations, we added 2-by blocking behind the board sheathing where its ability to hold a screw was questionable **(6)**. We reattached the brackets top and bottom with GRK R4 multipurpose screws **(7)**.

Prior to reinstalling the brackets, I traced one that was undamaged on a scrap piece of plywood and cut it out to use as a template **(8)**. Back in our shop, I repaired the damaged brackets, cutting replacement pendant profiles from scraps of salvaged heart pine, joining new to old with wood glue and multipurpose screws.

With the brackets reinstalled, we sheathed over the foamed area with ¾-inch CDX to match the thickness of the board sheathing, then sheathed over the entire roof deck with ⅝-inch Zip System sheathing **(9)**. Along the top of the front wall, we installed a strip of plywood sheathing to close in the exposed wall framing, trimming the upper edge to match the roof pitch **(10)**.

For the sheathing layout, it worked out that the last course extended over the gutter, so we decided to use the sheathing to protect the gutter work area from the weather. Each night we tacked the last course of sheathing in place and taped the seams; then each morning, we peeled off the tape, removed the plywood, and continued working on the gutter. When the gutter work was done and we were ready for roofing, we ripped the last course of sheathing to width and fastened it permanently.

Built-in Gutter Details

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NEW GUTTER ROUGH-IN

With older homes like the one here, substandard framing and years of snow and ice loads cause the exterior walls to bow in the middle (the ends are more resistant to lateral forces due to their proximity to corner framing), which also brings the top of the wall out of level—with the middle being lower than the ends. For the new gutter, though, we wanted the middle to be the high point, with a downward slope toward the ends. That meant the new one would have to be taller than the original.

The wall had bowed approximately 2 inches out of line—not too bad for a house this old, though still significant. We decided to split the 2-inch difference. When we installed the new 1x12 pine soffit on the existing brackets, we scribed it to the wall, taking about an inch from the soffit's width in the middle of the wall where the bow was at its worst. We also "cheated" the bracket-to-fascia relationship somewhat: Whereas the brackets and new fascia touched at the ends, we left a 1-inch gap between them in the middle (see illustration, page 57).

To make it possible to keep the new gutter straight and fine-tune its slope, we installed a series of ¾-inch plywood "ribs" 20 inches on-center, scribing them to the bowed wall as needed to keep them in line, and adjusting them up or down in a few spots to help keep the bottom flat **(11)**. We cut them out using a router, providing a 73° slope for the sides and a notched front to receive the fascia board **(12)**. On one side of each rib, we fastened 2-by support blocking to the wall with a couple of 6-inch-long TimberLok screws. After the ribs were secured, we installed the rest of the Zip roof sheathing along the eaves, then inserted the sloped ¾-inch plywood sides of our rough trough, cutting the top of the inner panel to the roof's pitch.

Then came the fun part: fitting the sloped plywood bottom. First, we snapped lines on the plywood sides representing the ⅛-inch-per-foot slope we wanted, which worked out to about a 2½-inch drop from the middle out to the ends. Next, we custom-fit the plywood bottom, which, because of the angled sides of the trough, became narrower as it dropped in height **(13)**. This process took some time, but was made easier by having straight, parallel sides to work with. From inside the trough, the slope looked more pronounced than the 2½-inch drop we needed **(14)**, but this was an optical illusion created in large part by our compensating for the out-of-level wall. We fastened the trough bottom with screws countersunk into the angled sidewalls.

With the trough bottom in place, we installed a 3½-inch plywood cap that would help to align and support the crown molding **(15)**. The cap and molding wrapped around both ends of the trough, which

were sloped inward at the same angle (73°) as the sides **(16)**.

The last step in prepping the trough was to back-prime and install the fascia and crown **(17)**. We used Lifespan trim (lifespanoutdoor.com), a pressure-treated, solid select pine from New Zealand. I ended up milling the new crown, using knives from a previous remodel, to match the existing rake molding at the return **(18)**.

We ran peel-and-stick membrane up the roof 5 feet, leaving the backing on the bottom 12 inches until after the copper was in place. Before starting the copper work on the gutter, we installed architectural-grade shingles, leaving the bottom three courses off until the copper work was complete.

COPPER LINING

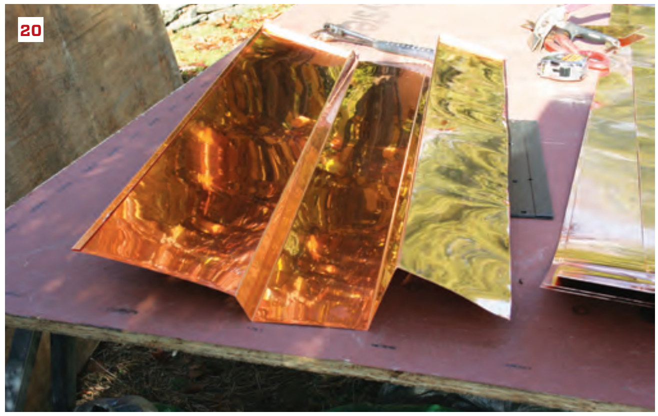
We've worked on five or six similar built-in gutters over the years. On the earlier ones, prior to installing the copper lining, we would fit building paper into the trough as best we could, fastening it with galvanized staples. But half the time the wind blew away the paper. Using a peel-and-stick membrane under the copper is out of the question because of the heat generated from soldering. These days we just place the copper directly into the plywood trough, which we are careful to keep free of debris, splinters, and raised fasteners.

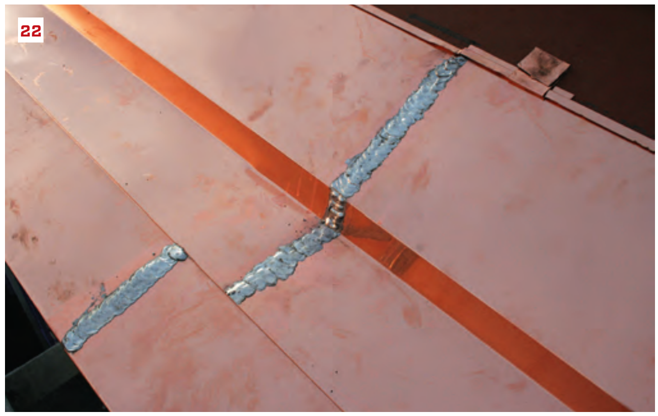
Typically, we install 16-ounce copper on all our work. We use a lot of it throughout the year, so we buy it in bulk to get the volume discount, which helps in the long run. The copper comes in 3-by-8-foot sheets, which worked out perfectly for this job.

We planned to start at the ends of the trough and work toward the middle, running two full-length pieces on each side, with two 44-inch lengths in the middle of the 39-foot gutter, where we would also create an expansion joint. To make all of the necessary bends, hems, and cuts, we used a Tapco Port-o-Bender Pro 2 brake **(19)** and a cut-off wheel. We began by running a continuous copper drip-edge along the top of the crown molding to keep water from running down the face of the molding and fascia. This is a big improvement over older methods, in which the metal liner was simply bent over the crown and nailed off every inch or so.

Each panel was formed with a trough in the middle and an upper and lower leg **(20)**. On the 6-inch-long roof-side leg, we formed a ½-inch upturned hem that would receive the copper cleats that hold the panel in place. It's important to gap this hem a little less than ⅛ inch to allow for movement when the copper expands and contracts. On the 4-inch-long crown-side leg, we made a ½-inch downturned hem.

Starting at one end of the gutter, we slid the crown-side hem over





the drip edge and settled the panel into the trough **(21)**, then secured it on the roof side with 1 ½-inch-wide copper cleats 24 inches on-center, fastened to the sheathing with 1 ½-inch-long copper nails. We overlapped the next liner panel by 3 inches, then soldered the seam **(22)** (see Soldering Seams, facing page). With two panels in place at one end, we switched sides and installed two panels at the other end.

EXPANSION JOINT

As the sun heats up a copper liner, every 20-foot run has the potential to expand approximately ¼ inch, moving from the fixed end point toward the center. Without an expansion joint on a gutter this long, the solder joints would likely fail. Where expansion joints should be located depends on the gutter's width and the thickness and profile of the copper. As a general rule of thumb, there should be an expansion joint no less than every 30 feet. Following guidelines from an old edition of Revere Products' *Copper and Common Sense*, I determined that our new gutter—built with 16-ounce copper, a 5 ¼-inch bottom dimension, and sidewalls angled at 73°—should have expansion joints somewhere between 19 and 21 feet on-center, which works out to be dead-center in our 39-foot run, between the two 44-inch panels.

One end of each of these short panels overlapped the full-length panel next to it. At the other end, where the two short panels faced each other, we bent 1-inch upturned hems. We left a gap of a couple of inches between the two panels—this would become the expansion joint—then soldered vertical "dams" in the troughs **(23)**. Hems at 90° on the edges of these dams would interlock with the expansion-joint cap where it crossed the gutter trough.

We installed the cap in two pieces **(24)**, bending its hemmed edges over the hemmed edges in the panels, then soldering the horizontal seam between the piece running up the roof and the one covering the trough **(25)**. The unsoldered hemmed edges would act as slip joints as the gutter expanded and contracted.

With the expansion joint set, we finished off the returns at each end. We used the brake and a pair of tin snips to form filler pieces that capped the ends of the trough and also covered the remaining exposed roof and the crown-molding cap returns. Where the filler

SOLDERING SEAMS

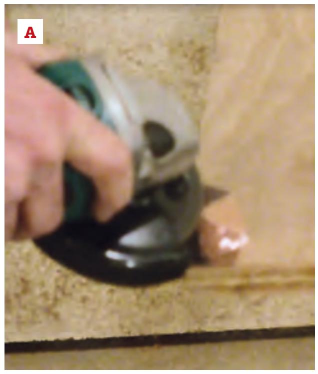
We use a pyramid-tipped, acetylene-fueled soldering iron for our roof and gutter work; propane models and other types of tips are available. Regardless of the iron or tip used, soldering requires some prep work. Make sure that the tip is clean and that the four facets are flat and meet at a sharp point; otherwise it will be difficult to control the flow and direction of the solder. We use a grinder with a metal wheel to flatten the facets **(A)**, then we sand them using an orbital sander with 80-to-120-grit paper.

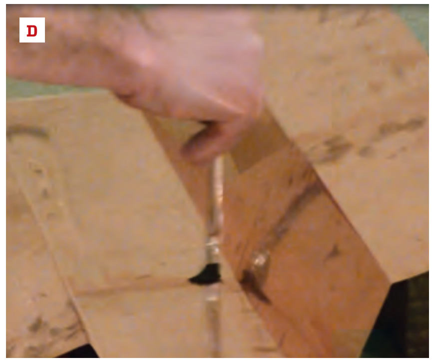
Light the iron and keep it on a low setting so it heats up slowly. When it's hot enough, "tin" the tip on a scrap piece of copper **(B)**. Spread flux, then melt enough solder to spread evenly on all four facets of the tip **(C)**. Tinning makes for a smooth flow of solder when working a seam.

Most of the seams in a gutter are flat—no fold, just metal overlapping metal. To begin soldering, brush flux on the seam, making sure it flows between the sheets **(D)**, then "tack" the seam in several places with a spot of solder **(E)**. This keeps the two pieces of copper in close contact with each other so that they will heat up evenly.

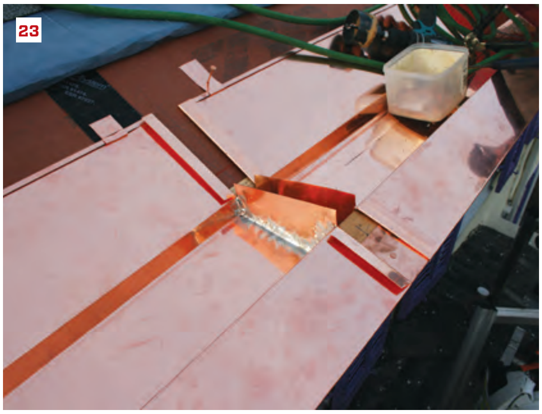
Soldering is two-handed work: One hand works the iron, the other controls the solder stick. While holding the iron at a shallow angle with the tip against the metal, press the solder stick against one facet of the tip until a drop of melted solder forms **(F)**, then use the iron to spread the drop across the seam **(G)**. Each drop adds another layer, and the heat of the iron on the copper draws the solder into the seam to make a water-tight seal. The thick "ribs" reinforce and strengthen the seam **(H)**.

If the copper gets too hot, the solder will become runny and difficult to work, especially on a vertical seam. A slightly cooler tip will give you better control as you build layers of solder. If the copper gets too hot, lift the tip off the metal for a few seconds; adding flux will also cool the seam. —*K.D.*





Photos captured from author video



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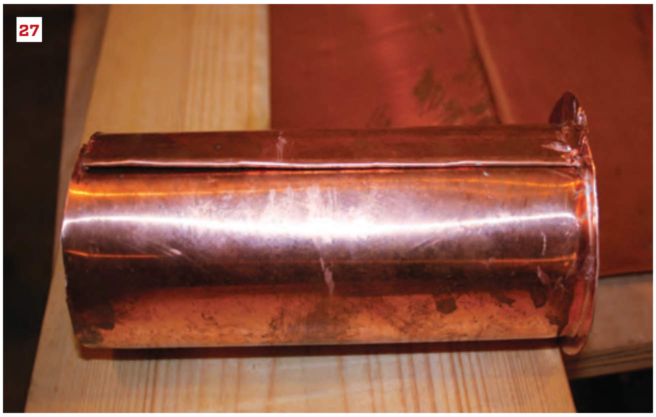

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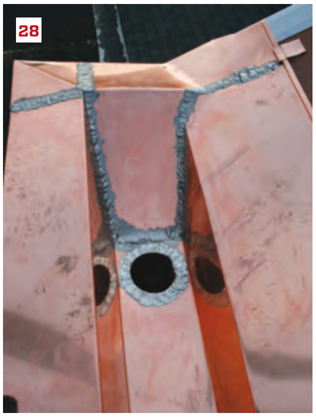

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met the trough, we bent a ½-inch leg that would form the soldered connection. To install these pieces, we slipped the legs under the liner trough, molded the upper portion to the roof, the crown-molding cap, and the gutter return, and soldered the seams **(28)**.

DROP TUBES

We install drop tubes last. A typical flaw with older built-in gutters is undersized drop tubes—I've seen them with diameters as small as 1 inch. For this gutter, we planned for larger, 3-inch-diameter drops. We began by drilling a 3-inch-diameter hole through the copper liner, plywood trough, and pine soffit. We then shaped an 8-inch-wide piece of copper over a piece of pipe and closed the tube with a single-lock seam. Next, we inserted the drop pipe through a 3-inch hole drilled into a 2x8 clamped in a vise, then pounded down the top ⅜ inch with a hammer **(26)**, creating a flange that would seat itself against the trough bottom **(27)**. (Copper is only so malleable—any more than a ⅜-inch flange and it will tear.) After soldering the seam, we slid the drop tube into the gutter trough—it projected about 4 inches below the pine soffit—and soldered the flange to the trough liner **(28)**.

With the copper work finished, we peeled the paper from the last 12 inches of the peel-and-stick and sealed it to the copper, then nailed off the bottom three shingle courses, being careful not to drive any nails through the copper lining.

COST

Start to finish, the work described here was mostly done with a three-man crew and took about two weeks to complete. The total cost for the gutter, including the plywood trough, was about $6,400, with the copper fabrication and installation portion accounting for about $3,100 of that (roughly $165 per linear foot). Every project has complicating factors; this one was made more difficult by the work that had to be done to compensate for the bowed, sagging wall. I expect the other gutters on the house to be a bit easier and less costly to repair when we return in the spring.

Kyle Diamond is a partner with his father, Dale, in New Dimension Construction, in Millbrook, N.Y.