

Beating the Old Flue



Learning about old houses is a never-ending process. In the past I've sized up many a chimney with a simple "looks ok" or "needs a little repointing," but watching masonry contractors like Marty Naber repair and restore chimneys has given me a deeper understanding of what I'm seeing. Marty taught me that even good eyesight and experience are no substitute for climbing the roof and inspecting a chimney up close. Some chimneys that appear good from the ground are ready to blow over in the next hard wind.

That's what Al and Barbara Jenkins discovered when they bought their 1908 home in Rochester, New York. The prepurchase

inspector suggested that their chimney needed work, an assessment confirmed by their roofing contractor, who recommended Marty Naber for the job. Marty's prescription, however, was more extensive: Take the chimney down to the roof, clean the old bricks, and rebuild it with new clay tile liners, flashing, and flue liners. Watching Marty work became a hands-on lesson in the methods for rebuilding chimneys and caps.

Undoing the Flue

Al and Barbara's three-flue chimney is original to the house and is constructed of long, thin Roman bricks laid in narrow mortar beds. Sometime in the past, the outer wythe (vertical section) of brick had been repointed from the roof up, but the

pointing was shallow so the bricks were loose in their mortar beds. When I arrived, Marty had already begun disassembling the chimney—removing the bricks by hand without force and setting them aside for the next step.

Since Roman bricks are no longer available, Marty cleaned the old bricks with a hammer, chisel, and grinder for later reuse. Recycling brick is not always possible or economical, but in this case, it preserved the architectural character of the house. The clay flue liners, however, were deteriorated from years of flue gas that slowly ate away at the clay. These were easily removed and discarded once the brick was gone.

Before starting to rebuild the chimney, Marty experimented with masonry tints to

Blues

By STEVE JORDAN

Steps to restoring chimney tops.

Viewed from the ground, many old-house chimney tops look sound, but it's this above-the-roofline masonry that usually suffers most from weather exposure and flue gases that condense into corrosive liquid.

Marty Naber easily disassembled the chimney to recycle the thin Roman bricks. A shallow repointing job left much old, crumbling mortar in the joints.

ALL PHOTOS STEVE JORDAN EXCEPT WHERE NOTED



The original cap was a piece of stone, now broken, that protected brickwork while it covered the voids between bricks and flues.

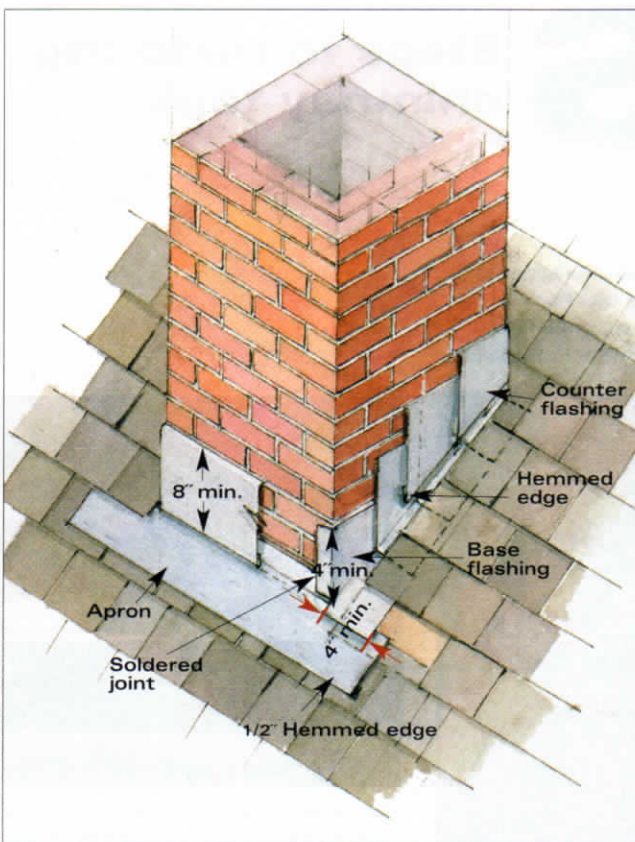


With tiles gone, Marty begins rebuilding the chimney with the first course of brick at the roofline, just below where he will set the flashing.



Once the chimney was disassembled, it was easy to see the deteriorating clay tile liners and remove them—down about 36" for one flue.

Chimney Flashing

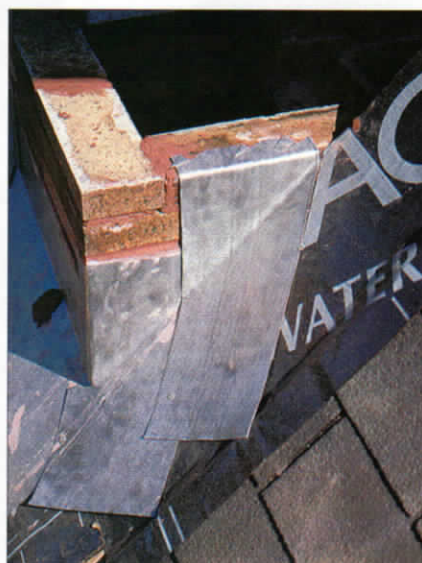


ALL ILLUSTRATIONS ROBL LEANNA

Two-piece step flashing can be installed in a variety of ways, but the method shown above is typical. An apron flashing lies atop shingles below the chimney, while pieces of base flashing installed with each course of shingles run up the sides a minimum of 4." Counter flashing set into reglets in the mortar joints then laps over the base flashing.



Marty bends his flashing right at the chimney and forms strips of lead-coated copper into a single piece flashing using his level as a form. Lead coated copper is popular for some roofs because of its grey color.



As each brick course gets another piece of sheet metal, the flashing builds into steps. Note how the metal edge turned into the mortar joint is fashioned into cut-out burrs to anchor into the mortar.

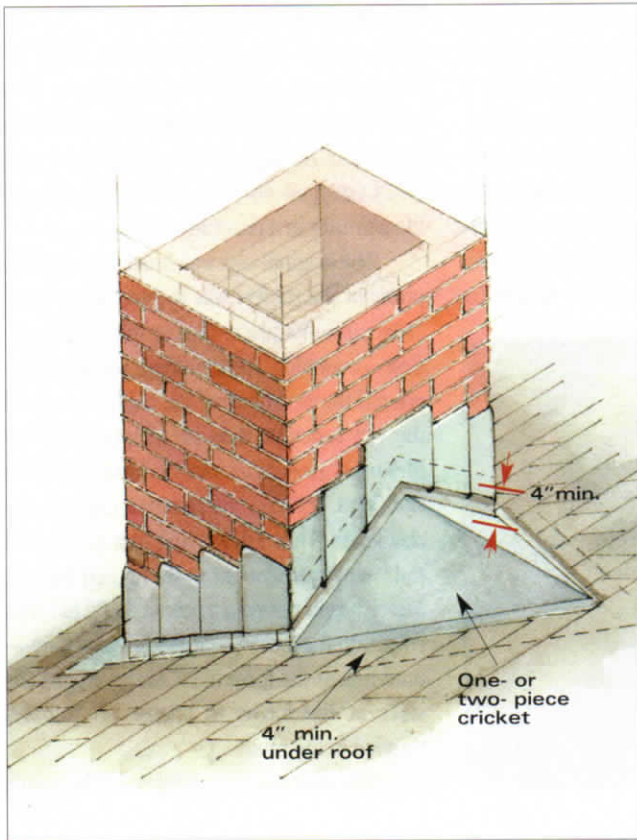
achieve a mortar color that, when dry, would look similar to the original mortar. Marty was also careful to choose a mortar recipe that would be the appropriate hardness. The ASTM type N mortar he chose (approximately 1 part portland cement, 1 part lime, 6-plus parts sharp sand) is typically used with relatively hard 20th-century brick. It is too inflexible, though, for older, soft brick that was common in the 19th century and earlier. A softer formula, ASTM type O (approximately 1 part portland cement, 2 to 2 1/2 parts lime, 8 to 10 parts sharp sand) is appropriate.

When repointing or repairing brick or stone structures, it is important to hire a contractor experienced in historic mason-

ry. Repointing and reconstruction is a tedious process but, when well done, lasts a lifetime. Remember, the mortar should always be softer than the masonry units (brick, stone, or block). In fact, historic mortar is actually a sacrificial material that absorbs shock and movement. Repairing cracks and deterioration in the mortar joint is normal maintenance while replacing the masonry units is not. When the project requires it, most masons match the color of old mortar with limefast masonry tints, sometimes including white portland cement. In important preservation and restoration work, the original mortar color and texture are best replicated by using sand that matches the original in color and

size. The older the house, the more likely that the sand came from a local creek, river, or quarry. Since every project has different requirements, it's valuable to first research the subject in references, such as the National Park Service Preservation Brief #2 "Repointing Mortar Joints in Historic Brick Buildings" (available online at www2.cr.nps.gov/tps/).

As Marty carefully laid up the new courses of brick, he installed new flashings of 20-ounce lead-coated copper to ensure a waterproof transition between the chimney and the roof. Many sheet-metal craftsmen use a special metal-bending tool called a brake to form flashing, but Marty expertly bends his flashing on the roof



Saddle flashing, also called a cricket, is customary to shed rain and snow on chimneys that don't penetrate the roof at a ridge. Saddle flashings extend a minimum of 4" out onto the roof deck and 4" up the chimney, where they are lapped by counter flashing. Large saddle flashings are supported by wood framing underneath.



The basic chimney rebuilt with original bricks and new flue tiles is ready for the corbeled top and cap. Note the completed flashing and the metal ties securing the bricks between the liners.



After corbelling out the flared brick top, Marty attaches metal cap forms, then pours in buckets of high-strength, premixed concrete mortar (Quickrete 5000). Wrapping the flue liners with thin, closed-cell foam (the same material used for sill insulation) prevents the mortar from adhering to the tile.



When the form is partially filled, Marty inserts lengths of steel "pencil rod" to reinforce the concrete cap. Finding matching clay flue tiles was not a problem on this project. Most of the old sizes are still available, although small dimensions such as 4" x 12" and 4" x 16" may have to be special ordered.

using his level and the rigid edge of the scaffold plank. As the work proceeds, he weaves his metal under the shingles forming the base flashing. Then he forms a short but adequate right angle bend on the counter flashing and bars it on the end with tin snips for grip as he sets it in the mortar joint. As the courses rise, Marty's technique creates a one-piece stepped flashing system. Chimney flashing is also commonly installed as a two-piece system that allows the base flashing to be changed when replacing the roof while still retain-

ing the counterflashing attached to the chimney (see drawing on previous page).

Always choose a mason with the skill and experience to install your chimney flashing. Although roofing, sheet-metal work, and masonry are separate trades, the job should go more quickly and more economically if the mason installs the flashing while the scaffolding is in place and without having to postpone work or wait for another tradesman to arrive and finish. Since a chimney restoration lasts a lifetime, your flashing should, too. Don't be penny-wise but pound foolish by

opting for aluminum or galvanized steel flashing; 16 ounce or 20 ounce copper should last 50 to 75 years.

Constructing a Cap

While Marty laid the courses of brick, he installed new replacement clay liners that match and join up with those in the rest of the flue below. As he neared the top, Marty corbeled (stepped out) the bricks to terminate the chimney in a decorative flare.

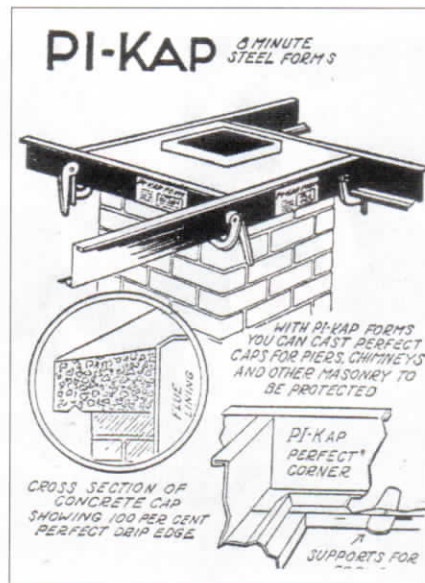
The original cap was broken, so the last phase of the project was to pour a new concrete cap in its place. To cast this cap, Marty first assembled four angled metal forms around the perimeter of the chimney to hold the wet concrete. Next he wrapped the flue tiles in 1/4" closed cell foam to leave an expansion joint between the concrete cap and the clay liners. Then after laying in a 3/8" "pencil rod" reinforcement bar to strengthen the cap, Marty began pouring a mix of 5,000 psi concrete into the form—one bucket at a time—until full. As the form filled, Marty tapped the sides of the forms to release air bubbles trapped in the mix.

The next day Marty released the forms

After he removes the cap forms, Marty cleans the brickwork and cap before proceeding with the final steps, such as cutting the drip reglet under the cap, cutting back the foam, and caulking the joint around the flue tiles.



Right: Today's universal chimney cap forms work essentially the same way as the first versions that appeared in the 1910s. The PI-Kap advertised in 1929 even cast a drip reglet in the cap bottom.



Right: To bring the furnace flue up to code, Marty installed a stainless steel liner by starting at the chimney top and pulling the liner through the flue with a guide rope.



Why Flue Liners?



JAMES C. MASSEY

Cast-in-place liner systems form a seamless conduit inside the chimney masonry using lightweight, cementlike materials and proprietary methods, such as this inflatable bladder device.

On a February day a few years ago, my nearly new gas furnace shut down for no apparent reason. After inspecting the furnace and looking for obvious reasons for failure, my HVAC repairman removed the metal exhaust joining the furnace to the chimney to find the flue plugged with small clay shards and dust from the deteriorated clay liner in my old house. Fortunately, my modern furnace was designed to stop firing if the flue gases could not be discharged. Had this not been the case, my house could have filled with carbon monoxide, and we might have been killed.

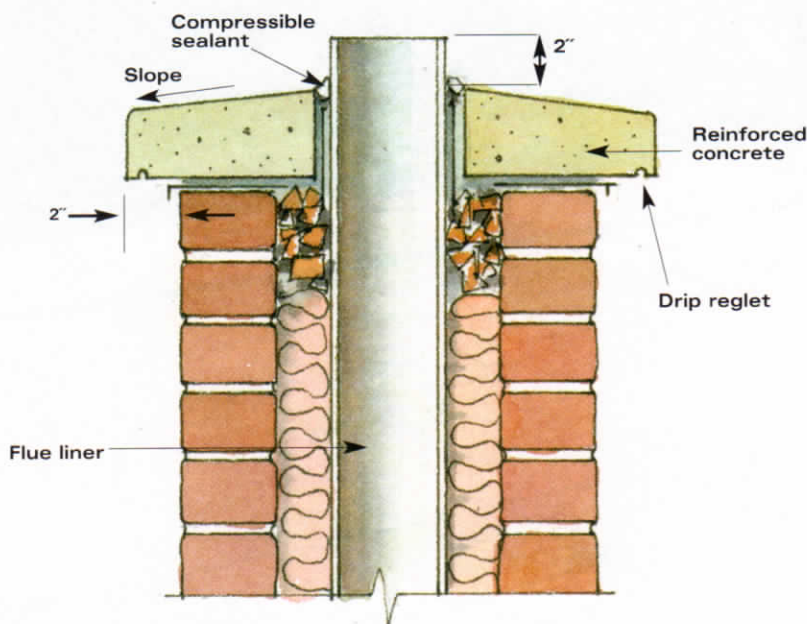
That day I learned, once again, why regular inspections and fire-code compliant flue liners are essential for the safe performance of any masonry chimney. Liners not only protect wood and other combustible house parts from the heat moving in the chimney, but they also protect the chimney masonry from combus-

tion byproducts that can corrode it. Modern high-efficiency furnaces contribute even more to the deterioration of old chimney flues because their exhaust gases—which carry far less heat than former heating-plant designs—condense before they reach the top of the chimney.

There are three main types of flue liners: clay tiles, metal conduits, and cast-in-place systems. Consulting a chimney inspector and assessing the construction of your chimney and the nature of your heating system will determine which is appropriate for your old house. If your furnace is powered by gas, for example, either an aluminum or stainless-steel liner may meet code. If your furnace is powered by fuel oil, you'll need a stainless-steel liner.

Before you embark on lining a chimney, also weigh the option of installing a high-efficiency gas furnace that vents through the foundation wall. —S.J.

Cast-in-place Chimney Cap



from the freshly set concrete. He mixed a small amount of portland cement, sand, and bonding agent and rubbed it into the pin holes and imperfections in the surface of the cap. A few days later, he cut back the foam wrapped around the new flue tiles, filled the joints with a durable flexible silicone sealant and applied a coat of sealer (Conproco K-88) to the cap to prevent water penetration. Last, fitting a diamond blade on his grinder, he cut a drip reglet on the under side of the cap overhang to prevent excessive amounts of water from running off the cap and creeping back onto the brick.

Since Al and Barbara's house was fitted with a recent high-efficiency gas boiler, the final step in rebuilding the chimney was to install a metal flue liner in the aging clay flue to meet the building code. Marty and his crew prepared the top quality, 316 TI-alloy stainless flexible liner on the ground and attached a messenger line that would help pull it through the chimney. When finished, the chimney was ready for another generation or two of heating in Rochester winters. 🏠