Building a fireplace step by step

Tom Kasper probably has built more than 2,000 fireplaces during the 25 years he has been a mason for Fragassi & Son Inc., Wheaton, Illinois. Kasper knows fireplaces inside and out and all the tricks to building them.

The following steps are not textbook rules or theoretical techniques for building a one-story fireplace. This is simply the way one mason—Tom Kasper—built one fireplace. The completed fireplace is part of a stone fireplace wall. Flush with the wall, the fireplace has a raised hearth that projects into the room. On the exterior, the chimney is brick and the wall is veneered with brick.

In all, this fireplace required 75 firebrick for the firebox, about 600 brick for the backup walls and throat, 700 brick for the shell and 1,100 brick for the chimney. This is not including the concrete block used for the foundation or the stone veneer. The entire fireplace required about 64 labor hours. Three masons built the shell and chimney, but only one—Tom Kasper—built the fireplace.

Step 1: The foundation
The concrete contractor poured most of the fireplace foundation integrally with the concrete basement wall. The 10-inch-thick basement wall was simply jogged out to create the ash pit under the fireplace. Kasper and his crew closed off the fourth side of the ash pit by infilling with concrete masonry, leaving a cleanout door in the masonry wall to remove ashes.

The size of the fireplace foundation was determined by the firebox size. In this case, a 3-foot-wide firebox on the first floor required a 6x2-foot foundation.

Step 2: The foundation top
At the top of the foundation, two sets of 4x6-inch angle irons were placed from the foundation’s outside wall to its inside concrete masonry wall. Then, three rows of half concrete blocks were laid on the angle irons to close the top. Split lengthwise from 4-inch-thick block, the half shells left space for a concrete hearth slab. Mortar placed on the angle irons held the blocks in place. Later, a wooden punch was used to knock a hole through the middle row of blocks so ashes could fall into the ash pit. This row of blocks was laid flat side up to make the hole punching easier.

Step 3: The shell
Next, the shell, or outside walls, of the fireplace was laid. Kasper and his crew built the shell with used brick and raked the mortar joints for aesthetic reasons. Built to the top of the first floor, the shell was nine-and-a-half brick wide and three brick deep. The inside of the shell was parged with Type N mortar to seal and weatherproof it.

Step 4: The hearth
On top the block halves that formed the roof of the ash pit, a...
reinforced concrete slab was poured. This slab supported the firebox and cantilevered from the block infill wall to support the raised outer hearth. A rectangular opening had previously been cut into the wood floor of the room to allow for the cantilever and raised hearth. A temporary sheet of plywood was used to form the soffit of the cantilever. The plywood sheet was laid from the top of the block infill wall across the floor opening to a parallel floor joist. At the joist, it was set on and nailed to the top of a 2x4 that had been nailed to the side of the joist. This caused the plywood to slope upward from the block wall, making the slab thinner and lighter as it jutted 20 inches into the room. To reinforce the slab, #5 rebars were placed every foot. The hole to the ash pit was left open.

After the concrete slab had set, the hearth was built up further, first by a course of concrete block, then a course of standard brick. The number of brick courses determines the height of the hearth, which can be level with the floor or raised as high as 1 1/2 feet, depending on the owner’s preference.

Along the wall to each side of the fireplace, a narrow strip 5 inches wide also was cut into the wood floor, directly above the basement foundation wall. The resulting voids were filled with concrete to support the stone veneer face of the fireplace—the final step.

**Step 5: The firebox**

Kasper laid the firebrick floor of the firebox over the standard brick. Also called the inner hearth, the firebrick floor was four brick wide and five brick deep. The firebrick were laid as tight as possible (3/8-inch joints) with refractory mortar. Kasper says the most common mistake made when building the firebox is making the joints too wide. Wide joints may burn out faster.

The side and back wall brick were laid on their sides in the shiner position (the Brick Institute of America, however, prefers the thicker wall created by stretchers). The back wall was three brick wide and the side walls were two brick long. This arrangement and the angle of the damper determined the angle between the back wall and the side walls. The back wall was centered on the floor and the side walls flared out to the firebox opening, which was four brick wide (32 inches).

Kasper used his trowel to cut the angles that don’t show and thus don’t have to be precise. These include some of the brick forming the back angle, as shown in the photo.

**Step 6: The firebox slope**

At some course height, the firebox must begin to narrow to the size of the damper. Kasper sloped the last four courses of the back wall toward the fireplace opening. Each course was angled in 1 inch.

He carefully measured and marked the angle on the end brick of the side walls and cut the brick with a saw to maintain the proper angle. Then he carefully laid the back wall to that angle.

To slope the back wall, the bed joint of the first course that was sloped was laid thicker at the back of the joint than at the front. The angle could have been cut into the brick, but then the side walls would have been higher than the back wall. The back wall of the firebox shouldn’t be curved, says Kasper. Curving it makes it difficult to align joints and thus doesn’t look as nice.

When the 31 3/4-inch-high firebox was complete, Kasper used a pointing trowel to fill chips and cracks in the mortar joints.

**Step 7: The damper**

After the firebox was built, Kasper set a steel angle lintel across the fireplace opening from side wall to side wall. To make room for the lintel, he left the last course of each side wall about 2 inches short in the front. The lintel supports the damper and the masonry above the firebox opening (called the fireplace face).

After installing the lintel, Kasper installed a 36-inch-wide damper, setting it on a bed of mortar laid over the lintel and the top course of the firebox. Mortar laid on the lintel sealed the seam so smoke wouldn’t escape out the fireplace face. Conventional mortar was used for this step; refractory mortar was used only in the...
The Brick Institute of America (BIA) recommends installing the damper a few courses above the lintel, not directly on the lintel (Ref. 1). To allow for thermal expansion and damper movement during fireplace operation, wrap the damper with a compressible, noncombustible material—such as fibrous insulation—after setting it on a thin bed of mortar. An additional lintel placed above the damper keeps the masonry above the damper from bearing on it. If the masonry does bear on the damper, thermal expansion of the damper can stress and crack the masonry. Also, place a compressible, noncombustible material at the ends of the steel angles where they are embedded in the masonry.

Step 8: The throat

Next, four courses of brick were set on top the damper, leaving enough clearance for the damper door to open upward. At the fifth course, the side and front walls were corbeled an inch, while the back wall remained straight. Corbeling of the throat (also called the smoke chamber) continued an inch each course until the throat was the width of the square clay flue tiles that line the chimney—10\(\frac{1}{2}\) inches in this case.

To compute how much to corbel each unit, divide the horizontal distance to be corbeled by the number of courses. According to the National Fire Protection Association (NFPA) 211 (Ref. 2), smoke chamber walls shouldn’t be sloped more than 45° from the vertical and shouldn’t be taller than the width of the fireplace opening. Walls should be at least 8 inches thick, 6 inches if they’re lined with firebrick. And they must be at least 2 inches from combustible materials, including wall studs, exterior sheathing, and drywall.

According to BIA, the last two courses before the flue liner should be laid as headers cut to a length that provides total perimeter support of the flue liner without obstructing the flue liner opening (Ref. 1).

Kasper parged the top of the throat with mortar, then set the first flue tile. The outside of the throat also was parged with mortar to seal it.

Step 9: The backup wythes

As Kasper built the fireplace, he also laid two wythes of conventional brick surrounding it. Their purpose simply was to fireproof the firebox. Because they’re not exposed, these wythes didn’t have to be carefully laid.

Once the backup wythes were as high as the damper, Kasper laid concrete block in the back corners of the shell to fill the remaining spaces between the firebox and the shell. Concrete block was used for convenience—stacking concrete block was quicker than laying several courses of brick. The block were laid to a height above the first-floor ceiling, where they supported the raked stones on the chimney (Step 11).

Step 10: The fireplace face

After the throat was connected to the chimney flue, Kasper could finish laying the brick backup for the fireplace face. He installed corrugated flexible wall ties in the brick bed joints for attaching the final stone veneer finish.

Step 11: The chimney

The flue tiles were mortared together end on end and laid as the chimney was built around them (NFPA 211 requires nonwater-soluble refractory cement). As each tile was added, brick were laid to the tile height. The chimney extended from the fireplace throat to above the roof of the house. It was six-and-a-half brick wide and
required nine-and-a-half flue tiles. On the outside of the house, the shell was cut on a rack to reduce it to the width of the chimney. Thin, rectangular stones were placed on top of the racked face. Without the stones, several battered courses of brick would have had to be laid to reduce the shell to the chimney width. The stone also provided a good, weather-resistant surface.

The carpenter used a chain saw to cut a hole in the roof overhang to make room for the chimney. The hole could have been made when the roof was built, but the hole might not have aligned with the chimney.

By code, the chimney top must be 2 feet higher than any part of the roof within 10 feet and 3 feet higher than the highest point of roof penetration. In this case, the chimney top was 16 feet from the roof peak. Kasper’s crew built the chimney 2 feet higher than the peak so the fireplace would receive a good draft.

Step 12: The chimney cap

Centered in the rectangular chimney shaft, the flue left a void on each side. To close off these voids, under the second to last chimney course Kasper placed short steel conduit tubes across the opening. Then he set the top two courses of brick on the tubes, laying the last course about 8 inches below the top of the flue tile to allow room for the cap. To create a recess for pouring the cap, to form a drip, and for aesthetic reasons, the last course protruded \( \frac{3}{8} \) inch past the course below it.

To form the 4-inch-thick concrete cap, Kasper set a rectangular wooden frame on the edges of the last course and filled it with concrete. After the concrete set, the wooden frame was removed. A spark arrestor screen, a square wire basket that keeps fly ash from coming out the top of the flue, was placed over the flue tile, thereby completing the chimney.

BIA recommends flashing cast-in-place caps to prevent water intrusion (Ref. 3). Flashing also serves as a bond break between the cap and the brick chimney. To allow for vertical thermal expansion of the flue tile, a minimum 1-inch air space should be left between the flue tile and the cap. Fill the air space with a polysulfide, butyl, or silicone sealant supported by a backer rod.

Todd Watson is a graduate of Southern Illinois University, where he earned degrees in journalism and civil engineering. Watson also took the photographs for this article.

References