

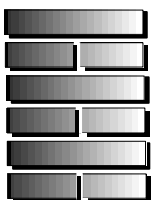
Revised September 7, 2000

Heat-Kit System
Modular Contraflow Masonry Heater Core
Assembly Manual

HK-22no

22" Firebox, no bakeoven

Custom: top left exit, reduced height, clearance for beam on right



Masonry Stove
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Material List (in addition to core components)

240	Standard Firebricks 4.5"x9"x2.5" (2.5" dimension may vary. Important: The 4.5" and 9" dimensions are important)
20	Firebrick "Splits" 4.5"x9"x1.25"
30	Common clay bricks (8"x4" nominal)
2 bags	"Mortar Mix" (ie., premixed with sand, as opposed to "Masonry Cement", which requires mason's sand)
1 bag	Portland
1 bag	Vermiculite (Blok-Fil, Zonolite, etc.)

Assembling the Bottom End

The bottom end of a contraflow heater is where most of the complication is. The two downdraft channels connect here, underneath the firebox. As well, the chimney connection and the cleanout openings for the particular installation need to be determined and located here. (Note: this custom heater has no chimney connection at the bottom)

Our thinwall refractory castings simplify the job of making the necessary cutouts with a portable masonry saw or a skilsaw. If you take a little extra time at this stage, particularly with the layout, you'll avoid problems later on.

Note: the normal 4" insulating base pad is not used with this heater, due to the height restriction. To lay out the core, mark a 41.5" wide X 23" deep rectangle on the basement floor, according to the layout below:

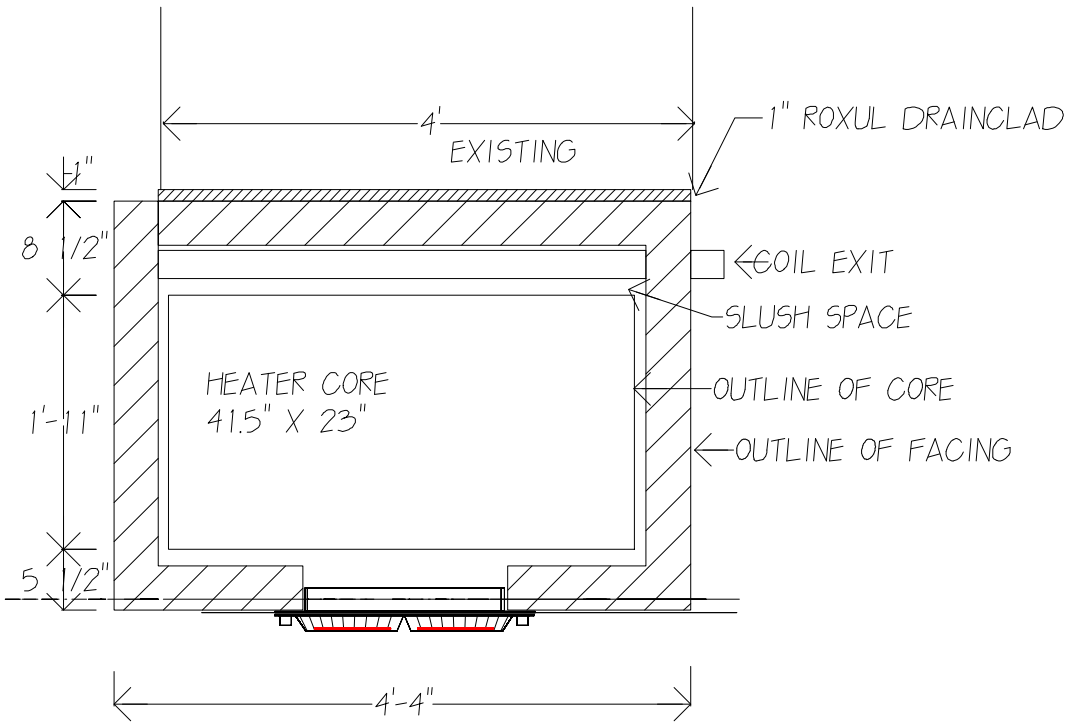


Figure 1

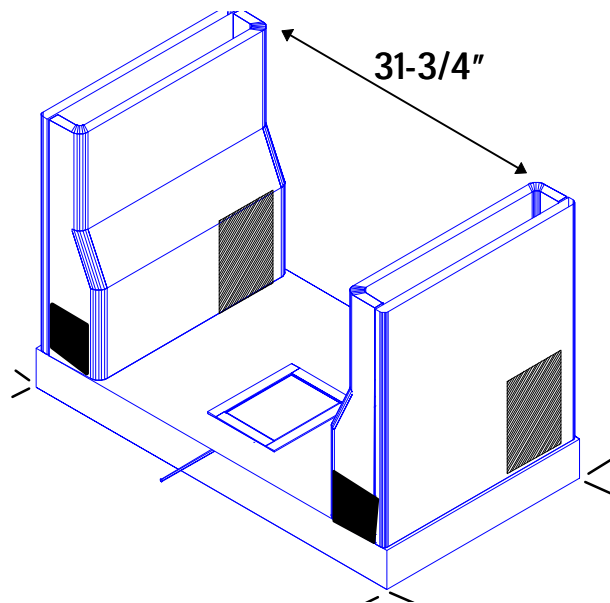


Figure 2.
2 Base channels sit dry

(Note: the insulating base slab shown above is not used. Set channels on concrete basement floor instead. Where reference is made to the base slab, use the layout lines that you have made on the floor, instead.)

Before setting base channels, cut appropriate holes for clean outs. Also make the cutouts for the connecting duct, that are pre-marked on the channels in red. In this example, a right side chimney and front channel cleanouts are shown. There is no bottom chimney connection on this heater.

Set base channels dry as shown. Bottom seam will be sealed later by mortar slush between channels and facing.

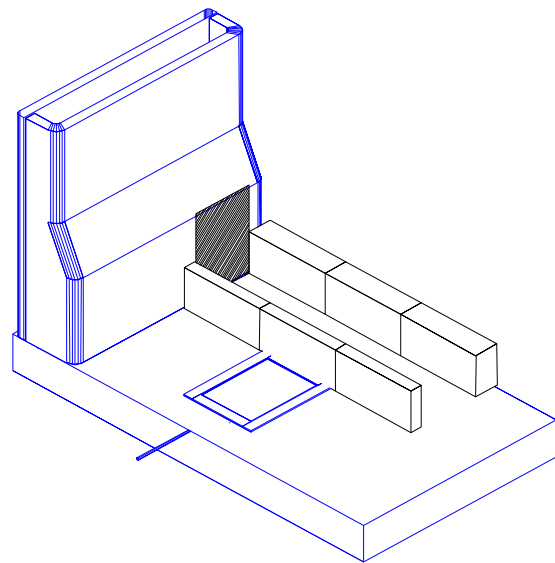


Figure 3.
Connecting channel is started
Right base channel not shown (for clarity)

Build connecting channel, using refractory mortar.

Firebrick shiner is flush with outside of slab. Firebrick split shiner is set to form a 6-1/2" channel.

(Note: "shiner" = brick set on edge)

The air control that is shown is not used for this heater. Because it is sitting on a slab, there will be an ash space under the firebox floor. The combustion air will come in through the ashbox door (installed in the facing), which has an air slider.

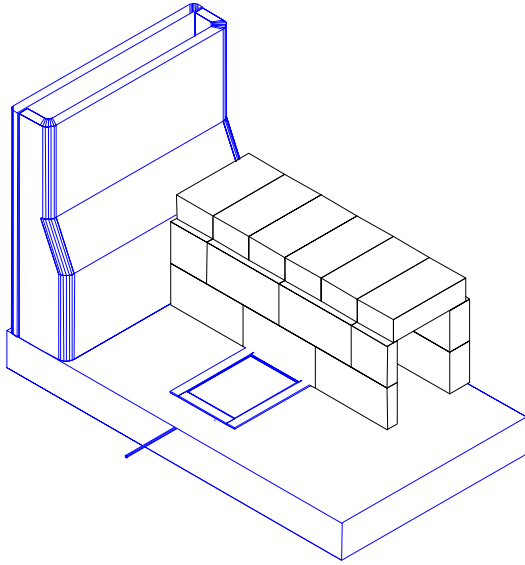


Figure 4

Form connecting channel ceiling as shown.
Sponge inside of channel to remove hanging drips.

Fill any large gaps between bricks and lower channel with regular mortar.

Because there is no insulating base slab, to keep heat off the basement floor, lay in 1 - 1.5" of vermiculite/portland on top of the existing concrete floor, inside the ducts. The mix should be around 2.5 vermiculite to 1 concrete, water to suit.

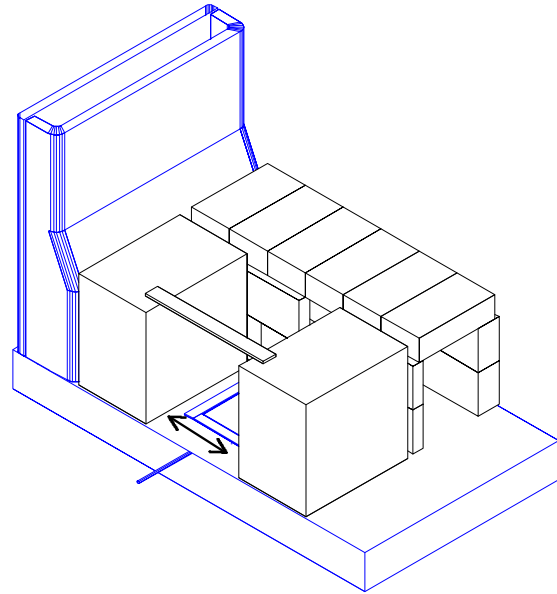
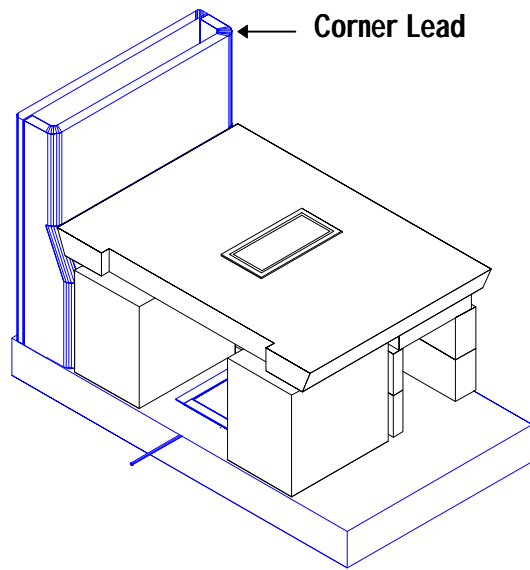


Figure 5

To form support for firebox floor, build up fill as shown to same height as firebrick. Arrow indicates approx. 8" channel for ashes.

Install 14" flatbar as shown to provide extra support for firebox floor. Use mortar joint to gain height



Install firebox floor onto generous mortar bed and level accurately.

Back corners of floor line up with leads that are precast into lower channels.

Ensure full mortar bed between flat bar and floor.

You are now ready to build the firebox.

Figure 6

Setting Firebricks

Firebricks are laid up with clay air setting refractory mortar (“Sairset”, or fire cement) with thin joints. Only enough clay needs to be used to completely fill the joint. No joint thickness needs to be built up - you are only filling in gaps and irregularities between the bricks. Although masons are used to trowelling firebricks, the best joints are obtained by dipping the bricks into mortar that has been thinned to the right consistency. It looks messy, but the cleanup is easy later with a sponge.

The Sairset that comes with the heater core kit has been pre-thinned to dipping consistency. You may need to add a some water, since it tends to thicken a little with time. You can tell if the Sairset has the right consistency by setting a brick down in a bucket of mortar. It will sink about half way. We like to dip the bricks and also keep a margin trowel (small rectangular trowel) handy for the odd bit of trowelling.

Assembling the Firebox

The firebox is laid up from standard firebricks. Standard firebricks are 4 ½” wide by 9” long by 2 ¼” thick. The thickness will vary between 2 ¼” and 2 ½” depending on the supplier. Since the Heat-Kit is designed around the standard firebrick module, it is important to check the width and length of your bricks beforehand, to avoid having to make modifications to the assembly procedure.

There are two methods of building the firebox, **Method A** and **Method B**. Method A gives you a replaceable firebox, and method B is easier to build.

Choosing Between Method A and Method B

The advantage of a replaceable firebox is that, should the firebox ever burn out, you can replace it without dismantling the heater. Although we have never had to replace a firebox, there have been a handful of heaters over the years that required repair work to the firebox, usually replacing a few bricks at the rear bottom, where they get the hottest. All of these heaters were regularly over-fired by the operators. In addition they all had an older combustion air system that used a grate in the firebox floor. With this older air system, the burn rate was extremely fast, resulting in a lot of stress on all the firebox components.

The current combustion air system was developed after extensive laboratory combustion testing by us. It is known as overfire air. Compared to the older underfire air, the heater burns cooler, cleaner, and with higher efficiency. The burn itself takes longer (about 2 hours as opposed to 1 hour).

We have not seen ANY damaged fireboxes since we have been using the new air system (about 5 years). This includes heaters that we have purposely abused. Therefore, building a non-replaceable firebox is a pretty safe bet. On the other hand, having the firebox be replaceable is a unique feature not found on other masonry heaters.

The replaceable firebox requires more cutting of bricks, and requires about 2 - 3 hours of extra time for a mason who has no masonry heater experience but who is used to setting firebricks.

METHOD A

The firebox consists of two shells of firebricks set on edge. This allows the inner shell to be a field replaceable firebox liner. The firebrick installation sequence has been numbered. By following this order, you maximize the ability to “bury” odd lengths where they don’t show and reduce the amount of precise cutting that you have to do. Note that full contact between inner and outer shell is not required at the inside corners. Where convenient, a little play right at the corner provides some expansion room for the liner.

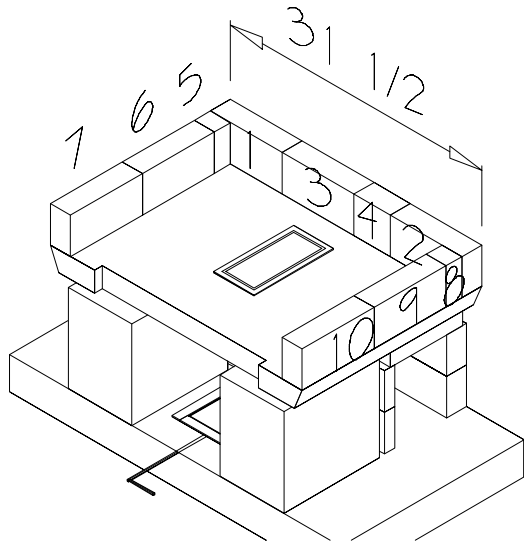


Figure 7

Lay out the firebox as indicated, using air setting refractory mortar. Line up back corners with the leads that are precast into the lower channels (right channel deleted from drawings for clarity).

Outer width of firebox is 31 1/2". Firebricks sit dry against base channels.

Error! Reference source not found. shows the firebricks numbered in the order in which they are installed.

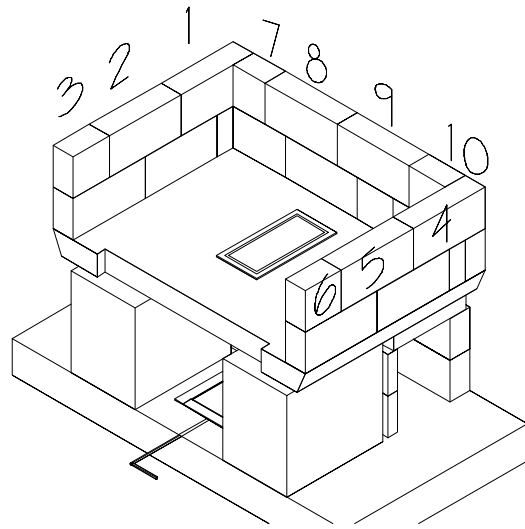


Figure 8

Exact bond is dependent on firebrick thickness, generally between 2-1/4" and 2-1/2".

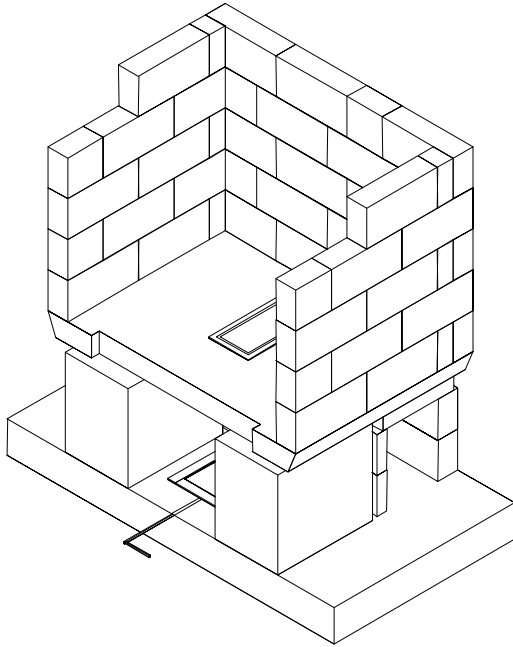


Figure 9

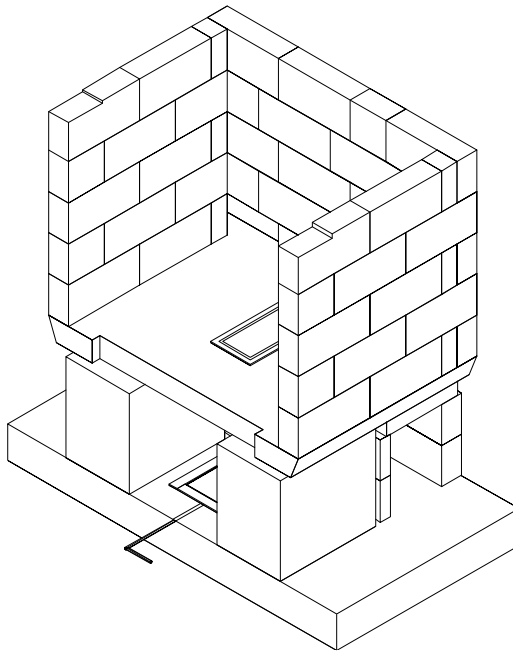


Figure 10

Top front firebricks are notched 1/4" x 4" for firebox lintel.

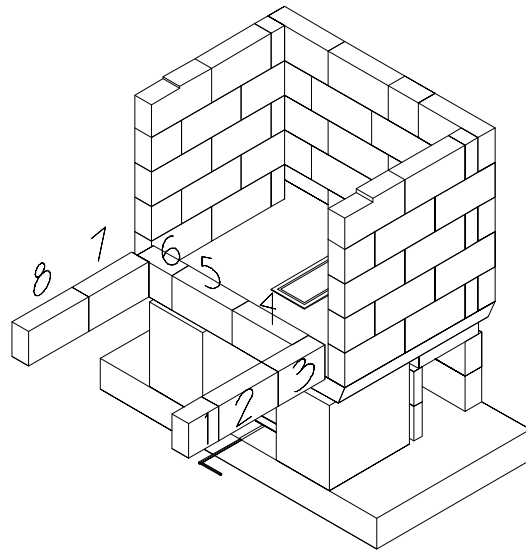


Figure 11

Begin inner firebox. Note that the bricks are left about 1/4" short at the blind inside corners. The cuts on these bricks are hidden.

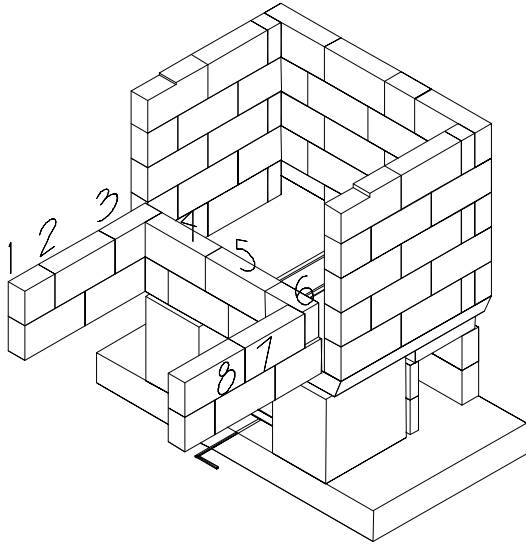


Figure 12

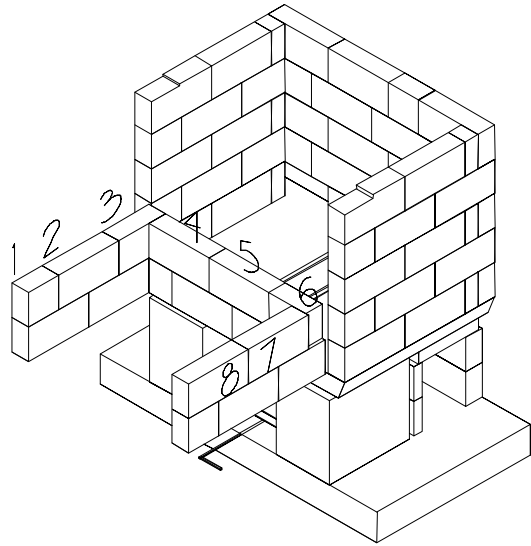


Figure 13

The inner firebox is set dry against the outer firebox. There is no mortar joint between the two fireboxes.

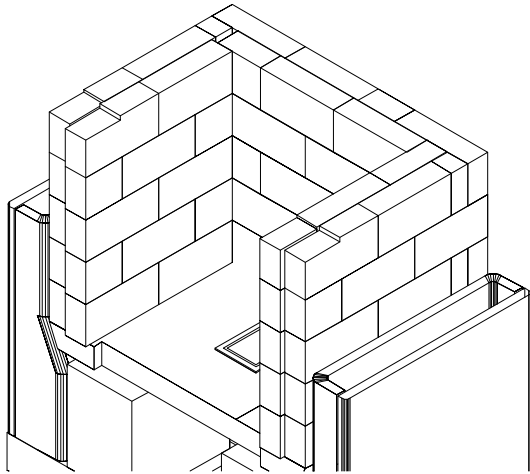


Figure 14

Notch top course of liner as shown. Notches are 1/4" x 4"



Figure 15

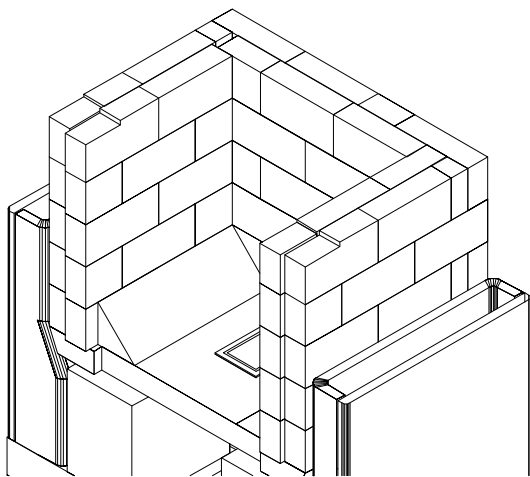


Figure 16

Firebrick floor slopes are glued in place with Sairset - this can be done later.

Continue at Figure 20

METHOD B

Use the same instructions for setting firebricks as Method A. Instead of building a double shell firebox with bricks set on edge, you will be building a single shell firebox using bricks set flat. Use the layout shown in Figure 17 to Figure 19 .

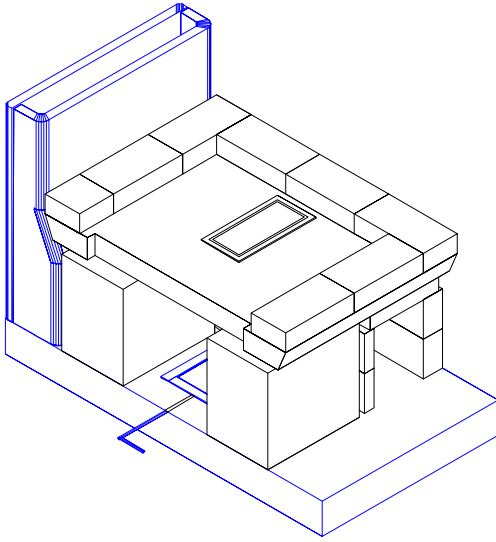


Figure 17

The cut edge of the half brick should point towards you as you stand in front of the heater.

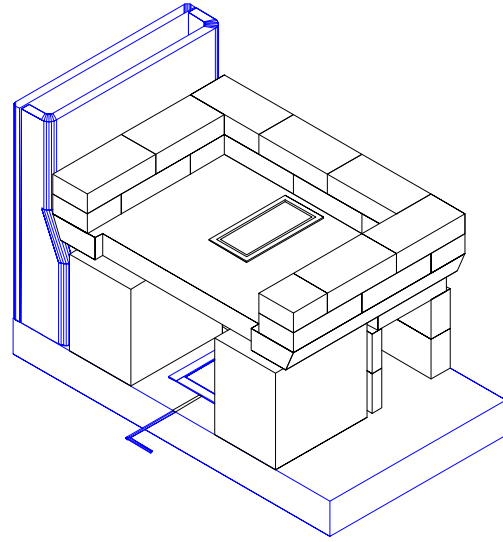


Figure 18

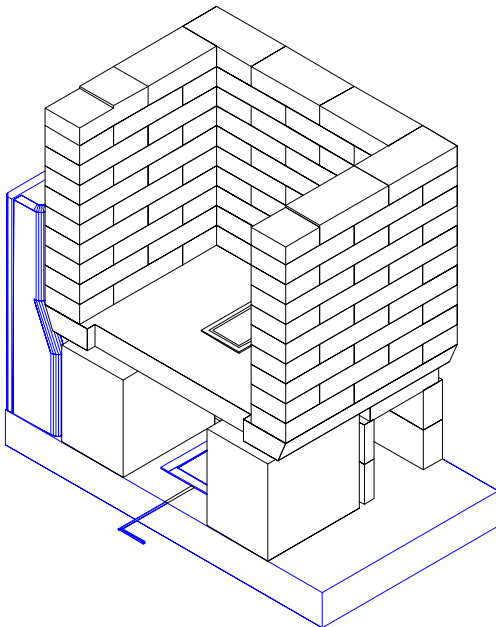


Figure 19

Notch the two front bricks on the top course 1/4" X 4" as shown. This provides space for the firebox lintel shown in Figure 20.

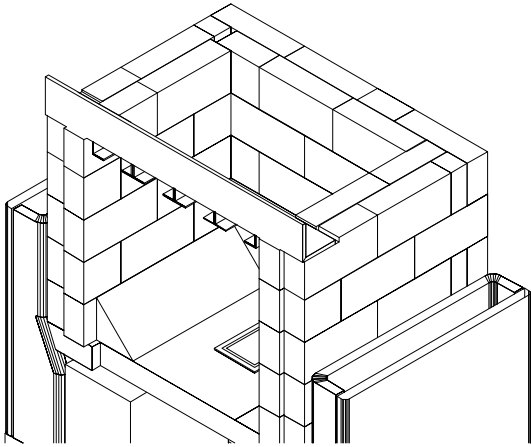


Figure 20

Install firebox lintel. Brackets on lintel are for heat shields (firebrick splits, installed later, see Figure 46)

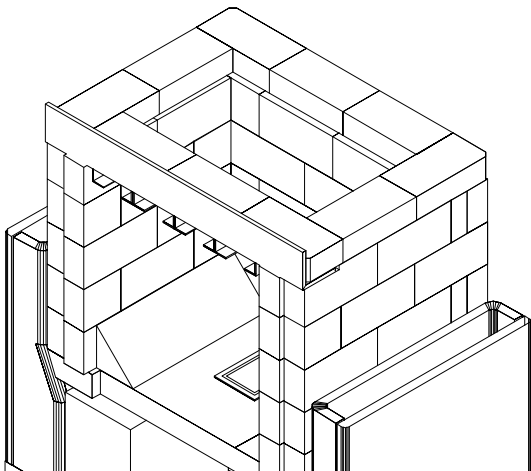


Figure 21

Lay up next course as shown. Use a dry joint with lintel.

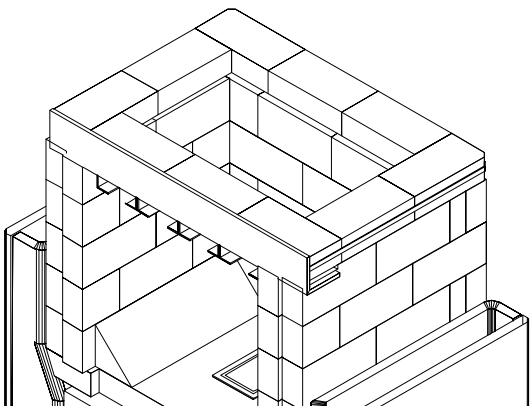


Figure 22

If you have access to strapping tools, this course can be strapped as shown. This is optional. If a strap is used, then round outside corners of bricks slightly.

The purpose of the strap is to transfer weight onto the outer firebox.

This allows the complete inner firebox to be removed, if necessary, rather than in sections.

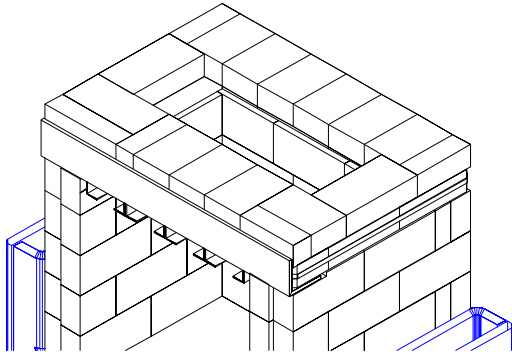


Figure 23

A total of 16 soaps (8 bricks ripped lengthwise) is used. All bricks are either full length (9"), $\frac{3}{4}$ length (6 $\frac{3}{4}$ ") or half length (4 $\frac{1}{2}$ ").

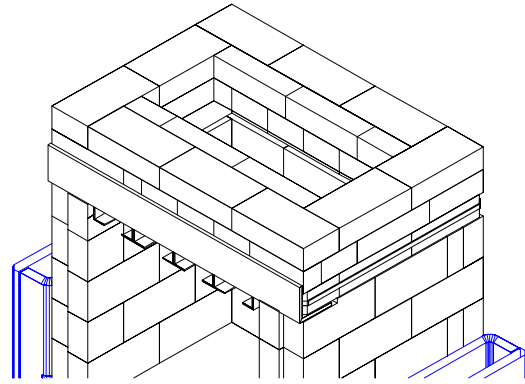


Figure 24

Next course.

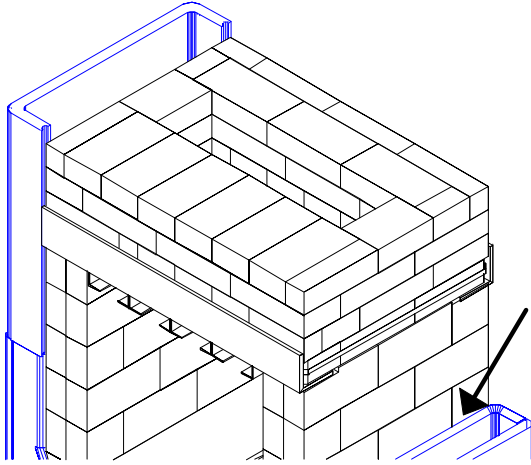


Figure 25

Seal gap between top of lower channels and firebox with silicone.

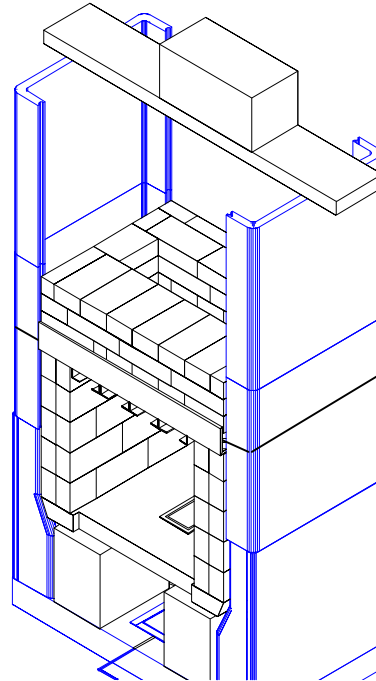


Figure 26

Install middle channels onto a bed of Sairset.

Strap middle channels or use tie wire. When strapping, compress expansion joint gaskets no more than 50%. Strap at same level as firebox strap.

Clean off joints from inside. Make sure there is no mortar bridging at the expansion joints from inside.

Install top channels and brace temporarily as shown.

Install top set of channels and brace temporarily as shown. Plumb gasketed edges, which will then be corner leads for the remaining firebrick infill.

(Not shown: the right top channel for this custom heater is 4.5 " shorter. Adjust the temporary bracing accordingly.)

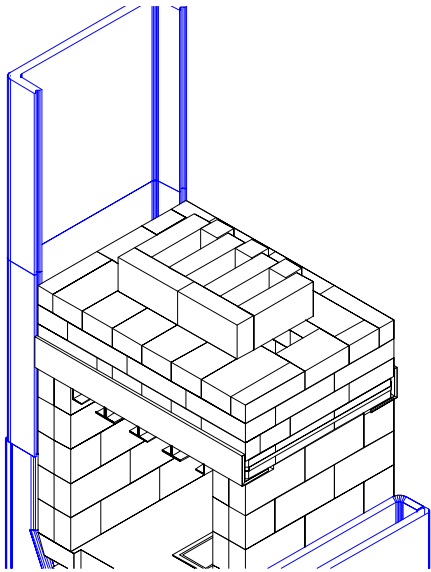


Figure 27

Right channels not shown for clarity. Without a bakeoven, a dummy mass is built up from firebricks as shown. This is required to soak up heat.

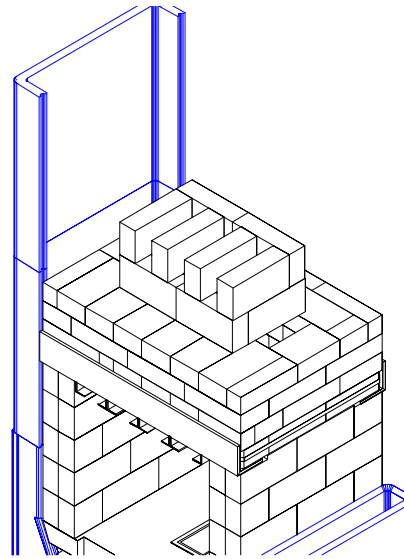


Figure 28

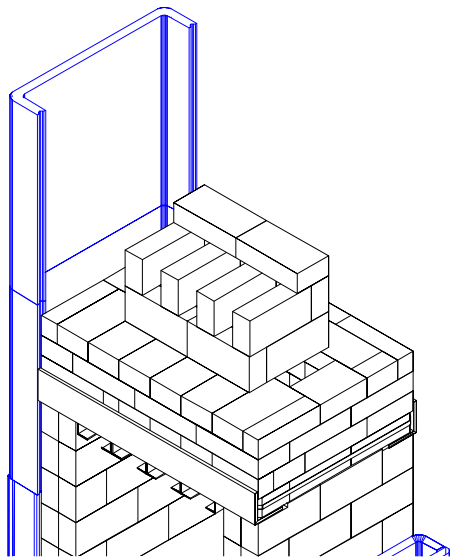


Figure 29

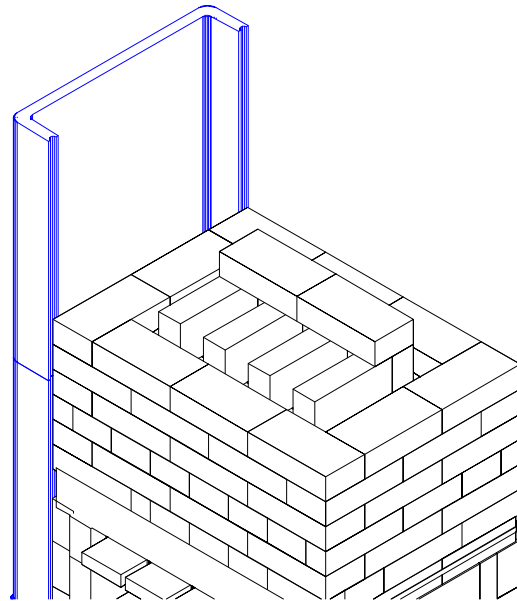


Figure 30

3 courses with full bond.

At this point, check expansion joints. Make sure there is no mortar bridging at gasket rope, particularly inside channels.

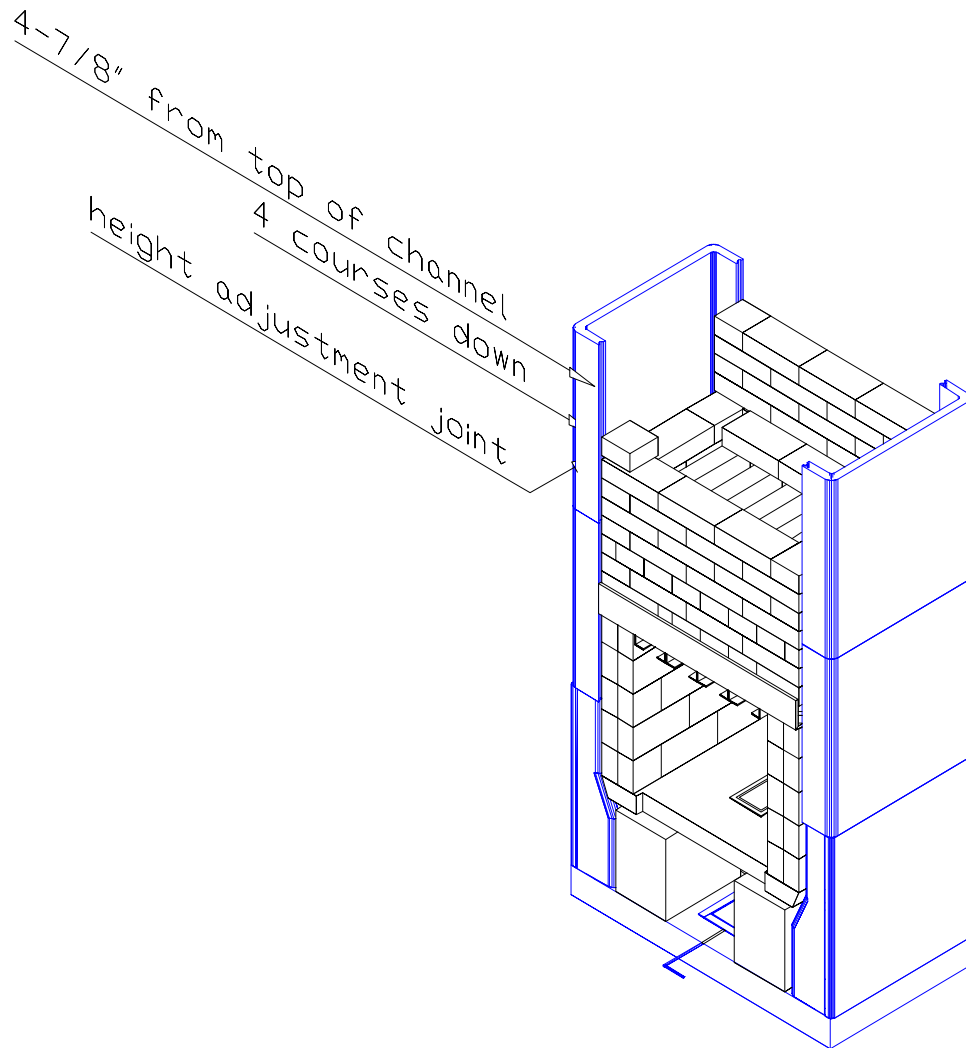


Figure 31

At this point, a height adjustment is necessary.

Place a pencil mark 4-7/8" from the top on the 2 left channel ears. Next, measure the height of 3 existing courses of firebrick. Using this distance, place a second mark on all 4 ears as shown.

The second mark indicates the top of the next course. If an adjustment greater than 1-1/4" needs to be made, insert a course of splits. If the adjustment is less than 1/2", use ordinary brick mortar. For 1/2" to 1-1/4", use castable refractory or 1:1:5 portland:clay:sand mix.

Alternatively, you can cut the bricks to height on a brick saw. If you have a brick saw, you can skip the height adjustment here and do it on the final course.

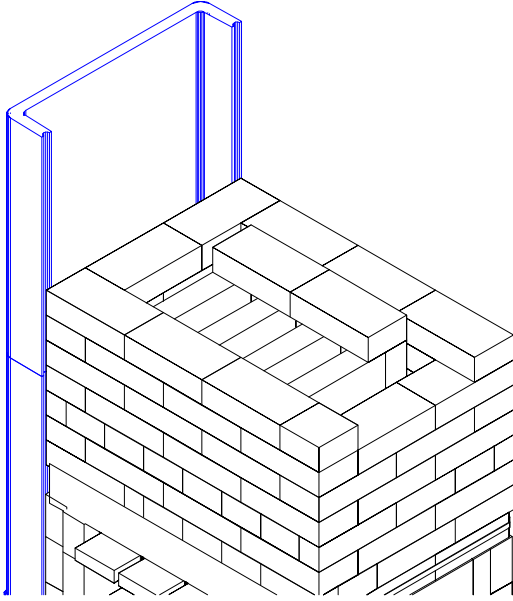


Figure 32

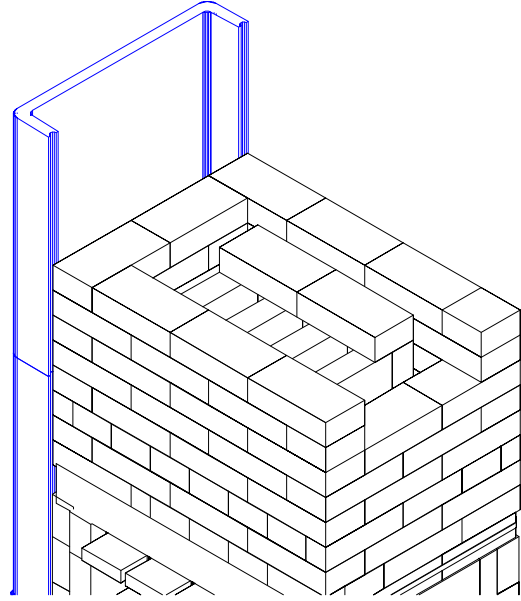


Figure 33

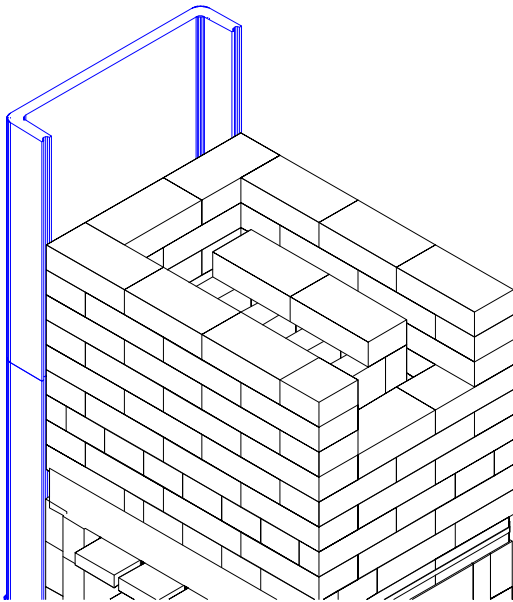


Figure 34

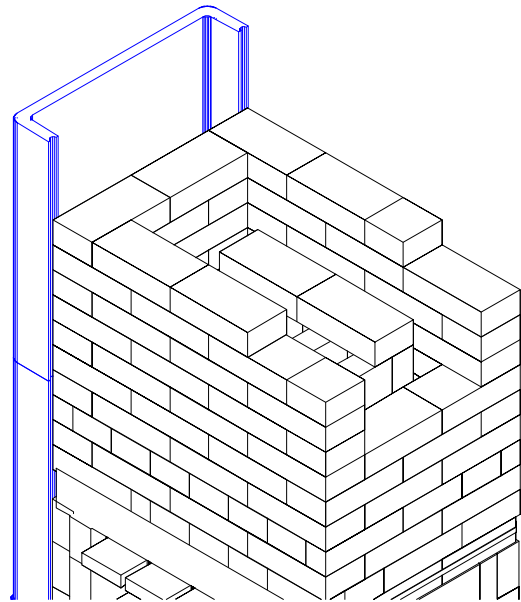


Figure 35

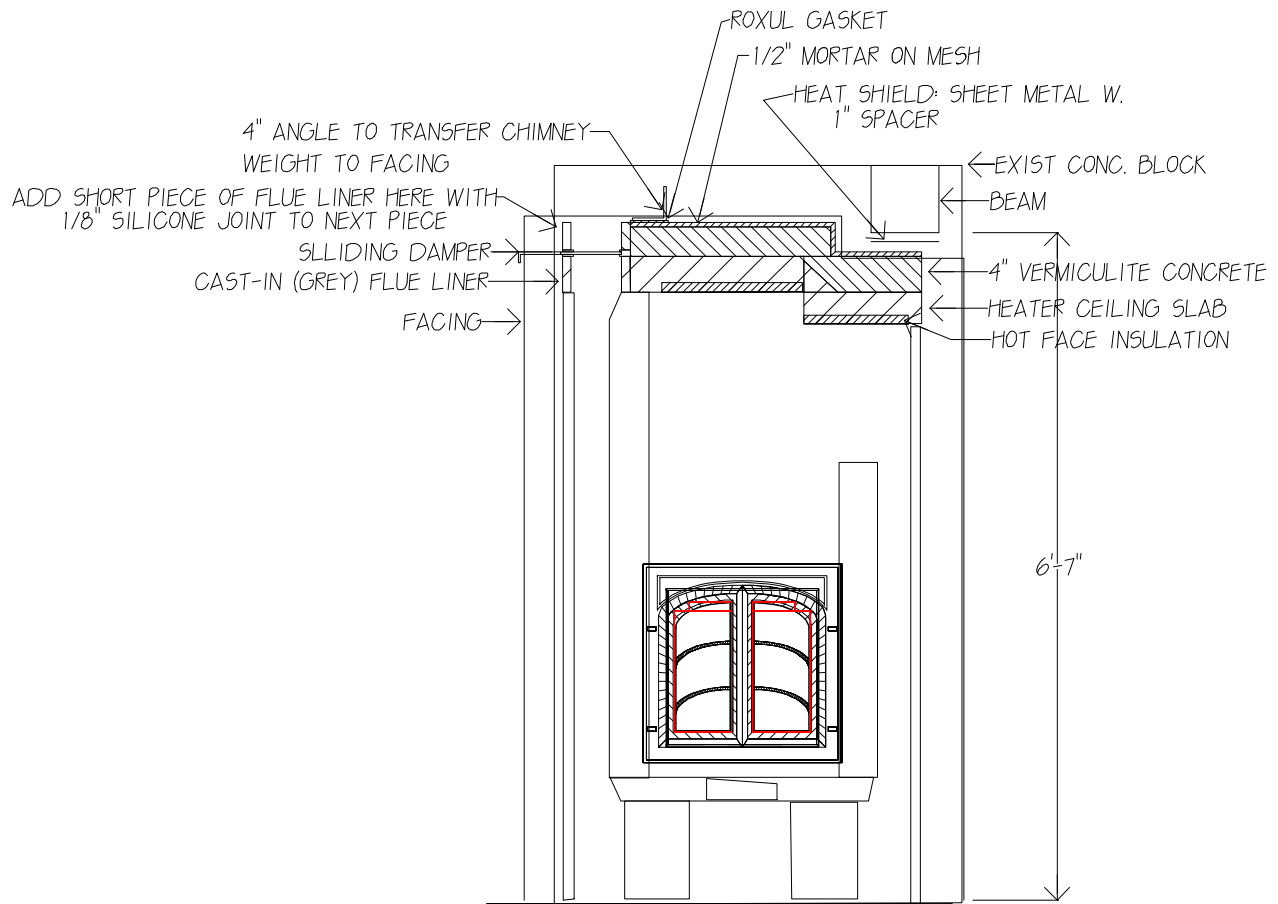


Figure 36 Section showing location of beam and ceiling components.

Refer to this drawing during the finish work as well. The vermiculite mix above the ceiling slabs, etc., are done after the brick facing is installed.

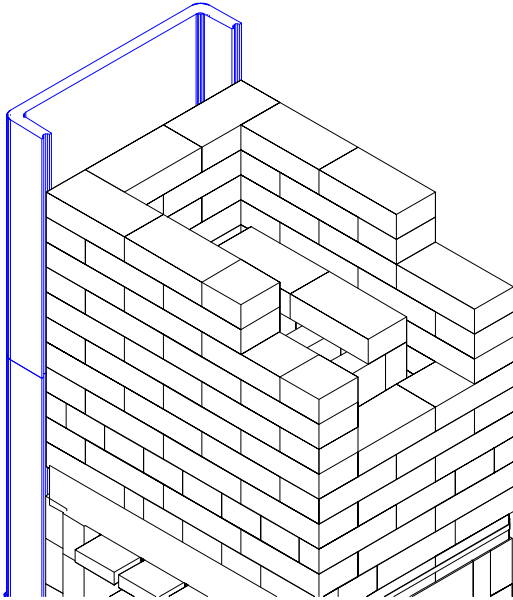


Figure 37

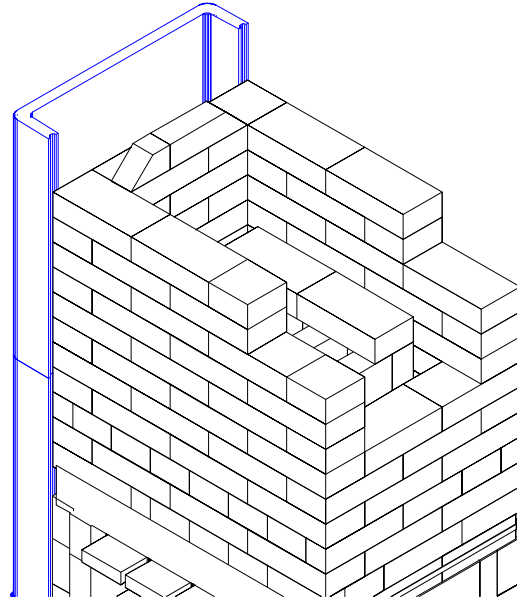


Figure 38

Fill with soaps as shown. Soaps have a 45 degree angle at the ends. Smooth off the ledge that is created with mortar.

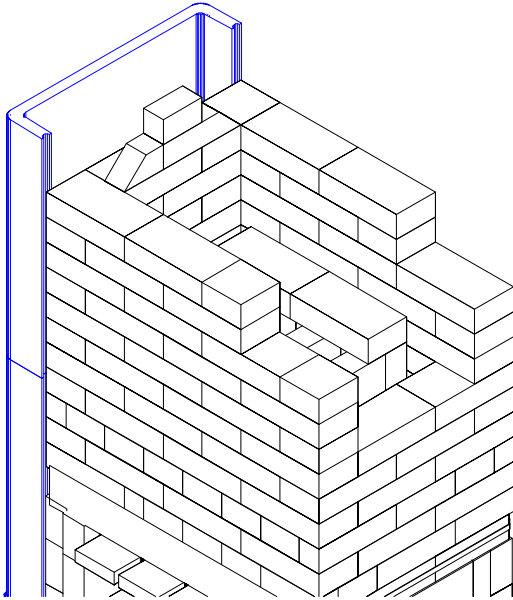


Figure 39

Centre a 4.5" soap as shown. Do not fill in the space on either end. These will form a bypass (direct connect to the chimney) to aid in cold starting the heater.

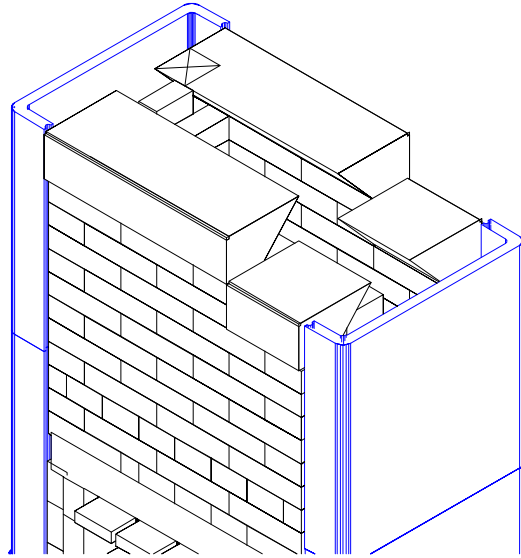


Figure 40

Install ceiling transitions. They should be 1/16" to 1/4" higher than side channels

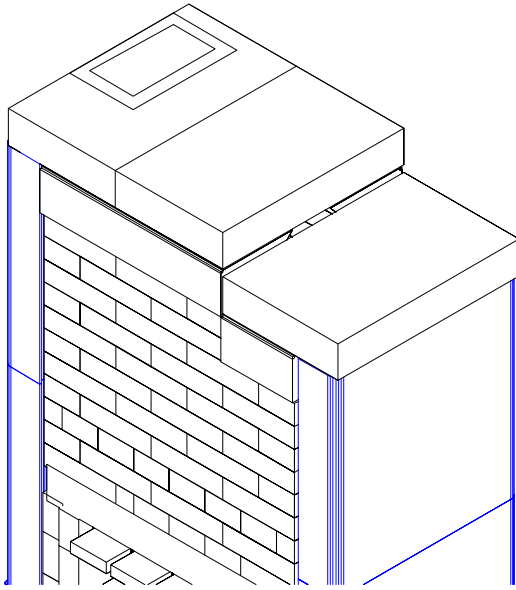


Figure 41

Install ceiling slabs dry. Use a helper, and set up adequate staging (foot planks). Be careful handling them, as the insulating board facing on bottom is fragile. Use the registration marks in the tops of the slabs to ensure the correct order. Next, check firebricks for full joints.

Next, check side channel gaskets and use silicone to tighten where needed.

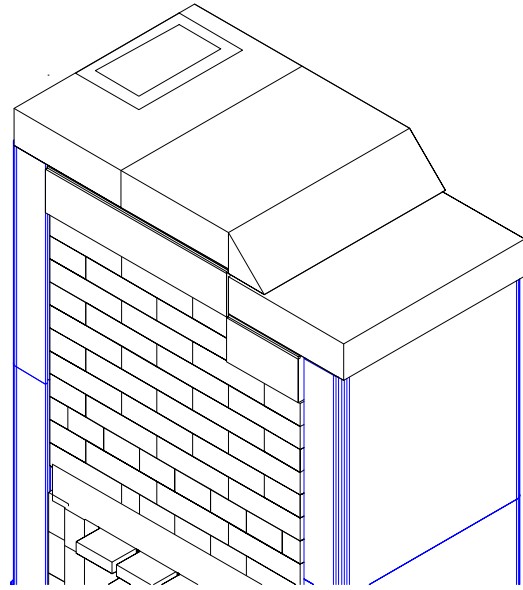


Figure 42

Install the cove (2 pieces) as shown. Use a bead of silicone on each mating face.

Using GE clear silicone, carefully seal all ceiling slab joints, particularly the shiplap joints and the bottom joint. If gap between slab and top of side channels is greater than 3/16", stuff with ceramic fiber first.

At the rear of the core, you may need to apply the silicone with a trowel, etc., in order to ensure that all joints are sealed.

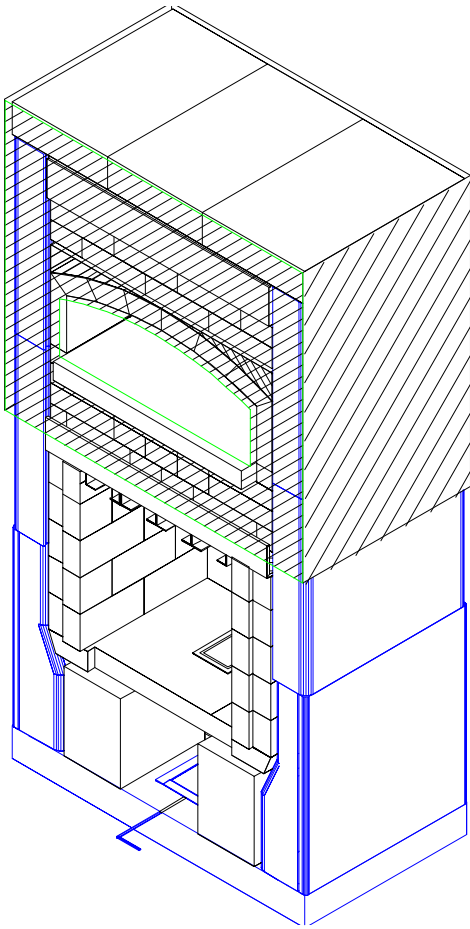


Figure 43

(Note: ignore the bakeoven shown)

Next comes a double wrap of fiberglass matt to act as an expansion and slip joint. The mat is somewhat fragile, and releases glass fibres if handled too much - wear old clothes.

Two pieces of fiberglass are supplied -- a 38" wide piece and a 52" wide piece. Start with the 38" wide piece.

Quickly dab silicone approximately 4" - 6" o.c. over entire area indicated. Start at top of ceiling slab and go 38" down. Carefully unfold fiberglass mat and, with a helper, wrap around heater. Make sure mat goes all the way to top of ceiling slab. Have helper hold in ends in place, and go around heater, patting the mat onto the silicone.

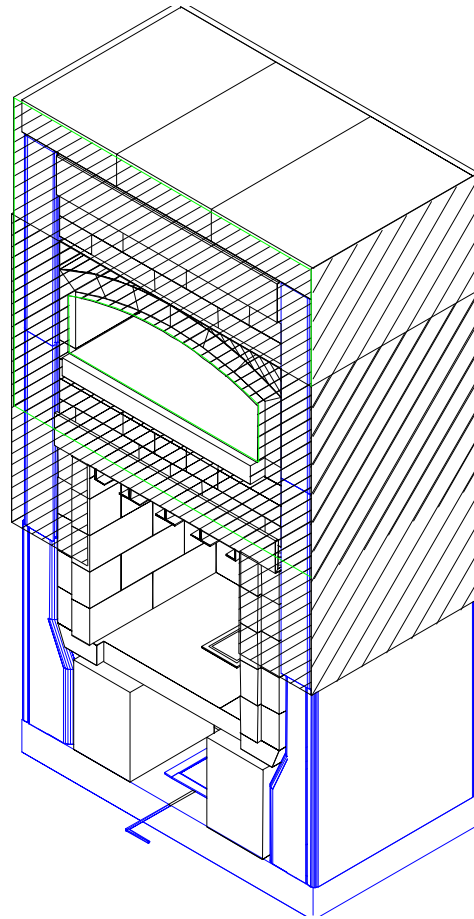


Figure 44

Trim to give approx. 4" overlap, and secure end with metal tape supplied

Second wrap of fiberglass mat is 52" wide, and also starts at top. Use same procedure as before. Trim around firebox and use offcuts to cover exposed firebricks at front. (Figure 45)

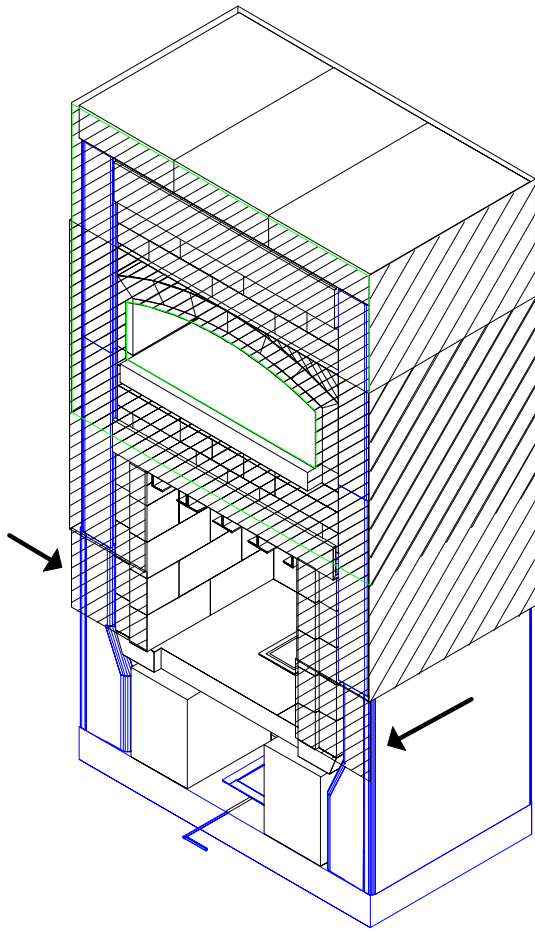


Figure 45

Add two additional pieces as shown.

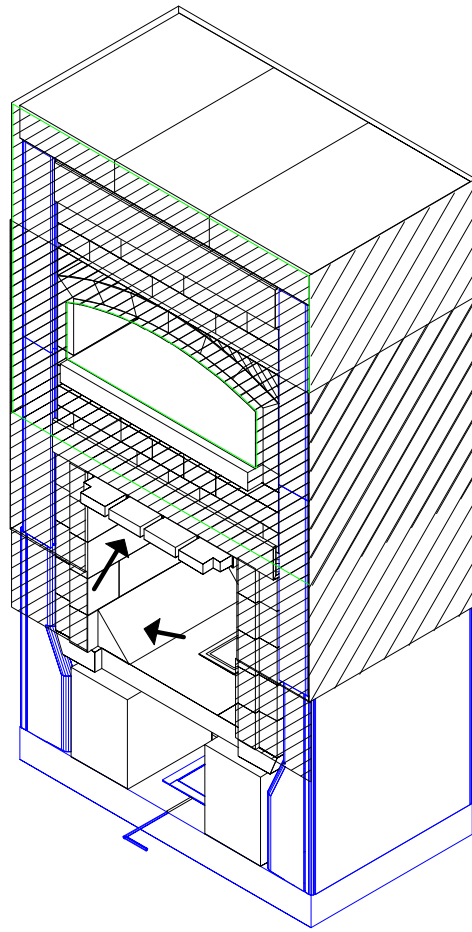


Figure 46

Note location of firebrick split heat shields.

If not installed already, set sloped floor pieces onto a bed of refractory mortar, similar to setting a firebrick.