Heat-Kit System
Modular Contraflow Masonry Heater Core
Assembly Manual

HK-22ro-c

22” Firebox Corner Unit with Front or Rear Bake Oven

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Masonry Stove Builders

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Material List

210	Standard Firebricks 4 ½ ”x9”x2 ¼ ” (2 ¼ ” dimension may vary. **Important:** The 4.5” and 9” dimensions are important - please ask your supplier to confirm that they are +/- 1/16”)
20	Firebrick “Splits” 4 ½ ”x9”x1 ¼ ”
30	Common clay bricks (8”x4” nominal)
2 bags	Mortar Mix
1 bag (20 lbs)	Vermiculite (Block Fill, Zonolite, etc.) (See “Instructions for Finishing Heater”)
1 bag	Portland Cement (See “Instructions for Finishing Heater”)

Assembling the Bottom End

The bottom end of a contraflow heater is the most complicated part of the whole job. 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.

The insulated base slab allows you to do a dry layout first and make sure that everything is located properly in relation to the chimney and the slab.

Cleanout Openings and Chimney Connection:

You will need to allow for a chimney connection and a cleanout opening for each downdraft channel (3 openings total). If there are heated benches, there may be additional openings. See “Assembly Details” documents for photos of typical heated bench setups. **NOTE**: Location for these vary and are not indicated in the drawings below.

A short piece of 8x12 flue liner will later connect the heater opening with the chimney opening. It will simply be butted up against the channels from outside. The cleanout doors will get installed later in the facing, so the openings in the channels don’t have to be exact.

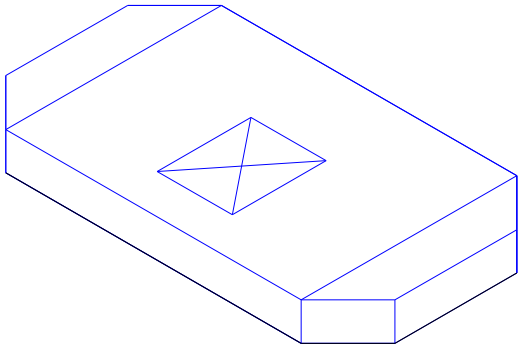


Figure 1

Position insulating base slab dry to determine layout for heater and chimney.

Mark final position at corners with a pencil.

Install insulating base slab level onto a full mortar bed.

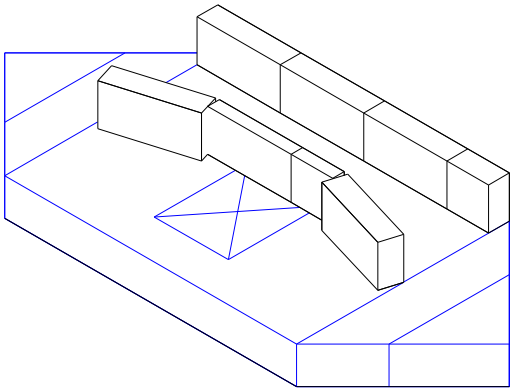


Figure 2

Build connecting channel.

The rear of the connecting channel is 31.5” long.

(If there is a rear chimney, leave 10.5” opening and span with flat bar supplied (notch bricks to maintain thin joints)).

Firebrick shiner is flush with outside of slab. (Note: “shiner” = brick set on edge)

2 full firebricks and 1 -1/2 firebrick splits are set to form a 6-1/2” channel.

See Figure 3 for more layout information

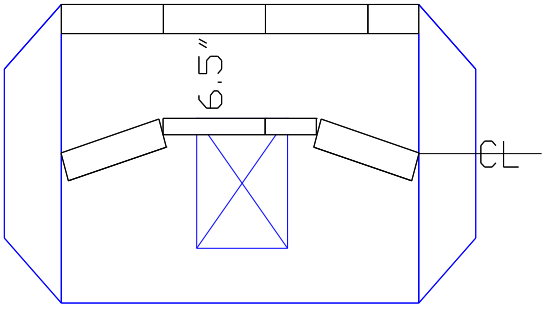


Figure 3

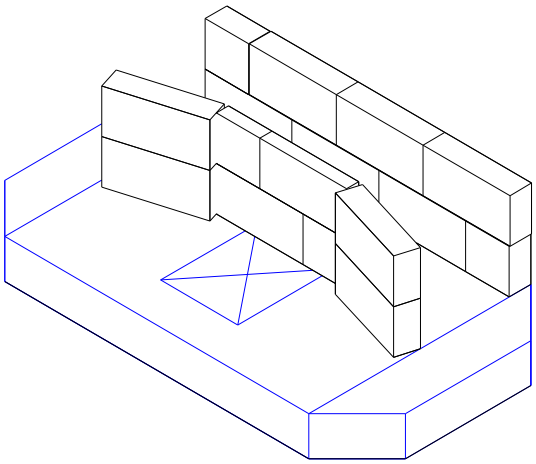


Figure 4

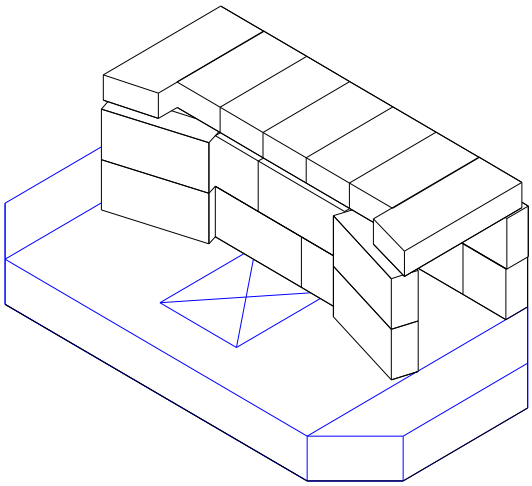


Figure 5

Form connecting channel ceiling as shown. The two endpieces are precast (supplied).

Use a sponge and water to clean any hanging mortar drips from the inside of channel.

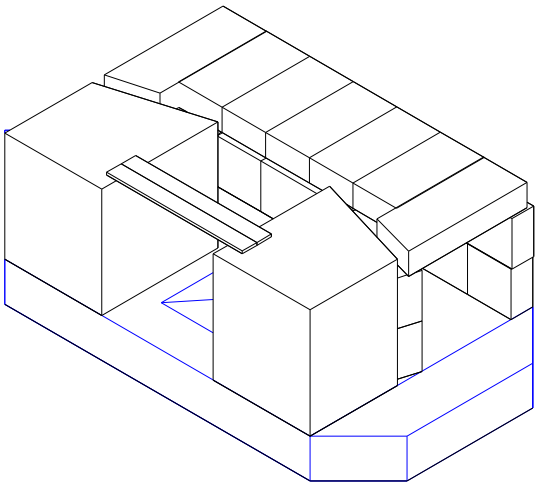
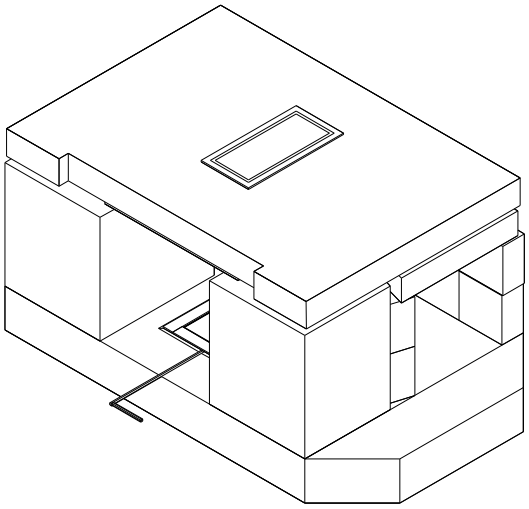


Figure 6

To form support for firebox floor, use common brick and mortar to build up fill as shown to same height as firebrick. Fill all gaps solid with mortar. Leave approx. 8 - 10” channel for ashes.

Install 2 14” flatbars as shown to provide extra support for firebox floor. Use mortar joint underneath flat bars to gain height



Install firebox floor onto generous mortar bed and level accurately in both directions.

Ensure full mortar bed between flat bar and floor.

You are now ready to build the firebox.

Note: the floor shows a cast iron pivoting ash dump, which has been replaced by a rear grate (see Figure 7b)

Figure 7

(Dec /08) Updated view of firebox floor, with hole for rear grate. Note that it overhangs the firebrick connecting tunnel, and the back of the hole is filled with mortar and angled to form a chute for the ashes.

Figure 7b

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 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.

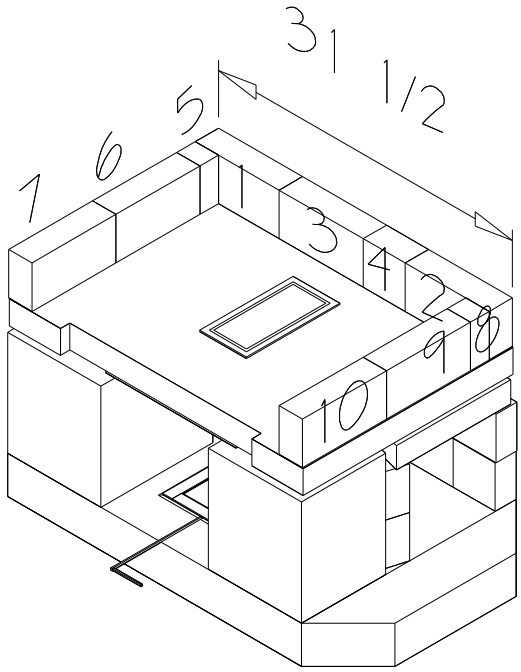


Figure 8

Lay out firebox as indicated. Outside width is 31½". Set bricks using air setting refractory mortar.

Figure 8 shows the firebricks numbered in the order in which they are installed.

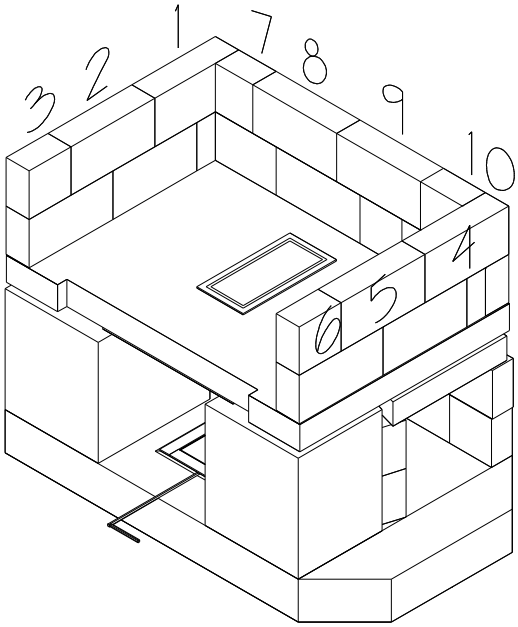


Figure 9

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

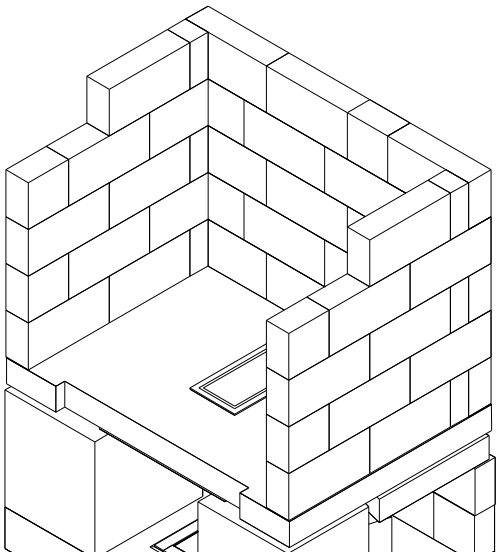


Figure 10

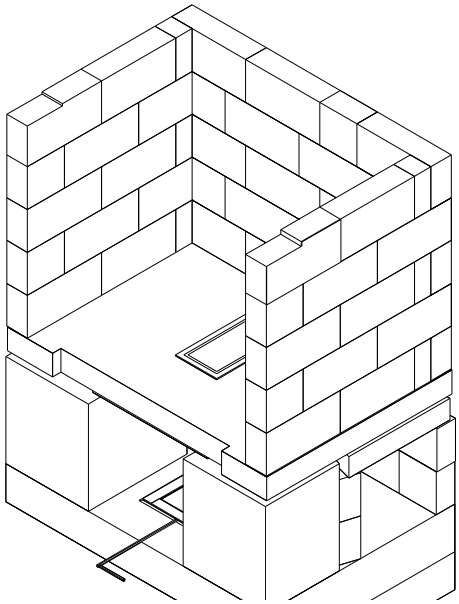


Figure 11

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

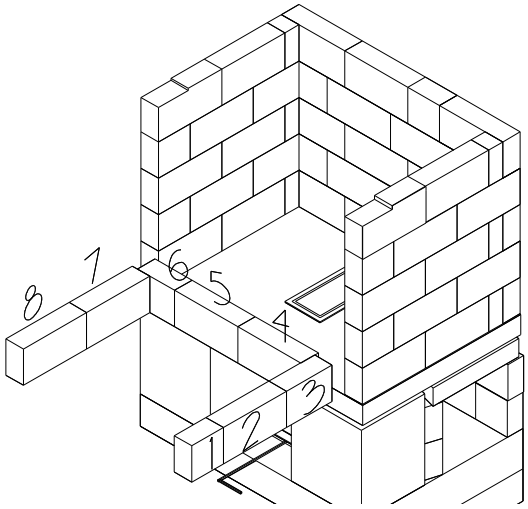


Figure 12

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.

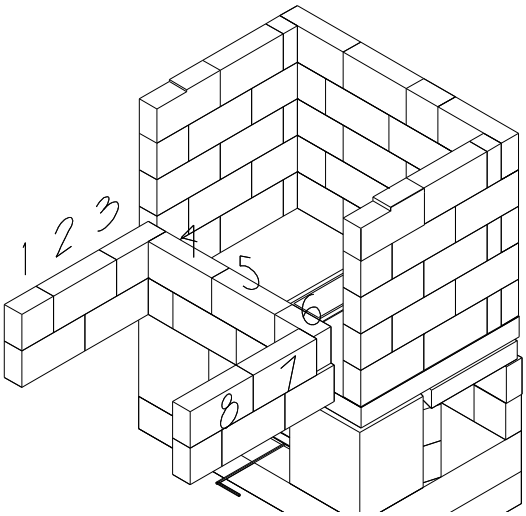


Figure 13

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

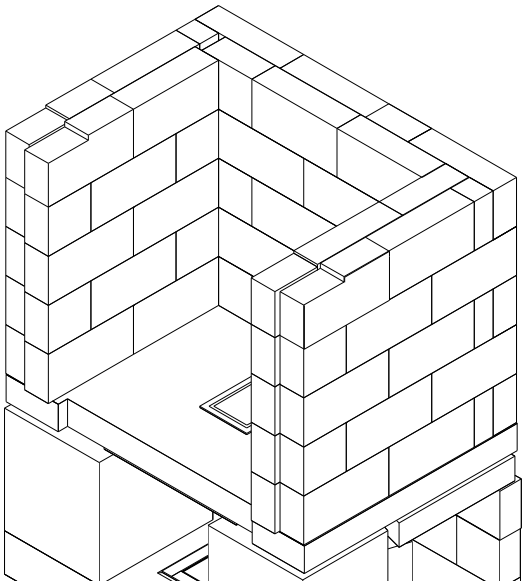
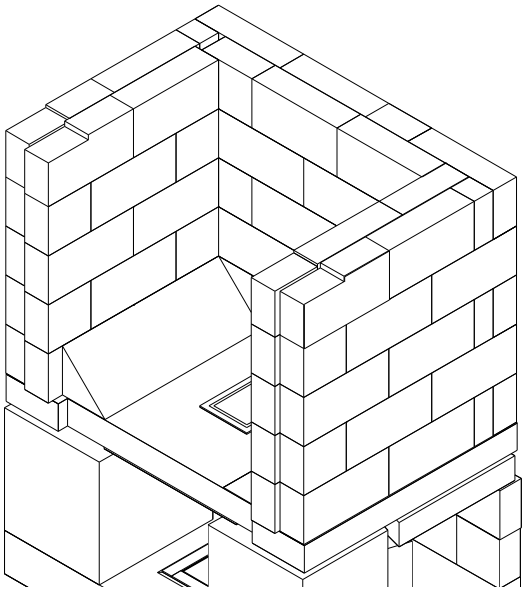


Figure 14

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

Immediately wash down the firebox with a sponge and a liberal amount of water. Rinse with clean water. If this is done right away, it is easy to get a clean looking firebox.

Figure 15



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

Go to **Error! Reference source not found.**

Figure 16

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. (Standard heater is show instead of corner unit).

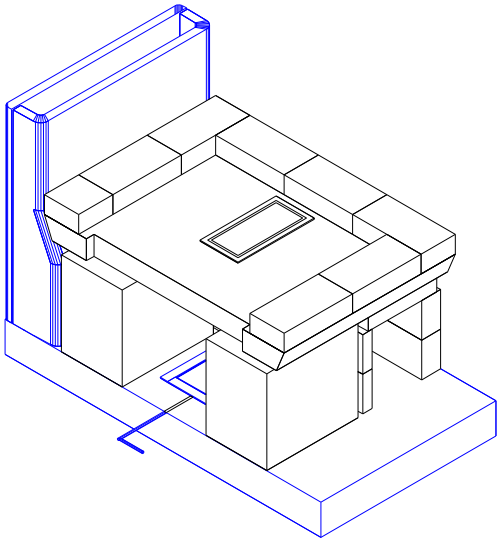


Figure 17

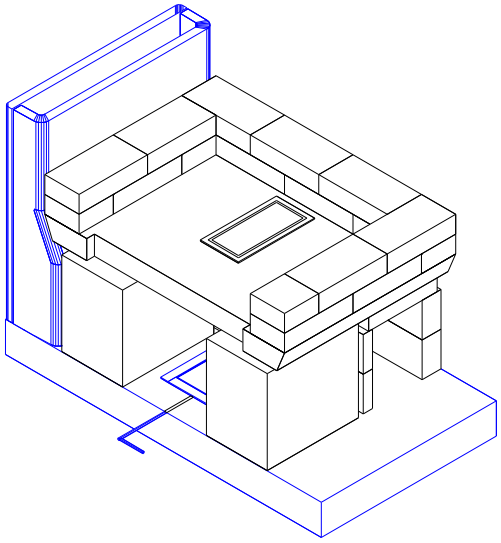
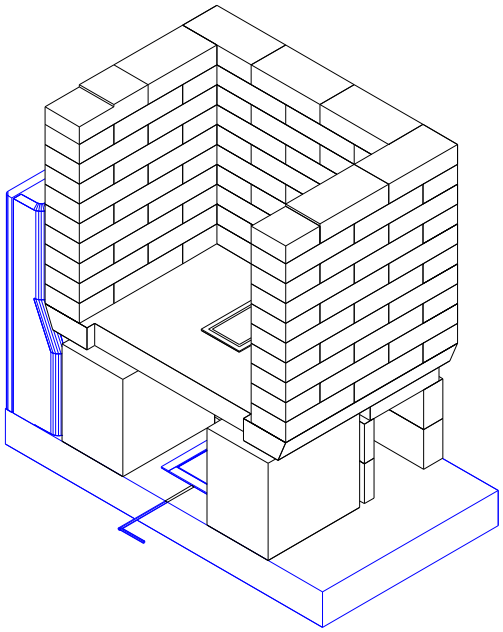


Figure 18

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

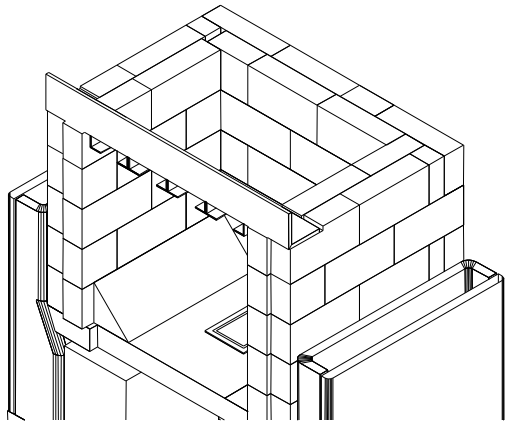


Notch the two front bricks on the top course 1/4” X 4” as shown. This provides space for the firebox lintel shown in **Error! Reference source not found.**.

Figure 19

Building the Upper Firebox

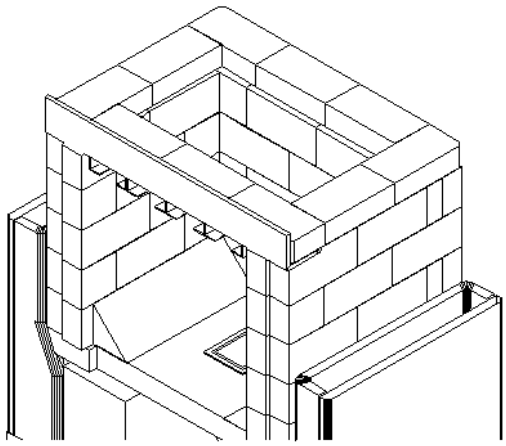
Rear Bake Oven: The drawings below show a front bake oven. For a rear bake oven, reverse the plan at this point. In other words, flip the remaining layout by 180 degrees.



Install firebox lintel. Brackets on lintel are for heat shields (firebrick splits, installed later, see **Error! Reference source not found.**).

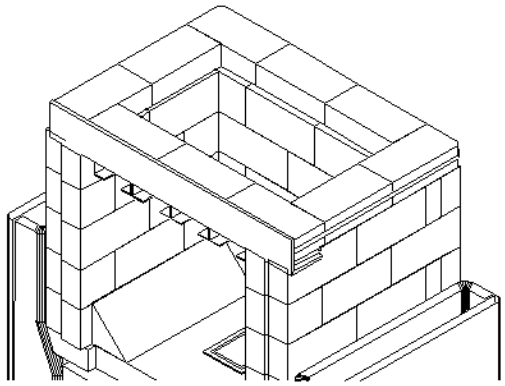
Note: the illustrations show lower channels from a non-corner heater. Please disregard these.

Figure 20



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

Figure 21



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 22

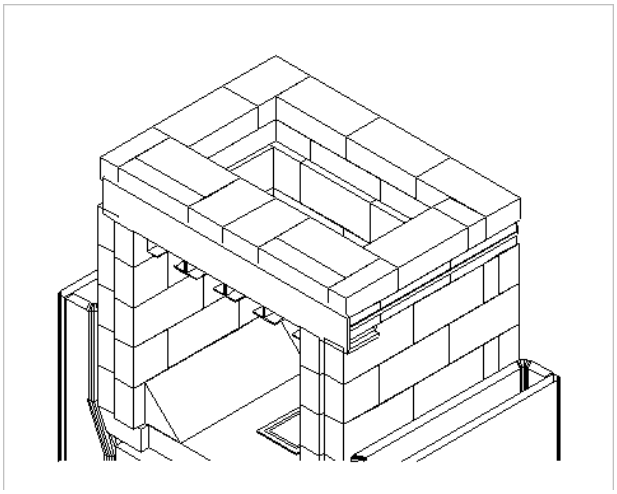


Figure 23

A total of 10 soaps (5 bricks ripped lengthwise) is used. All bricks are either full length (9”), ¾ length (6 ¾”) or half length (4 ½”)

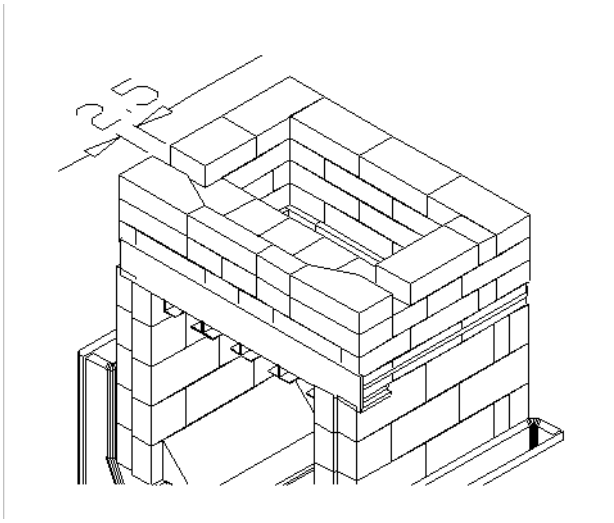


Figure 25

Check bricks for level before starting this course to see if there are high or low spots. When setting this course, carefully level the section where the oven will sit.

Cut front corner bricks as shown. Leave oven floor heat bypass gaps as shown. Standard gap is 2 ½ inches.

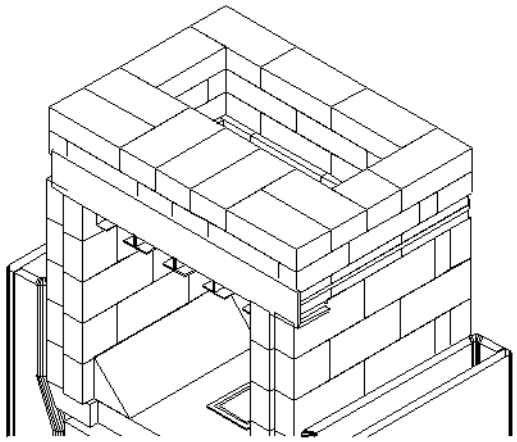


Figure 24

Next course.

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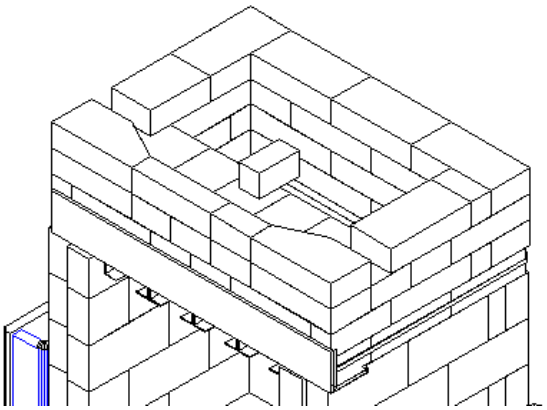


Install small floor support piece as shown.

Figure 26

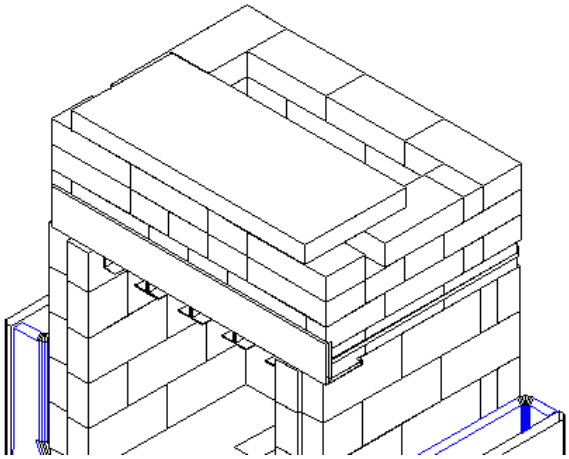


Figure 27

Install oven floor as shown.
Set floor into Sairset.
Use a generous bed, to give you a bit of extra leeway so that you can level it carefully.

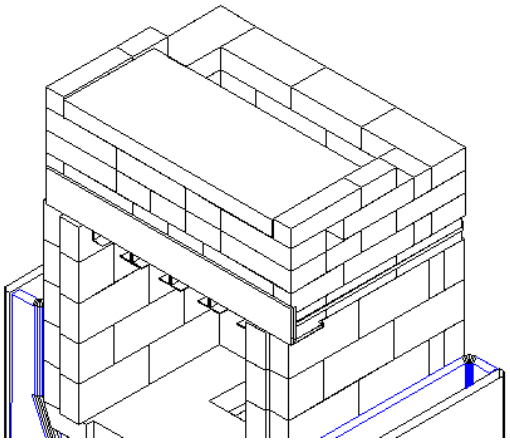


Figure 28

Install soaps as shown and level.

Figure 29

Note generous mortar along bottom edge, to provide a gas seal. Top edge is left open, and will be sealed with a rope gasket.

Oven will sit on these bricks.

Make sure they are level.

Figure 30

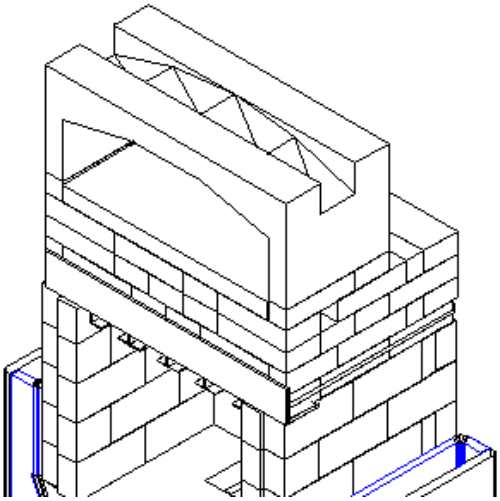


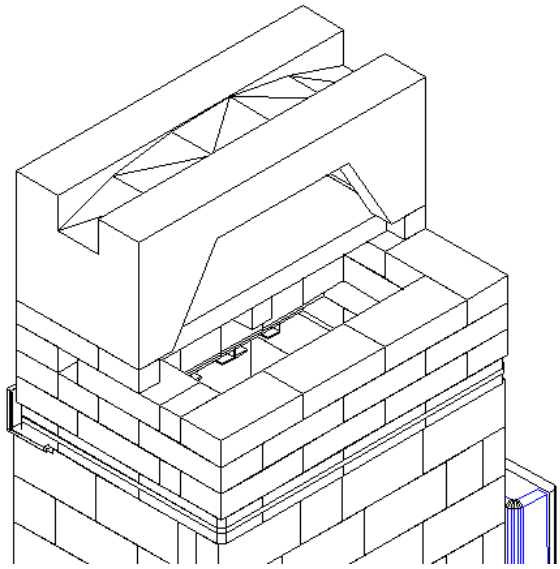
Figure 31

Apply Sairset to the soaps that will be under oven sidewalls. Make sure that you have adequate foot scaffold, and install large oven casting as shown.

Use a helper, being sure to set oven straight down. Oven is heavy. Plan your moves, and don't twist while you lift. A third person sticking his fists in the centre, to take off some weight, makes the job a lot easier.

The oven and floor are flush with the outside of the core.

Note: ignore the extra lines on the drawing of the oven itself. These are an artifact of the CAD drawing system.



View from rear.

Figure 32

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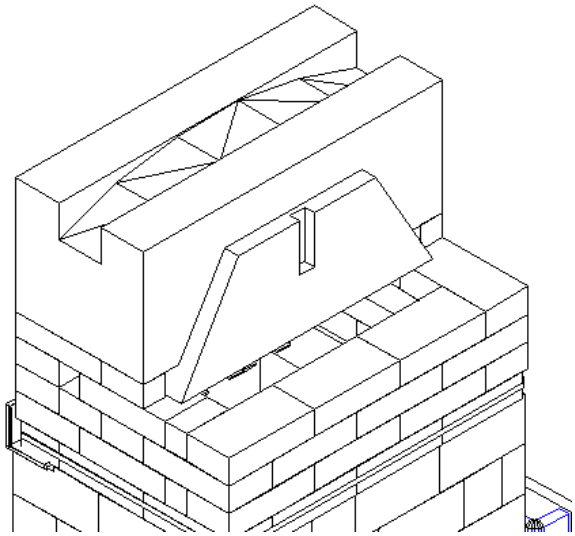


Install oven back.

Slide forward until it contacts back oven floor.

Back of oven floor should be tucked into the recess in the oven back piece.

Go to front and check gap between top of insert piece and oven.

Gap should be as narrow as possible.

If necessary, shim up oven back with cut-up brick ties to ensure snug gasket space at top (when viewed from the front)

Figure 33

. . .

Figure 34

View from front with oven back installed.

Note tight gap at top.

Look along the bottom of the oven back, and note the gap to the bake oven floor, which will receive a fiberglass rope gasket.

Figure 35

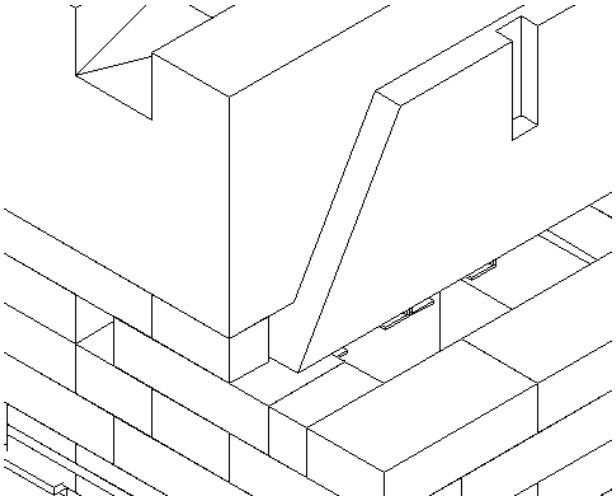


Figure 36

View from the back

Closeup of rear corner of oven.

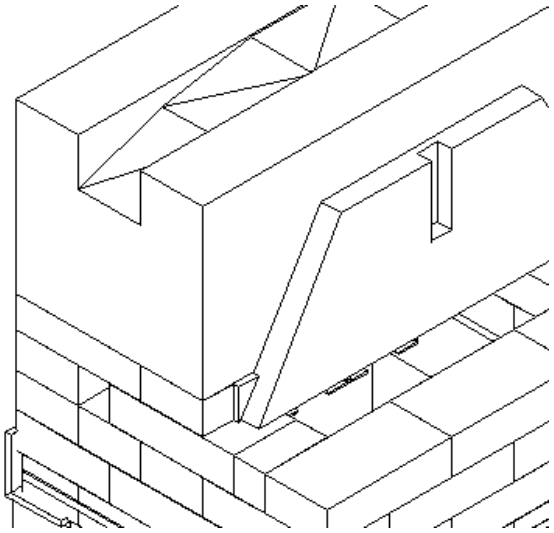


Figure 37

Install small wedge cuts (supplied) where shown. Mortar them in with Sairset.

Push wedge in until it contacts rear of floor.

From the front of the oven, scrape out excess Sairset from the corner recess.

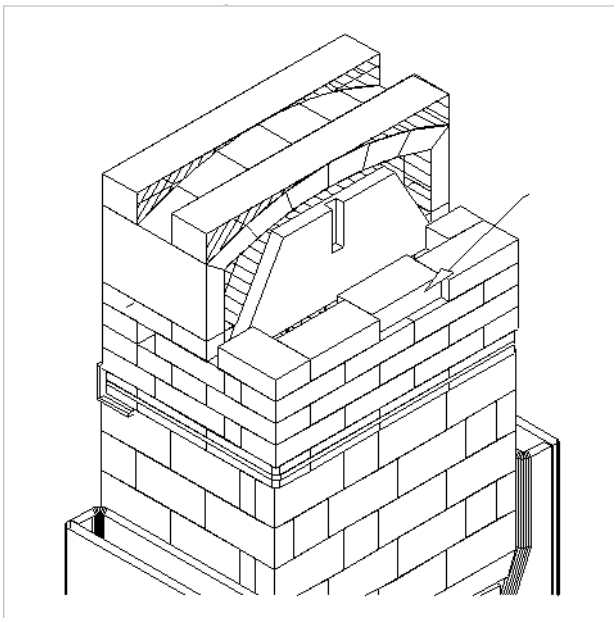


Figure 38

Project back brick ¾” as shown to form ledge for millboard.

The recess formed by the setback brick can be filled later with ordinary mortar to maintain a smooth surface on the outside of the core.

Figure 40

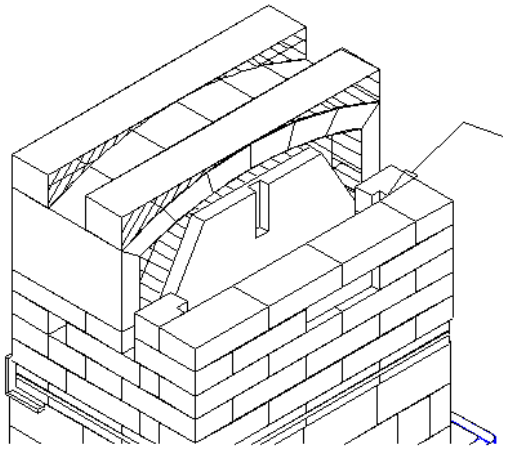


Figure 39

Form notches as shown for 1 inch millboard. Make notches slightly over 1 inch to allow for irregularities when sliding in millboard. The easiest way to cut these notches is to make 2 or 3 saw kerfs and pop the piece out with brick hammer.

There are 5 courses of notches.

Note that first two courses of notched bricks are shorter, to clear oven back insert.

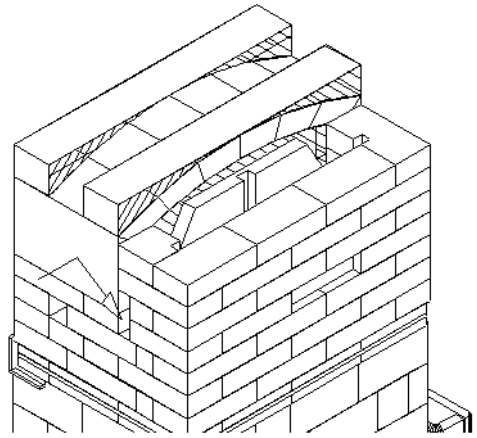


Figure 41

Continue as shown

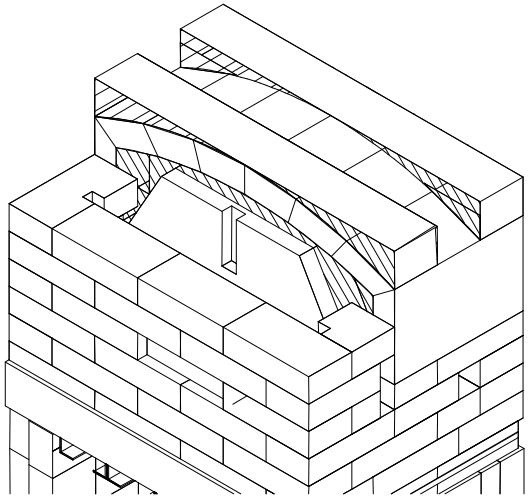


Figure 42

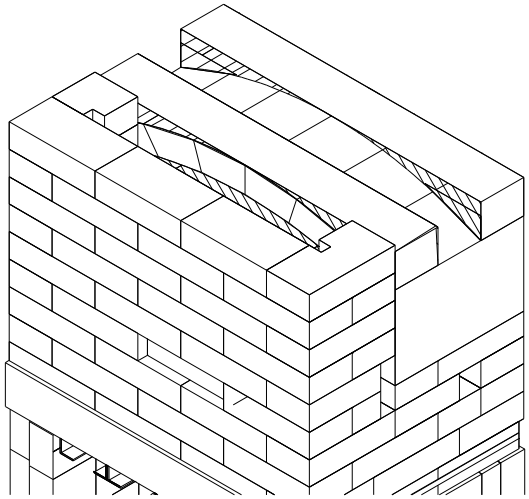


Figure 43

Continue as shown.

You may get a gap between the bakeoven and the bricks. Leave the gap open.

Note: the balance of the illustrations show a rear oven. The assembly is the same.

Figure 44

Figure 45

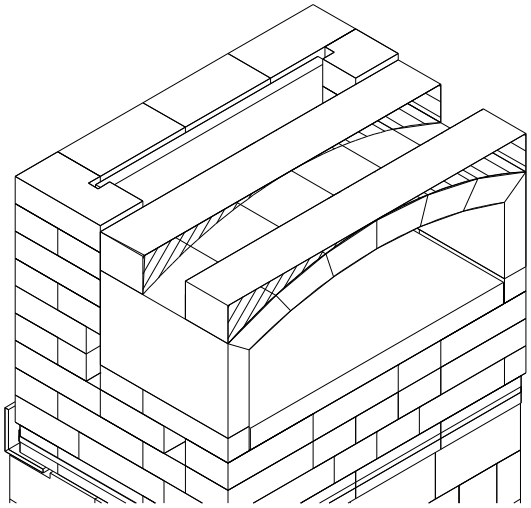


Figure 46

Slide in 24 ½” x 12” millboard.

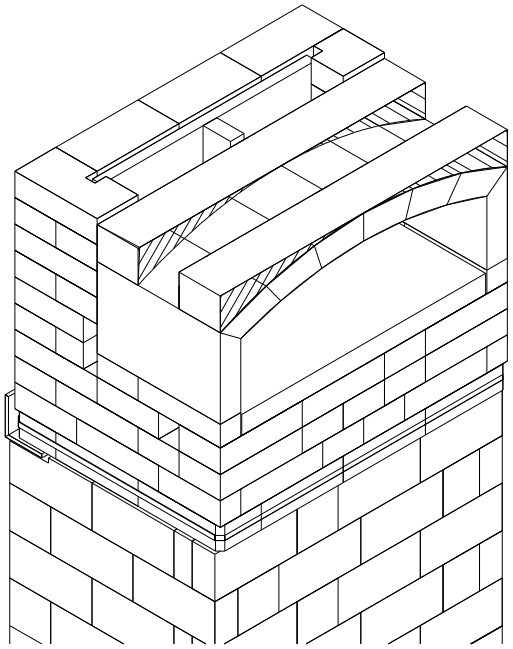


Figure 47

Rip a firebrick split and insert it into the notch that is provided in the oven back to form a retainer for the millboard, as shown. See also Figure 45.

Install fiberglass rope gaskets (supplied) inside oven. Gasket goes around 3 sides of floor, and around oven back.

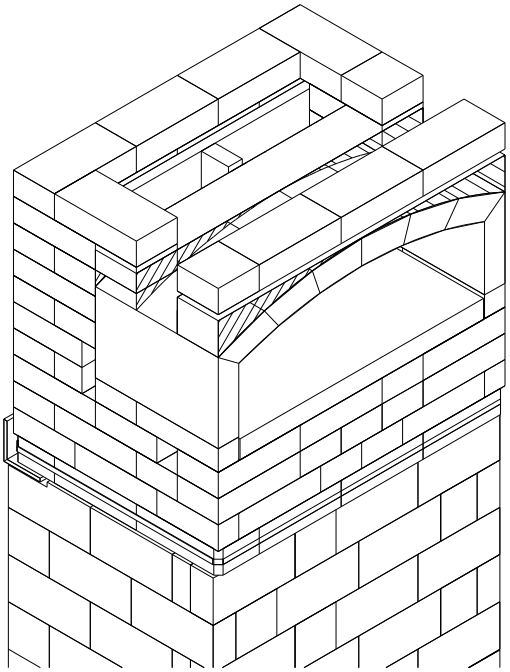


Figure 48

Top of oven and back firebricks need to be brought to same height.

In addition, a height adjustment needs to be made at this point.

The height shown in Figure 49 (next illustration) should be 67” above the top of the insulating base slab.

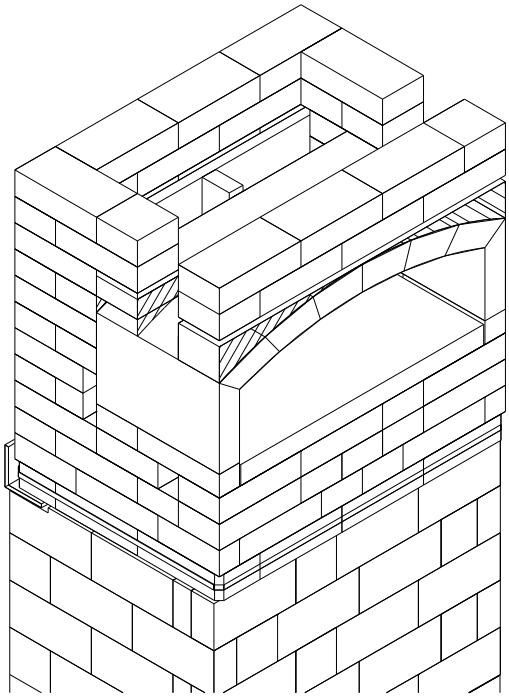


Figure 49

If makeup height is less than ½”, use a common mortar joint. If difference is greater than ½”, use either a castable refractory joint, or rip the bricks to the correct height.

If the makeup height is more than 1.25”, insert a course of firebrick splits.

Alternatively, adjust difference later by ripping firebricks or by cutting down one of the ceiling transitions (see Figure 50), which are a softer material.

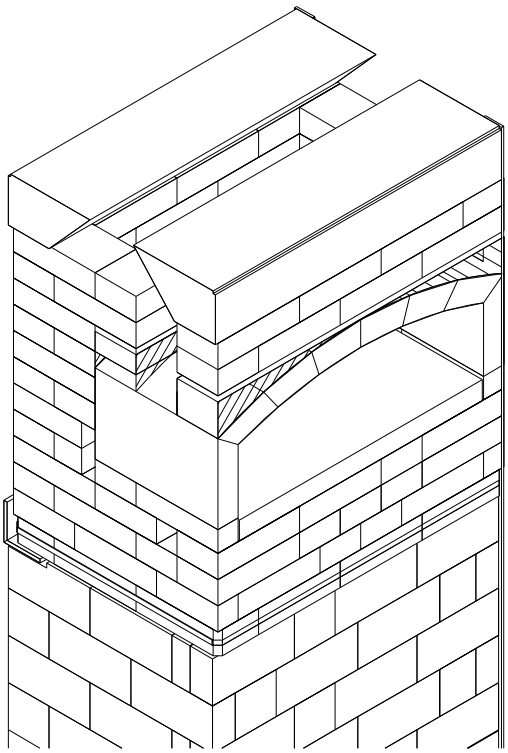


Figure 50

Install ceiling transitions. Front-to-back outside distance is 22.5”

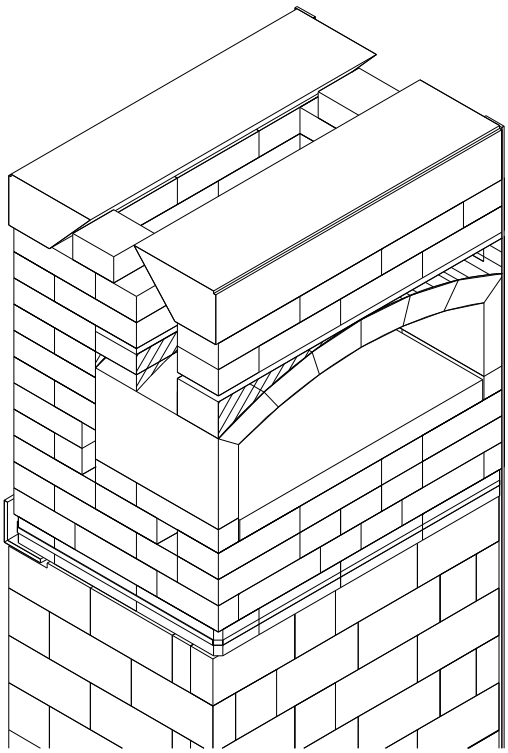


Figure 51

Install two half bricks as shown.

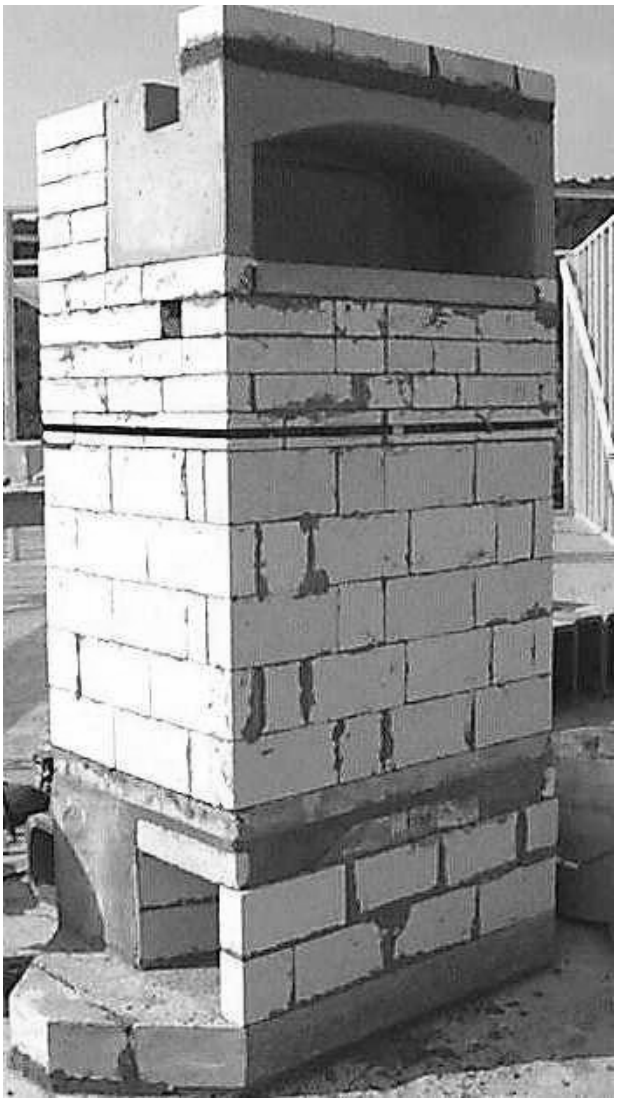


Figure 52

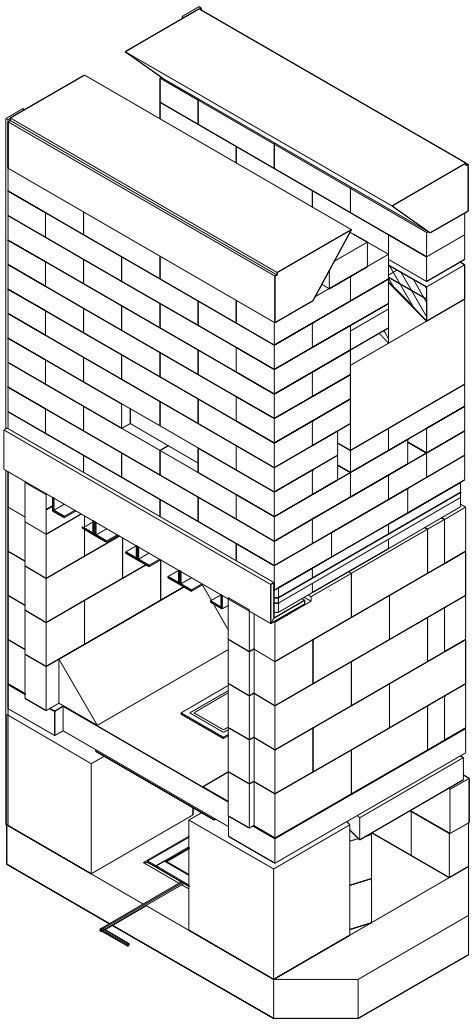
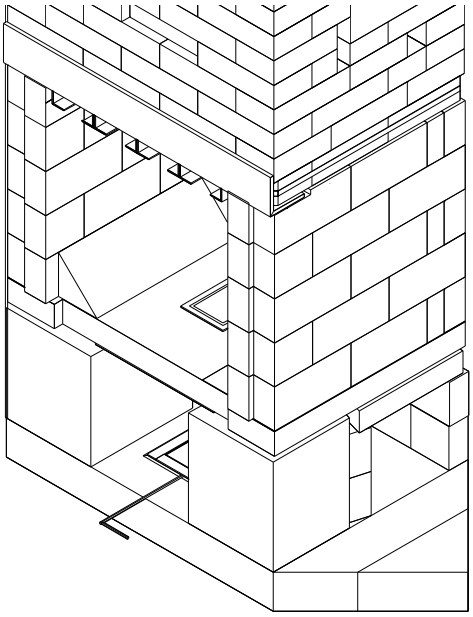


Figure 53

View from front.

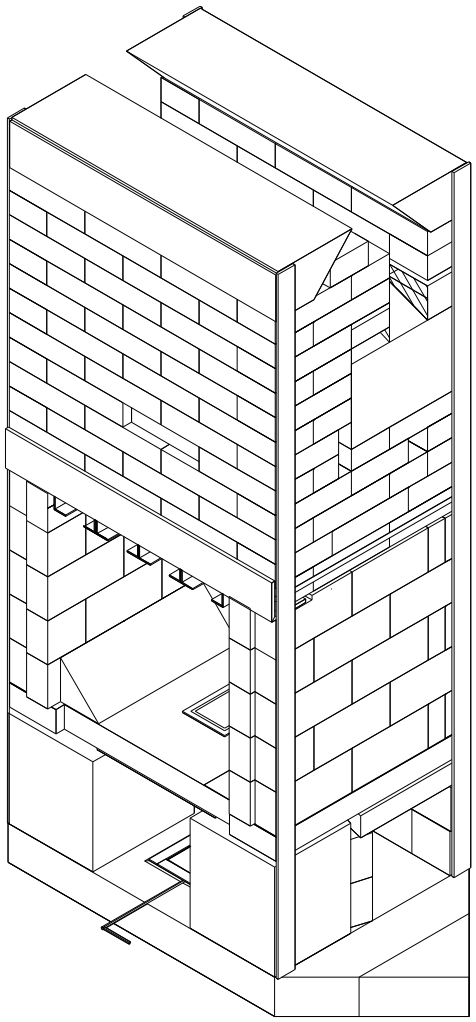


Install base slab extensions as shown. Set onto full mortar bed. Use a dry joint against the existing base slab.

Let mortar bed firm up before installing the precast downdraft channels.

Alternatively, insert brick scraps as wedges underneath the slab to prevent sagging as you install the channels.

Figure 54



Install strips of ceramic blanket against the inner core as shown to provide expansion joints between the inner core and the downdraft channels.

Take the 1” ceramic blanket provided, and cut 2” strips with a sharp utility knife. By hand, carefully split the 1” thick strips into 2 strips 1/2” thick.

Dab silicone against the inner core to hold the strips in place, and then press the strips against the silicone.

When installing the downdraft channels, set them dry against the expansion joints. Don’t use any mortar against the expansion joint.

Important Note: Ensure that there is no mortar bridging or dirt in the expansion joint. A solid connection will defeat the purpose of the expansion joint, and cause the heater facing to crack.

Figure 55

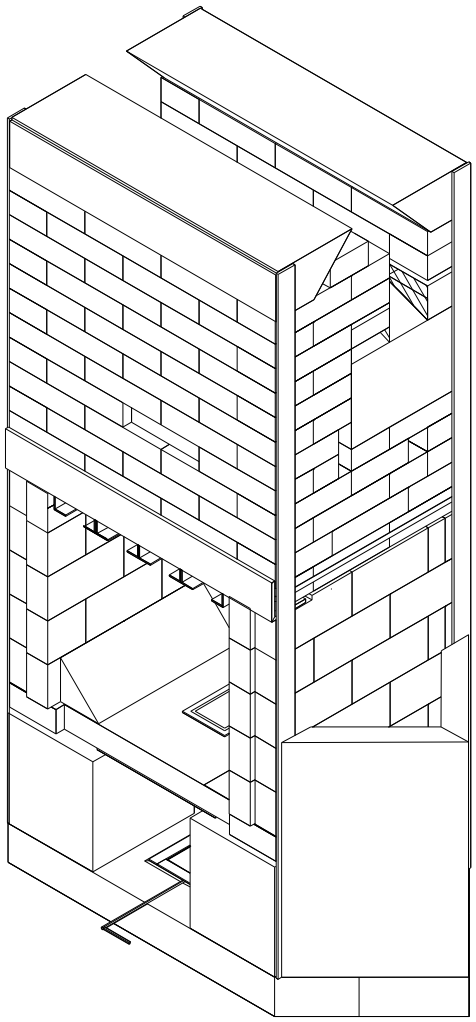


Figure 56

Install the downdraft channels.

Use a Sairset joint between the channels.

Install them with the aid of a helper, to avoid damaging the outer corners of the channels.

Once the second set of channels is in place, you can temporarily secure it with a web clamp (tie downs used for pickup truck beds). Don't tighten the clamp any more than necessary.

Figure 57

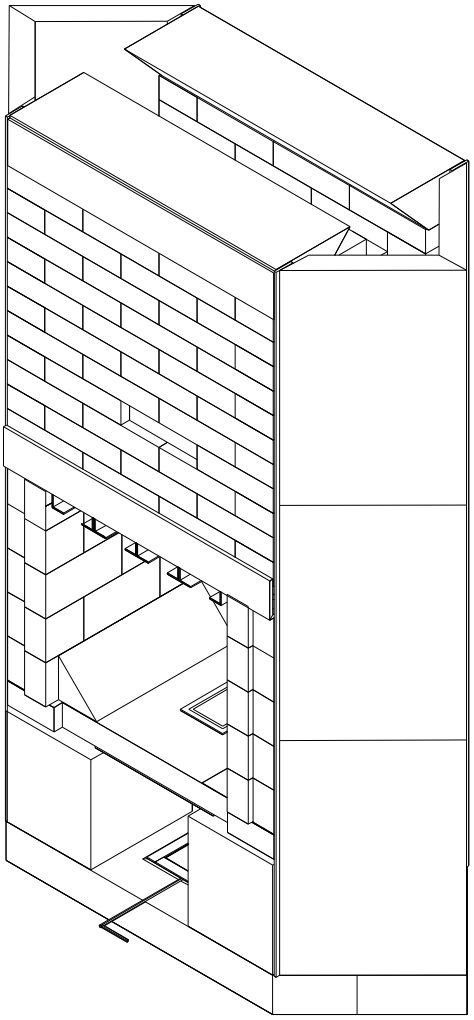


Figure 58

Secure channels to core with concrete tie wire or straps. If you use straps, use only a slight amount of pressure to avoid compressing expansion joints.

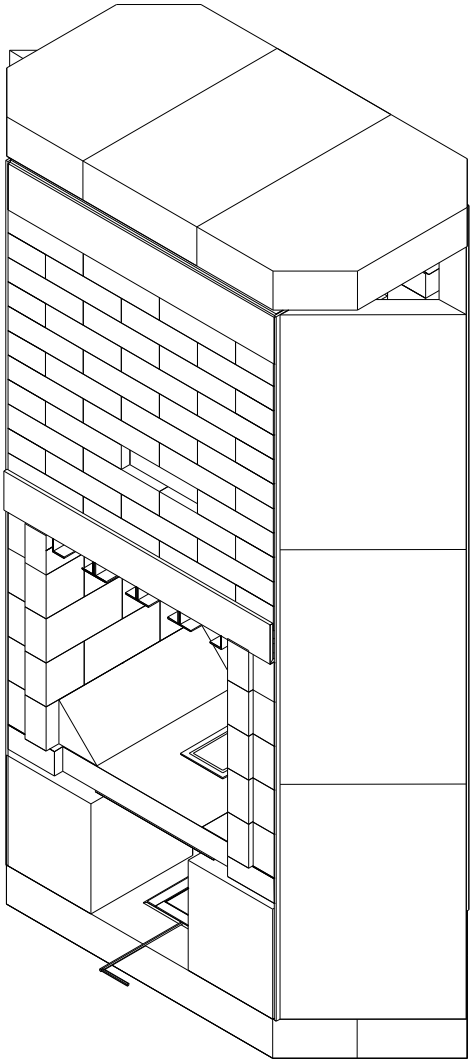


Figure 59

Install 3 piece ceiling slab. Slabs are set on dry.

Use a helper, and set up adequate staging (foot planks). Install smooth side down.

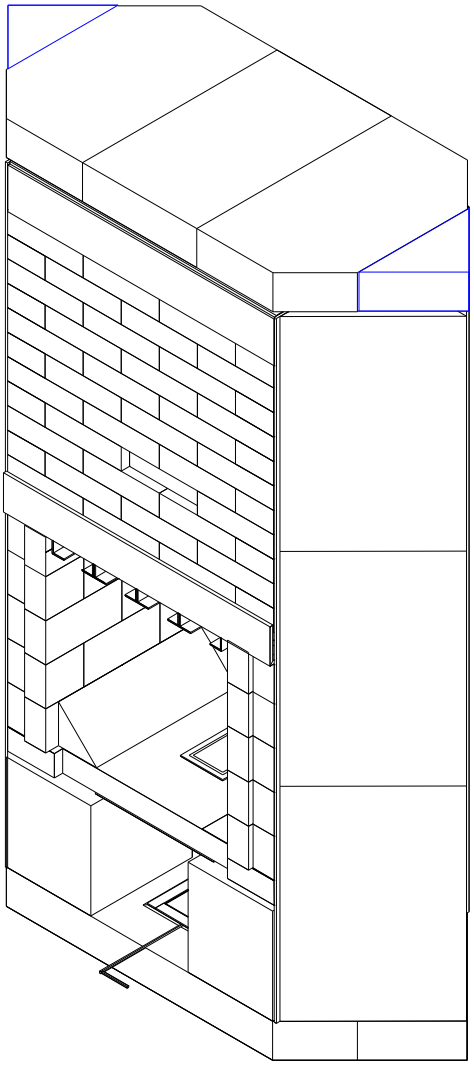


Figure 60

Figure 61

Install triangular ceiling slab extension pieces, using clear silicone to make tight joints with main ceiling slab and with top of downdraft channels.

Using clear silicone, carefully seal all ceiling slab joints, particularly the shiplap joints and the bottom joint.

Installing the Fiberlass Wrap

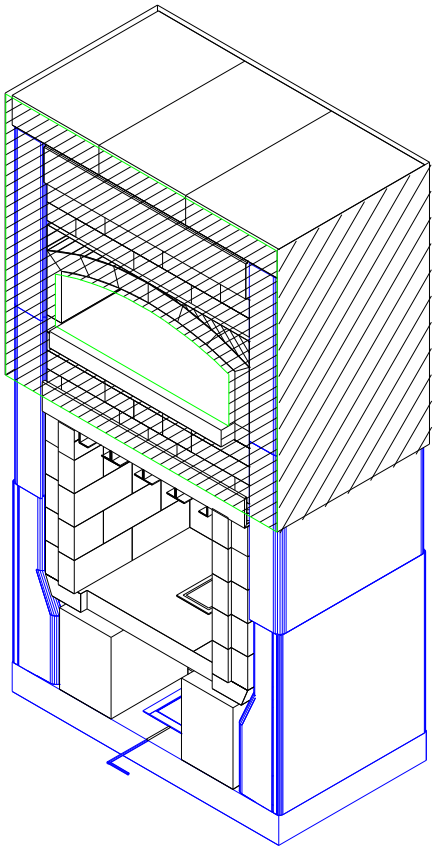


Figure 62

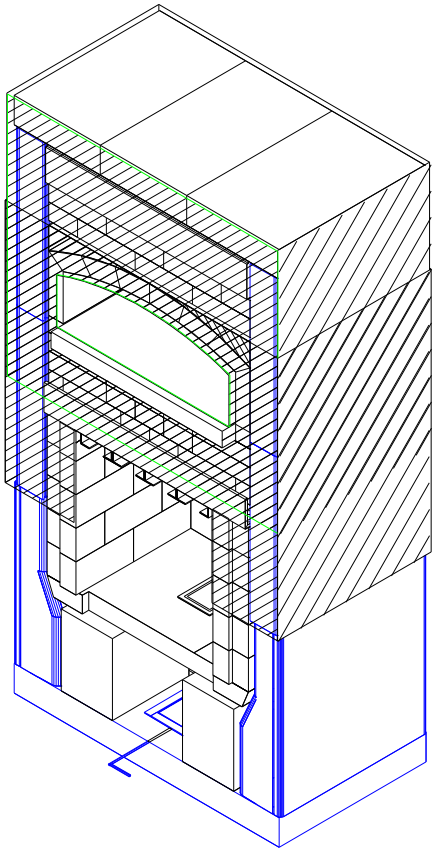


Figure 63

Note: drawings show standard heater. Procedure for corner heater is similar

Next comes a double wrap of fiberglass matt to act as an expansion and slip joint. 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. The mat is somewhat fragile. Trim to give approx. 4” overlap, and secure end with silicone dabs and several 3” pieces of duct tape.

Second wrap of fiberglass mat starts 28” above the concrete and goes 38” up. Use same procedure as before. Trim around firebox and use offcuts to cover exposed firebricks at front. (Next figure)

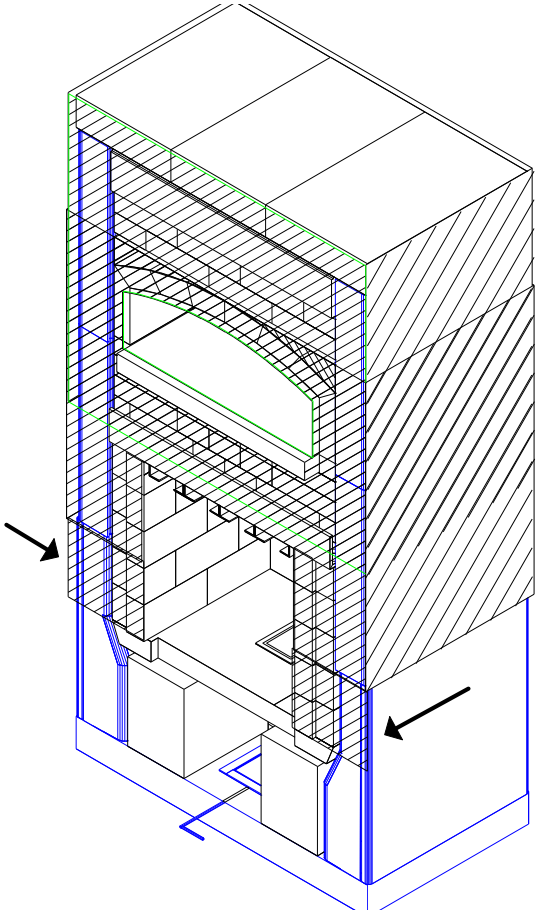


Figure 64

Add two additional pieces as shown.

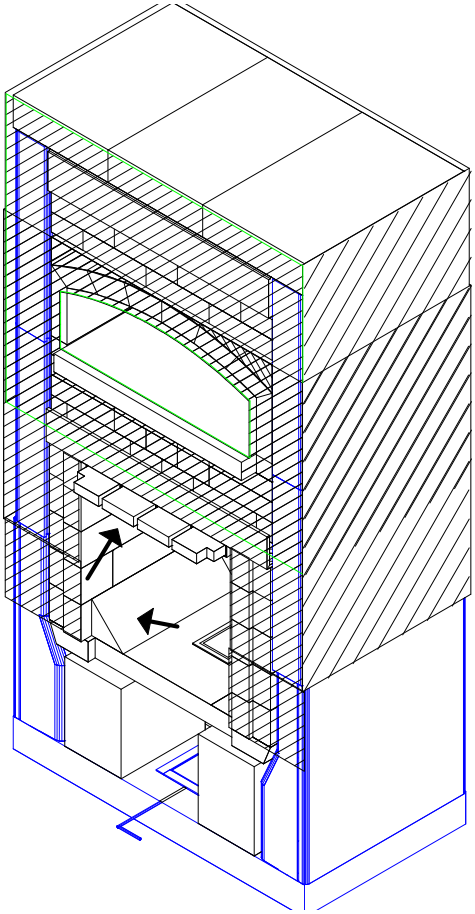


Figure 65

Note location of firebrick split heat shields.

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