

SPECIFICATION FOR PORTABLE CHARCOAL KILN

The portable charcoal kiln is made of light steel, in two sections, with a coned lid.

BOTTOM SECTION

The bottom section is in the form of a truncated cone and shall be of a vertical height of 2 feet, with an inner radius of 3 feet 6 inches at the base and a $\frac{1}{2}$ -inch horizontal flange around the lower edge to stiffen the shell.

A gutter shall be welded to the upper edge of the lower section to the kiln, to fit the lower flange of the upper section. The dimensions of this gutter shall be $\frac{3}{16} \times 2 \times 1\frac{1}{4}$ inches, the depth of the gutter being 1 inch below the upper edge of the bottom section. When the kiln is assembled this gutter is sealed with sand or wet clay to prevent air leaks.

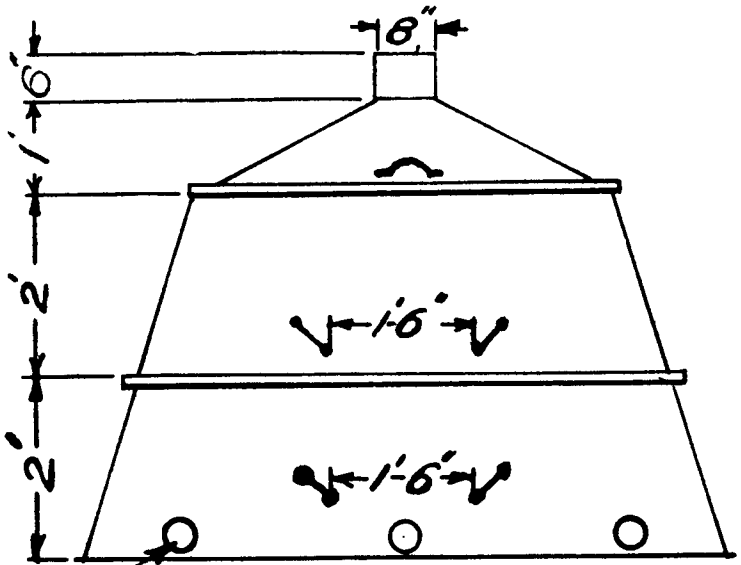
The bottom section shall have eight (8) draught holes $4\frac{1}{2}$ inches in diameter arranged symmetrically as shown in the figure, so that the lower edge of the hole is $1\frac{1}{2}$ inches above the lower edge of the bottom section. When assembling the kiln, inlet elbows and outlet pipes are fitted to alternate holes.

Four (4) handles out of 1-inch round iron, 6 inches in length, are fitted to the bottom section at an angle of 45 degrees to the horizontal, the handles of each pair being 1 foot 6 inches apart and 8 inches from the lower edge. Handles shall be welded on to a 3- by 2-inch base of $\frac{1}{4}$ -inch iron.

No. 14 gauge sheet metal shall be used for the bottom section.

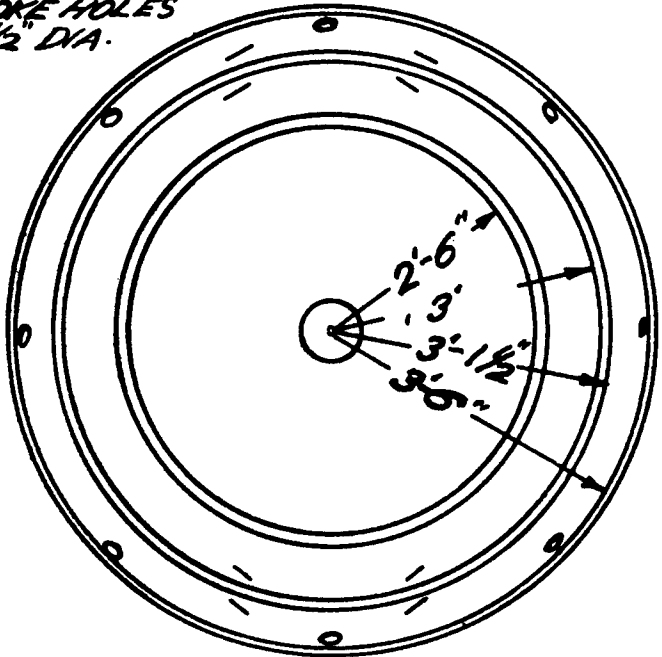
TOP SECTION

The upper section is of similar form. The vertical height shall be 2 feet 1 inch. The inner radius of the lower edge shall be 3 feet $1\frac{1}{2}$ inches and the inner radius of the upper edge of this section shall be of 2 feet 6 inches radius.



DRAFT OR
SMOKE HOLES
4 1/2" DIA.

SIDE VIEW.



PLAN.

The lower edge shall have a 1-inch horizontal flange to fit the gutter of the bottom section of the kiln. A gutter shall be welded to the upper edge of this top section to fit the flange of the lid. The dimensions shall be $\frac{3}{16} \times 2 \times 1\frac{1}{4}$ inches.

Four (4) handles out of 1-inch round iron, 6 inches in length, shall be fitted to the upper section at an angle of 45 degrees to the horizontal, the handles of each pair being 1 foot 6 inches apart. Handles shall be welded on to a 3- by 2-inch base of $\frac{1}{4}$ -inch iron.

No. 16 gauge sheet metal shall be used for the top section.

Lid. This is of the form shown in the figure (side view). The vertical height of the section shall be 1 foot. The inner radius of the lower edge of the lid shall be 2 feet 3 inches. The lower edge of the lid shall have a $1\frac{1}{2}$ -inch flange to fit into the gutter of the top section.

A chimney of 8-inch diameter and 6-inch vertical height shall be welded to the lid as shown.

Two handles fitted as before, of length 6 inches, shall be fixed strongly to the lid in a horizontal alignment at a vertical distance of 3 inches from the lower edge of the lid.

The lid and chimney shall be of No. 14 gauge sheet metal.

Chimney Lid. A small lid of $8\frac{1}{2}$ inches diameter with a 2-inch vertical flange and a 6-inch handle fixed to the upper surface shall be made to fit the chimney neatly. No. 16 gauge sheet metal to be used.

Draught-hole Covers. Four thin covers of scrap steel about 8 inches square shall be slightly curved to fit the kiln shell. These are used to regulate the amount of air entering the draught holes.

Outlet Smoke Pipes. Five (5) 5-foot lengths of $4\frac{1}{2}$ -inch diameter down-pipe, of 22 gauge metal, with a 120-degree elbow at one end, shall also be supplied.

Inlet Air Pipes. Four (4) 90-degree elbows $4\frac{1}{2}$ inches in diameter, of 22 gauge down-pipe, with lengths of 8 inches and 6 inches from the elbow.

Vent Covers. Sixteen (16) vent covers, from $4\frac{3}{4}$ -inch squares of scrap steel to be supplied to fit inlet or outlet pipes. Four covers to have 3-inch, four to have 2-inch, and four to have 1-inch, holes. The remaining four to be blank. The four corners of the steel squares to be turned at right angles, to fit over the $4\frac{1}{2}$ -inch pipes.

METHODS OF OPERATION OF A PORTABLE KILN

It is preferable that dry wood be used for carbonization to charcoal, but, with experience, green wood can be converted successfully. Wood should be free from decay, bark and earthy substance, and should be more or less uniform in thickness. Stacking in the kiln is facilitated if the wood is cut into comparatively short lengths of about 15 inches. The short pieces are stacked solidly in the lower part of the kiln until a level of about 2 feet from the top of the kiln is reached. At this level a quantity of kindling, consisting of leaves, twigs and dry wood of small sizes, is placed on top of the billets in the centre of the kiln, and the remaining space is then filled with short billets over and around the kindling, in such a manner as to leave a small aperture to permit lighting up.

The lid is put on the kiln, and through an opening at the top a lighted piece of cloth soaked in kerosene is dropped on to the kindling. The chimney is then placed in position and the flue pipes are erected. After about half an hour, the chimney is removed and short billets are dropped into the kiln then fill the small crater left by the burning away of the kindling. The chimney is then replaced and the kiln allowed to draw for a further period.

The time required to ignite the wood varies with different timbers, with their degree of seasoning, with their size, and even with weather conditions. It is essential that the charge be properly lit and a substantial heat developed in the top of the kiln. When this is developed, the chimney is removed, the opening covered so that the draught then enters by the air inlet tubes, and the products of combustion allowed to escape through the flues. Under correct conditions the outlet flues should steadily give off copious white fumes. If the smoke is still emitted feebly after ten minutes, the kiln is not properly lit, and unless conditions are corrected, a successful even burn will not be achieved. It may be necessary to drop a further armful of dry, easily burnt material through the roof of the kiln or to replace the chimney for a further period to assist in igniting the main charge. With unseasoned or only partly seasoned billets, a longer period is required before the kiln is hot enough to allow the draught to be reversed, than is the case with dry wood. Experience will soon show the time required to ignite the kiln with any one type of material. When the chimney has been finally removed and smoke issues freely from the side flues, carbonization is under way. The subsequent period of rapid "steaming" should be timed from this point.

With timber of about 50% moisture content and varying from 3 to 5 inches in diameter, a steaming period of about 6 hours from the time the flues are smoking freely gives satisfactory results. If the timber contains more moisture, a longer period is required. This can be determined only by trial. After the steaming period, each flue is covered with a damper having a 2-inch diameter aperture. As each flue gives off a thin blue vapour, it is removed and the outlet sealed. When all have reached this stage, the air inlets are also sealed and the whole kiln gone over to make sure there are no leaks.

The kiln is then allowed to cool and it is advisable to inspect all openings to ensure that no air can get in. The cooling time varies with the size of the kiln and the weather, but in the small unit 9 to 12 hours, or overnight, should be ample.

After cooling the kiln can be opened up and the charcoal removed.

From the data available from English sources, it would appear that the volatile content of charcoal produced in internally fired kilns is considerably higher than that of charcoal burnt in brick-lined kilns. This is no doubt due to the lower temperatures existing by reason of the loss of heat from the steel sides and top of the portable kiln.

To overcome this defect it is advisable to complete carbonization at a high temperature (approximately 600-800 degrees Centigrade). This period, called by some investigators the "flash up", entails the following procedure:

When the kiln has reached the period where only faint blue smoke is being discharged from each vent hole, the central hole in the roof is uncovered and the chimney once more replaced; the outlet flues are then completely closed and the kiln allowed to burn with a direct upward draught.

The temperature of the whole kiln is rapidly raised, owing to the unrestricted volume of air now being admitted and a dense volume of greyish-blue smoke pours from the chimney. This should, in about 10 to 20 minutes, diminish in volume and finally become almost colourless. This is visual evidence that the tarry volatiles remaining in the charcoal before the "flash up" have been driven off and no longer remain to give trouble in the scrubbers of the producer plant or in the engine itself.

Inspection of the kiln through the central orifice should reveal an even body of glowing charcoal at a dull red heat, though the surface itself may remain black.

Should one side of the kiln be cooler than the other and remain black at the end of the "flash up" period, the inlet flues on the hot side should be completely closed and the cooler portion of the kiln be given a further 10 minutes or so of free burning until it too attains the same dull red glow, when the whole kiln should be closed down and completely sealed according to the instructions previously given.