Building a Metal Casting Furnace

by: Jerry Twaddell

The following gives a brief and somewhat sketchy description on how to build your own furnace for metal casting!

The first picture in a series of three shows my lid. I have and have used for years a smaller furnace that will handle up to a #12 crucible, but needed a larger furnace from time to time. So, what you will be seeing is made from a 55 gal. oil drum. But, the ideas apply equally to larger or smaller. IE a friend just finished one based on a 5 gal. steel bucket. The idea here is don't reinvent the wheel---use readily available shapes for free!!! I had to have a piece of sheet metal rolled for my inside form, but my friend used a paper form for concrete casting for his 5 gallon bucket furnace. Be inventive!

As you may have read from other sources that told you how to turn a shape in wood for your exhaust hole, you will note that I did something simple. My form for the exhaust is a tapered plastic cup--butter tub--something you have on hand for free. Simply screw/bolt it to a chunk of plywood so that you can remove it easily after the refractory has set up. Smear Vaseline on the board and cup so that they don't absorb water and for a smooth release from the refractory. Look close at the pic and you will see wires running in and out of the steel rim. I used stainless wire from an .045 roll of mig wire--works and adds strength to the lid. Advice!!! Make your refractory into a very thick slurry--much thicker than you would 'pour concrete'. You want a grog in thickness! Shovel on/spoon a gob and then tamp with a stick MANY TIMES. Otherwise you will have entrapped air bubbles.

I used KS4# refractory for this project (an AP Green product). It is a high temp. refractory with poor insulating properties, but it is very solid (non porous). I cast commercially and don't want to spend a lot of time relining my furnaces. But if you are into this for hobby casting, my advice would be to go for a less expensive refractory or make your own as outlined in several books available from Lindsay.
The second picture shows the furnace ready to cast the lining. I've already cast the bottom to which I have added stainless wire hooks to lock the side to the bottom. You may note from the pic the white lining around the edge of the drum. KS4+ due to it's poor insulating quality/ needs a bit of insulation. The insulation is two layers of insulpaper (read kao wool-same thing). (AP Green product.) Also, note the trolley that the furnace is mounted on. I/we use several sizes of furnaces and use the quick disconnects as shown. The idea for the trolley and qd is for quick change over between furnaces as our space is limited in the pouring room. You might want to consider something similar, with larger wheels if you are into hobby and storing your equipment in the garage, but casting outside.

![Picture 2]

The third and last picture is the completed furnace. The only thing to note here is my design for a simple lid lifter. You don't need this if you are working from small furnaces, but at this size and for my #12 furnace it is a worthwhile addition--lids get heavy and take up space. It is nothing more than a simple pivot pin and a step on lifter--the vertical lift portion is nothing more than a couple of close fitting iron pipes. The lid then swivels out of the way for adds or for removing your crucible for pouring.

![Last picture]
One last thought, CALCINING! For new folks, you will need to calcine your furnace. In simple terms this is more than simply 'drying out'. You are removing the moisture PLUS making your furnace into a waterproof ceramic. After ramming the grog to make the furnace, cover with a wet towel for a day or so to insure a slow cure of the refractory. Then 'dry' the refractory very slowly. My method is to place a hot plate in the bottom of the furnace with the lid on--low heat! (for you Northern folk--a bundle of eve heater for ice dams will work great). After 6 to 12 hours depending on the size of the furnace, turn up the heat. After several increases in heat AND WHEN YOU DON'T SEE ANY STEAM COMING FROM THE FURNACE, you are ready to calcine. Now, heat with your heat source around 10 min on and 20 off for several cycles at your lowest heat setting. Go hotter for several cycles and then finally at your max heat, heat until the lining gets to a white/yellow heat. YOUR'E DONE! You may have a few hairline cracks, as I do, but they will close when you heat your furnace for casting.-no problem!

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