

Furnace Insulation Material & Design Considerations

(This information is a incomplete work in process. There may be significant errors and omissions.)
Copyright 2001 by Budget Casting Supply LLC

Most hobbyists build a cylindrical furnace, with a internal diameter of about 6 to 8 inches. For this design a wall thickness of about 3 inches will suffice for a furnace used to melt aluminum with electric heating or gas firing. The 3 inch thickness will also provide adequate strength when using either Refcast RKS or IRC-26 castable type refractories. Three inches will also provide enough insulation to get up to melting temperature in a reasonable time (30 - 45 minutes or so for typical electric heating, faster for gas).

The amount of refractory required also depends on the exposed surface area. The larger the internal diameter and height of the unit the thicker the walls should be. My Gingery Li'l Bertha electric furnace has an internal diameter of 8.5 inches with an outer diameter of 13 inches, thus a wall thickness of 2-1/4 inches. I find that this wall thickness is just barely adequate, as the surface temperature is very hot, and even a breeze will sap enough heat to really slow down the process. If I were to build this size unit again I would use 3 inch walls. If I were going to build a larger unit with say a 10 inch internal diameter I would consider using 4 inch walls with electric heat, and maybe 3 inch with gas.

Another consideration is the type of metal that you are melting. The higher the melting temperature the more insulation you will require to keep the heat losses and external temperature to an acceptable level. Thicker is better from an insulation and strength standpoint. So what's the down side to thicker walls? First is weight. The total refractory weight gets heavy fast as the wall thickness increases. Note that the IRC-26 is a lot lighter per cubic inch (92 lbs per cubic foot) than the Refcast RKS (132 lbs per cubic foot). Another consideration is cost for the material and shipping. The thicker the walls the more material you have to buy.