

Crucible Melting Furnaces Operation Guidelines



The Schaefer Group, Inc

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ARTICLE TAKEAWAYS:

- When crucible melting makes the most sense
- Weekend operation to save energy costs
- Preventing cracks in crucible bowls

Let me start by saying that if you are comfortable using crucible furnaces—then you might not know how much they truly cost. With worker comfort issues, maintenance, crucible bowl costs, downtime, reline costs, and workers comp or safety costs associated with these units, they can cost more than the dollars saved in space, metal inventory (3 to 1 hold to melt ratio), and lower upfront costs.

Crucibles have their place, don't get me wrong. If you change alloys frequently, shut furnaces down often for extended periods of time, and have extremely limited space, then a crucible furnace is really the only choice.

There are some ways to eliminate some of the headaches involved in crucible melting and holding at the machine. There are a lot of companies offering quick change elements because unfortunately, they need changing often. Schaefer elements last on average two years and are easily changed (when you must change a bowl anyway). Some companies use only one burner on large units and should be using two.

OPERATION RECOMMENDATIONS

- Never allow a bowl to be drawn down more than 3 inches.

After that the temperature differential at the top of the bowl and the middle is so great that the top expands and cracks prematurely.

- Do not allow ingots to be dropped into the bowl.

This can cause the cracks to occur in the bottom of the unit. With a little pre-planning and care, expect a year or more of life out of crucible bowls.

MELT RATES

We have always taken basic melt rates very conservatively in order to ensure good crucible life and metal quality. Through years of experience

of foundrymen pushing melt-to-hold rates on crucibles at: 3 to 1 and even 1 to 1 range—has resulted in drastically reduced crucible life.

Many times, chilling or sludging causes alloy desegregation, inclusions, and metal chemistry problems. Due to these problems, we have gauged our melt rate on the conservative side. If a customer desires to melt beyond these conservative rates, then the furnace needs to have input power required to perform the task.

Evenly charging the furnace with ingot or small scrap (while it is still hot) will increase the efficiency of a crucible furnace. The rule of thumb is to put in whatever you take out, every 15 minutes. Unless you are making very large sand castings or permanent mold castings that require most of the liquid metal in the bowl, do not batch charge a crucible as that will greatly reduce the life of the silicon carbide bowls.

WEEKEND OPERATION

For a 1,000#/hr gas melter—leave it full of metal over the weekend for important energy saving reasons.

Energy to melt during production 1,000#/ for three hours 5,400,000 BTUs, if left full of metal at 12500 F will use about 105,000 BTUs/hour to hold for 48 hours or 5,040,000 BTUs for two days.

If the crucible is drained and shut off, it will use 6,000,000 BTUs just to get it full again. The melt rate slows way down when empty vs full of metal. It might take six hours to

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reheat and melt the metal until the bowl is full again. For the first half of the load, it will be using 2,000 BTUs/# you melt!

Not only does it cost more but you wasted the energy used to fill it the last time before it was shut off! Leave them on all weekend and make sure there is a leak detector hooked up to the unit that can sound an alarm if there is a leak in the bowl.

MELTING & HOLDING

Melting and holding in the same bowl can cause inclusions and an increase in hydrogen gas in the metal. Generally, plan to hold the temperature at a much higher than normal rate in order to overcome

the large temperature swings that are typical when loading these types of melters, as there is simply not enough stored BTUs in that small amount of metal left in the bowl to help with the melting process. It must draw all the energy from the heat source which can cause huge temperature swings and leads to cold shots, increased dross, and separation of the alloy constituents. Wet bath reverbs eliminate most of these issues because of their hold to melt ratio.

Follow these few guidelines to minimize down time and reduce energy costs usually associated with crucible furnaces.



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