

## Immersion Heating Provides Energy Efficiency Benefits

Palmer Foundry, an aluminum shape casting company in Palmer, MA, commissioned a crucible furnace with immersion heating technology (Figure 1), with support from the supplier Drache in Germany (Figure 2). By heating the melt internally (instead of from the ladle surface), immersion heaters are able to heat the melt (from 300 lbs to 25,000 lbs) more rapidly and uniformly. Although this type of heating technology has been used in Europe and Japan to raise and maintain metal temperature inside degassing units, holding furnaces, and transfer ladles for over a decade, this is the first of its kind to be used in the U.S.

Two 15 kW immersion heaters manufactured by Lethiguel in France were installed (Figure 2). The heaters, which are able to provide customized power, are well suited to maintaining or raising the temperature of aluminum alloys. This enables the company to achieve the required temperature increase in its melt within minutes.

Furthermore, each heater is managed by an external high precision bath thermocouple, which provides excellent control of the metal temperature, minimizing the risk of overheating. Thus, the amount of surface inclusions are reduced, significantly improving the overall metal quality. The quality of the Drache Fused Silica refractory material with its non-wettability also helps to improve the metal quality and the cleaning of the crucible after each pour. Degassing can also be performed directly in the furnace (Figure 4).

At the request of Palmer Foundry, the control panel for this furnace was designed to integrate with their existing process data historian system. The panel sends all sensor and PLC data to the central database, so that bath temperatures, power consumption, lid position, etc., are all recorded for future reference, validation of performance, and troubleshooting.

The crucible furnace is also designed to allow for further customization and automation of the process, such as increasing the ladle capacity and motorizing both the lid swing and crucible movements.

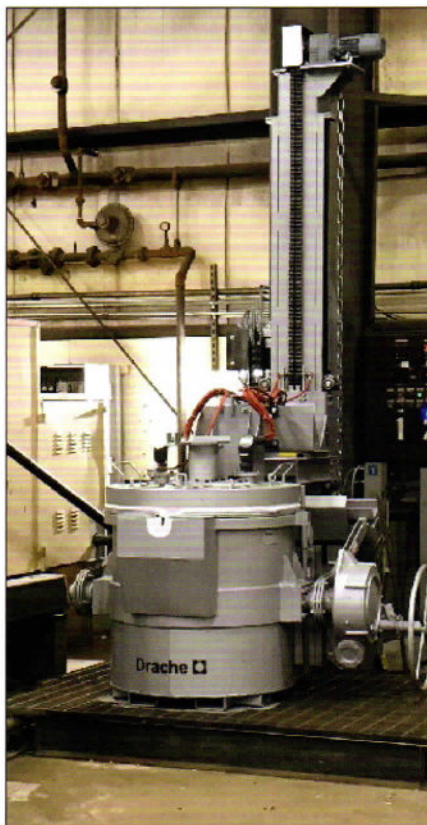


Figure 1. Crucible furnace commissioned at Palmer Foundry.

According to Palmer Foundry, with combined holding and heating, the furnace has an 80% reduction in energy, compared to their existing resistance ladles. This is because the immersion heaters introduce heat directly within the molten aluminum, so that more than 99% of the produced energy is absorbed by the melt instead of radiating into the plant. The Fused Silica refractory lining for the ladle also improves energy efficiency by being thermally efficient, keeping the outside shell of the ladle below 100°F, even when the metal temperature reaches 1,300°F.

Electrical utility providers in Massachusetts offer incentives for installing energy-efficient equipment and technologies that help reduce the demand on the electrical grid, with its fixed generating capacity. The incentive is based on every kW of energy saved. With implementation of this new energy efficient immersion heating technology, the incentive obtained could be as high as half of the cost of the furnace. ■



Figure 2. Robin Schmitz, Drache, sets up the electrical preheating system on top of the crucible during commissioning.

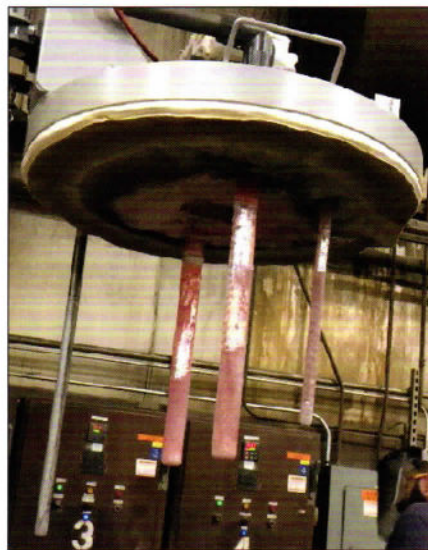


Figure 3. Crucible furnace lid showing two immersion heating rods and one silicon thermocouple.



Figure 4. Metal quality in the crucible after the degassing process. Precise thermal control with less overheating reduces oxides on the surface.