Down-sizing of induction furnace for process optimization

Tags
Type: Unit case study
Sub-sector: Foundry
Location: Kolhapur
Partners: GEF, World Bank, SIDBI, BEE, TERI, IIF–Kolhapur chapter, Kolhapur Engineering Association
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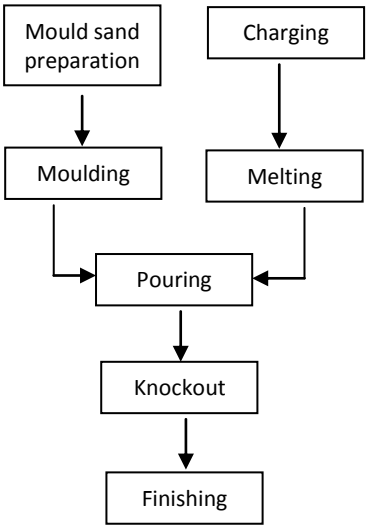
Cluster background

Kolhapur (Maharashtra) is one of the important foundry clusters in India. The cluster has around 300 MSME foundries producing about 600,000 tonne of castings annually, primarily ferrous (iron) castings for the automotive sector, and accounting for about 7–8% of India's total castings production. The production capacity of these units varies from less than 1000 tonnes to over 10,000 tonnes per annum (tpa).

Unit profile

The MSME foundry unit **K3** manufacturing cast iron and spheroidal graphite iron (SGI) castings. The annual production is about 770 tonnes. The total annual energy bill of the unit was about Rs 169 lakhs, which was around 14% of total turnover. The major process steps involved in the production of castings include mould preparation, melting, pouring, knockout and finishing. Green sand is prepared using sand mixer and the moulding is done manually. The charge material is melted in an electrical induction furnace. The molten metal is poured into moulds, which are cooled down and knocked out manually to remove the castings. The castings are subjected to finishing operations such as shotblasting and machining. The sand from the moulds is sent for reuse in moulding process.



Production process in a foundry

Energy consumption

The major energy consuming equipment used in the unit include the electrical induction melting furnace and electrical motors associated with process equipment such as agitators, pumps, etc. Electricity from grid is the major energy source used in the unit.The total annual energy consumption was calculated to be about 211 tonnes of oil equivalent (toe).

Intervention

The unit was operating an induction furnace with rated capacity of 350 kW and crucible capacity of 500 kg. The specific energy consumption (SEC) of this induction furnace was calculated at 820 kWh/tonne of molten metal, which was relatively high for this category of furnaces. Also, considering the fact that the unit produces small castings, the large crucible capacity of the existing furnace increased the holding time and resulted in significant energy losses.

L-Inefficient induction furnace; R - EE induction furnace

The unit replaced its inefficient FO-fired melting furnace with an energy efficient induction furnace

As per the recommendations of the energy audit, the unit replaced the existing induction furnace with a new 100 kW induction furnace with 150 kg crucible capacity. The SEC of the new system was calculated at about 700 kWh/tonne of melting. This represented a 15% reduction in the energy consumption for melting. The annual energy saving was estimated to be 169,039 kWh, equivalent to Rs 13.9 lakhs. The investment made towards installation of EE induction furnace was Rs 10.5 lakhs, giving a simple payback period of 0.8 years.