

Successful Implementation – Energy Conservation Measure

Measure
Replacement of inefficient indirect arc furnaces with medium frequency induction furnaces
Equipment
Medium frequency induction furnace
Industry / Sector
Foundry - Automobile
Year of Implementation
1996
Cost Benefit Analysis
o Type of Measure: Large investment
o Annual Energy Savings: 1.50 lakh kWh
o Actual cost savings: Rs. 5.36 lakh
o Actual cost : Rs. 10 lakh
o Payback: 21 months
Implementation Highlights
<p>Implementation of the measure has resulted in</p> <ul style="list-style-type: none"> ☞ Energy saving potential of 60%. ☞ Reduction in specific energy consumption by 40% - 80%. ☞ Better control over the metal composition. ☞ Increased productivity of the furnace by 25% - 66%. ☞ Flexibility and ease in operation. ☞ Improvement in working conditions. ☞ Reduction in thermal inertia of the furnace. ☞ Reduction in electrical distribution losses.

Summary

Replacement of indirect arc furnaces with medium frequency furnaces has resulted in energy savings, reduction in quality rejects and improved work conditions.

Background

A leading automobile components casting foundry had two indirect arc furnaces of capacity 30 kg and 80 kg respectively. These furnaces were used for producing specialized automobile components.

The specific energy consumption for melting of the cast iron in 30 kg arc furnace varied in the range 1119-1258 kWh/Mt and in case of 80 kg furnace it was about 1800-2000 kWh/Mt. The melting time in 30 kg furnace varied in the range of 25-35 minutes and in 80 kg furnace the melting time varied in the range of 80-95 min.

In addition to long melting time and high specific power consumption, a lot of heat radiated out and large volumes of smoke emanated from the arc.

Smaller capacities of the existing furnace meant the number of melting batches was high and correspondingly the fixed heat loss component was very high.

These inefficient arc furnaces were replaced with one medium frequency (3000 Hz) induction furnace of capacity 125 kW, having two pots 50 kg and 100 kg respectively. The 50-kg pot is rated at 90 kW while for the 100-kg pot rating is 125 kW.

Principle

In smaller sizes, induction furnaces are more efficient when compared with indirect arc furnaces. In indirect arc furnaces the basic draw back are

- ☞ Heat transfer is purely on radiation hence the efficiency of furnace is low due to high fixed losses
- ☞ High specific energy consumption
- ☞ Control of metal composition is poor
- ☞ High consumption of electrodes
- ☞ Long melting time

While the medium frequency induction furnaces have the following advantages.

- ☞ Faster heating
- ☞ Better control over metal composition
- ☞ Ease in operation

Details of techno-economics:

Particulars	Units	before (Sep 96) (Indirect arc Furnaces)			After (Sep 97)	Improvement	% Improvement
		30 kg IAF	80 kg IAF	Total/ ave.	125 kW IF		
Monthly energy consumption	kWh	14434	6280	20714	8267	12447	60
Metal tapped per month	Kg	13970	2100	16070	13974	-2096	-13
No of heats per month	No	438	27	465	330	-135	-29
Specific energy consumption per Mt	kWh	968	2990	1085	592	494	60
Annual energy consumption	kWh	173208	75360	248568	99204	-149364	-60
Cost of energy	Rs	621816	270542	892359	356142	-536217	-60
Annual energy savings	kWh	149364					
Annual cost savings	Rs	536217					
Investment incurred	Rs	1000000					
Payback period	years	1.86					

Implementation issues

Plant was not aware of smaller size induction furnaces. After identification of the supplier plant personnel approached them for the implementation.

To have more production and less number of heats plant has gone for higher size furnaces.