25% Fuel Saving Through Modification of Ladle Pre Heating System to Utilize Heat of Waste Flue Gases

Background:
In a foundry, ladle is used to transport and pour out molten metals from melting furnace. Ladle Preheater is required for removing the moisture from the ladle to avoid formation of gas / reaction with the liquid metal. A properly designed Ladle pre-heater gives a far more efficient and controlled method of pre-heating a ladle than the traditional methods of using either a gas flame poker with a “lazy flame” or a simple gas/air burner without a cover.

A foundry industry near Faridabad had two ladle preheating stations for preheating the ladles before pouring the molten metal from the melting furnace. The energy balance of the ladle preheating furnace indicated that the flue gas losses accounted for 33% of the total heat input which indicates on very high side. The hourly consumption of HSD in the ladles was 147 kg/hr. The ladle pre-heater uses ambient air as combustion air. The flue gas temperature is up to 950°C.

Scenario after utilizing heat from ladle Pre-heater:

The ladle pre heating system was modified to recover the energy of waste flue gases in an energy efficient way which enables the reduction in fuel consumption and reducing the pre heating time.

Modification of the ladle pre heating system has resulted in reduction on fuel consumption by 25% to 110 kg/hr. Along with the other added benefits as below:

• **Reduced preheating time:** The homogeneously distributed heat input at a high energy density allows an unmatched quick heating of the ladle. The heating-up times has reduced by 30 %

• **Increased durability:** So called “hot spots” that are due to local fire or flames as well as cold areas (“temperature holes”) completely eliminated. A minimal loss of material and an increased durability of the ladle lining are the positive consequences.

• **Reduction in Emissions:** significant reduction in CO2 and other pollutants.

• **Reduction in Operating cost:** Installation of waste heat recovery recuperator along with other modifications resulted in 25 % reduction in fuel consumption and reduced pre heating time. The payback period for the total investment made was less than 1 year.
**Brief Detail of Ladle Preheating System:**

- Ladle pre heater was equipped with the recuperator to recover the heat of flue gas discharged to the atmosphere. The flue gases from the ladle were passed through a recuperator to indirectly heat the fresh combustion air.
- High speed burner develops long & lazy flame leads to uniform heating across the Ladle length eliminating chances of any cold zone in the Ladle.
- Redesigning of ladle pre heating system for proper sealing of the lip of the ladle to the ladle heating apparatus. Tight seal between the lip of the ladle and the ladle heating apparatus prevents the leakage of hot air.
- Ceramic Fiber Lining on the face of ladle preheating system to prevent heat loss.
- PLC controlled operation of lid, burner, blower.
- Motorized lid up down and tilting motion

**Advantages of Properly Designed Ladle Pre-heater system:**

- Save Money, by being far more fuel-efficient than the traditional pre-heat methods.
- Reduce refractory lining damage caused by thermal shock.
- Reduce skull and dross formation caused by pouring metal into a cold ladle.
- Help to minimize the reduction of the temperature loss of the metal whilst it is in the ladle.
- Help to prevent the possibility of lining damage due to a poorly dried lining still having significant moisture content.
- Ensure that the ladle is evenly pre-heated.

**Skills Requirements**

Few hours training provided on various function, operating mechanism of control panel etc to the operator.

**Conclusion:**

The installation of PLC base ladle preheating system, has not only reduced the fuel consumption by 25 %, but also reduced the heating time, operation and maintenance cost. The refractor life, comfort to operator has improved.

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**About the Project**

The World Bank (WB), with support from the Global Environmental Facility (GEF), is executing a project titled “FINANCING ENERGY EFFICIENCY AT MSMEs”. The project aims to identify, design & implement Energy Efficiency (EE) solutions in 500 MSMEs in 5 clusters with potential of EE investment of more than Rs. 100 crore and reduction in GHG emissions equivalent to 1.2 million tonne CO2. Majority of the MSME units completing implementation have reported significant energy and cost savings. This project is being co-implemented by Small Industries Development Bank of India (SIDBI) and Bureau of Energy Efficiency (BEE)

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