

# Energy saving Opportunities in Steel Reheating Furnaces

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**Abstract** - The reheating furnaces used in the Re-rolling mills of Punjab use the old conventional technologies and are highly energy intensive. The technologies used in these mills and number of various energy conservation measures such as controlling furnace draft, using proper burner etc and waste minimization measures are discussed. There are number of ways by which the performance of these re rolling mills can be improved and their process can be made less energy intensive.

**Key Words:** Re heating furnace, burner, Furnace draft, hearth loading.

## 1. INTRODUCTION

A furnace is an equipment to melt metal for casting or heat materials for change of shape (rolling, forging etc.) or change of properties (heat treatment). In the case of Steel rerolling mill , a furnace is used for heating the raw material, ingots or scrap to a temperature of around 1100 to 1200° C so that it becomes ductile and this red hot material is later on elongated in a series of re rolling mills to obtain the desired product like Sariya/Angles /Patra/Bars. Some of the products of are rolling mill are shown in Fig1. The most important part of rolling mill's process is Re-heating furnace.



Fig -1: Iron rods of varying diameters, TMT, Patti, and L-strips.

These re-rolling mills are located in India. Clusters are located in Mandi Gobindgarh, Ludhiana & Khanna in Punjab, Calcutta, Bhavnagar in Gujarat, Nagpur & Nasik in Maharashtra and Jaipur in Rajasthan. In Punjab itself there are about 300 re rolling mills having various production capacities mentioned below:

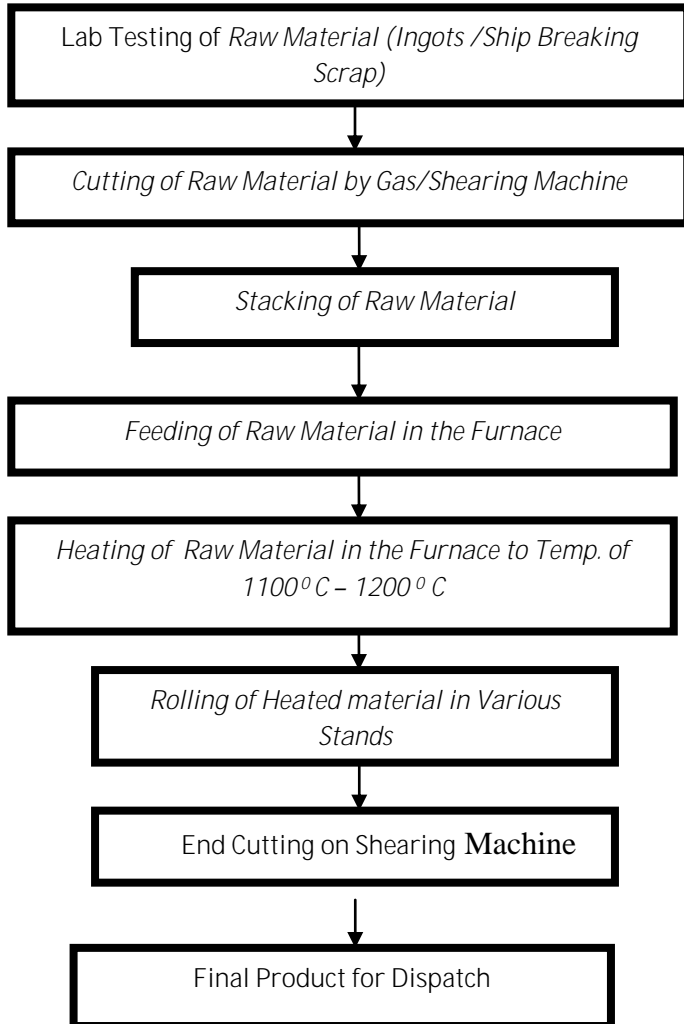
Table-1: Re-rolling mills having various production capacities in Punjab.

Category	Production Capacity (TPD)	No. of Units
Small	10-15	50
Medium	15-50	200-220
Large	50-100	50-70

Fuel worth Rs. 1000 million per annum is being consumed for re-rolling of 2.7 to 3 million tonnes of rolling product.

### 1.1 PROCESSES USED IN ROLLING MILLS

Various Processes used in rolling mills are as under[1,2]:



The steel re-rolling sector is further characterized by:

- Outdated technologies and practices.
- Low information and awareness levels.
- Inappropriateness of generic energy efficiency technologies developed.
- Lack of incentives to cater to small scale energy efficiency projects.
- High investment costs of energy efficiency technologies.
- Low research and engineering base and other institutional linkages.

The thermal efficiency of these rolling mills is in the range 20 to 30 % and lot of heat is lost in the flue gasses, convective and radiative losses, heating the cooling water, leakages from the furnace etc. The energy consumption in the rolling mills is very high due to inefficient and wasteful practices and conventional methodologies used.

### 2. MAJOR LOSSES IN FURNACE OF A RE-HEATING MILL AND THEIR POSSIBLE SOLUTION

Some of the major losses in Furnace of a re-heating mill and their possible solution for ensuring better fuel economy are discussed below:

(a) Charging and Discharging Method: The furnaces practice back charging and side discharging method. These are shown in Fig 2



Fig -2: Raw material Charging and Discharging in a Reheating Furnace

Lot of heat is lost during these operations. It can be minimized by opening the charging and discharging doors to the minimum extent possible.

(b) Doors: The furnaces are provided with a number of inspection doors, besides the charging and extraction doors as shown in Fig 3.



Fig -3: Doors used in the furnace

The losses from these doors can be minimized by providing insulation over these doors.

(c) Hearth of the furnace: The hearth of the furnace is either under loaded or overloaded as shown in Fig 4. In both the cases excessive energy per unit of production is used. The furnace should be properly designed and its hearth must be properly loaded[4].



Fig -4: Overloading Hearth of Furnace

The flue gases coming out from the stack of the furnace are having a temperature in the range of 700 to 800 °C . Most of the mills are not having any recuperator. In some cases it was observed that the recuperator was installed

underground having no provision of cleaning the tubes. This resulted in excessive pressure drop leading to back pressure in the exhaust system .The recuperators installed in the furnaces were not having floating head as a result the tubes get warped as shown in Fig 5. Due to thermal stresses of expansion and contraction.



Fig -5: Warped tubes of the recuperator

The recuperators be provided with floating head and these must be cleaned periodically.

There is energy losses due to wrong practices followed in the mills like using unnecessary bye pass in case of water recirculation and in case of FD fan as shown in Fig 6.





Fig -6: Energy Intensive practices

Such practices must be avoided.

(d) Furnace Draught: In any furnace, the entrance of uncontrolled air must be prevented. It pays to maintain a slight excess pressure inside the furnace to avoid the infiltration. Large furnaces, especially those with stack draft, are equipped with pressure sensing devices which by relays and servomotors adjust dampers or adjust the flow of protective gas into the furnace[3]. If negative pressure exist in the furnace, air infiltration is liable to occur through the cracks and openings thereby affecting air fuel ratio. Thus, the furnace pressure should be slightly positive. The standard practice is to maintain a slightly positive pressure (of 0.01" wg). Otherwise, with higher pressure inside, the flames leap out from the discharge end resulting in heat losses and with higher negative pressure inside the outside air infiltrates into the furnace leading to oxidative atmosphere inside the furnace causing scale losses. This calls for proper balancing of the pressures inside the furnace.

(e) Burner: A Burner used in pulverized coal fired reheating furnaces is a simple hollow pipe as shown in the Fig 7



Fig -7 : Hollow pipe used as burner

It is proposed that a burner having a provision of swirl be provide which will ensure better combustion.

### 3. CONCLUSIONS:

The reheating furnaces use excessive energy for heating the raw material. There are number of energy conservation measures which does not require much capital cost and have a pay back period of about 3 to 6 months but can significantly reduce the amount of energy consumption and will also reduce the pollution load caused from these mills. There is a need to improve upon and develop new energy efficient technologies and get them implemented in the rolling mills, especially in the small scale sector where the lack of awareness is a great barrier to the adoption of newer techniques. Moreover as the production is likely to grow, there is a vast potential for energy reduction through introduction of energy efficient technology packages.

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## BIOGRAPHIES



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