

## Revamping of Billet Reheating Furnace

By changing the design of the roof and combustion system of the 35 tonnes/hr furnace at ISWP, Jamshedpur (a subsidiary of Tata Steel), Encon Thermal Engineers Pvt Ltd (ETPL) was able to achieve a saving of approximately 10 ltr/tonne of furnace oil and increase in production of 5 tonnes/hr, the scale loss has been reduced by 0.5 per cent. The frequent breakdowns due to failure of bull nose have been eradicated. The furnace has been running successfully for more than three years without breakdowns.

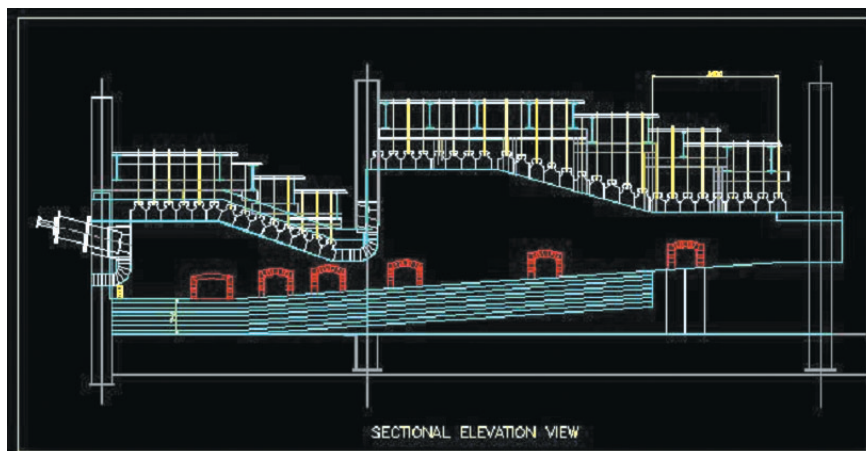
### Background

Indian Steel and Wire Product (ISWP), Jamshedpur, is a subsidiary company of Tata Steel Ltd. It is the country's first and the oldest wire product company, and was taken over by Tata Steel in 2003, when it was declared a sick company.

The furnace was designed to produce 30 to 32 tonnes/hr. The heating zone of the furnace had 9 IIP Encon Burners on the top of the furnace out of which 4 were of 5A in size and 5 were of size 4A, the soaking zone had 9 burners of size 4A.

The furnace had a Bull Nose design. The bull nose of the furnace was water cooled, over the years the water-cooling of the bull nose was discontinued due to which the clients were facing the following problems:

- Bull nose area furnace refractory bricks were getting damaged was frequently falling, and



GA Original Design of the Furnace

- Bull nose area refractory hanging bricks and cast steel hangers were getting burnt.

Apart from the above, following were the constant issues:

- Burner blocks were getting damaged and falling, there was no provision to replace them without complete shut down of the furnace
- Burner block back plate was getting excessively heated in the heating zone due to refractory failures
- There was failure in the short skid and long skids joints
- Long skids were bending
- Recuperator was damaged and leaking
- Heat loss due to water seepage in bottom flue duct
- Burners were manually operated and were choking frequently, and

- High specific fuel consumptions.

Encon was approached by ISWP in January 2009 to carry out a diagnostic study on the furnace and suggest them ways in which ISWP could eradicate the frequent bull nose failure.

After carrying out the diagnostics of the furnace the following observations were made:

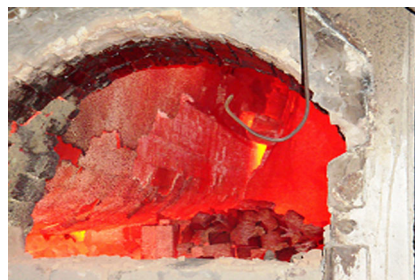


Figure 1: Failure of Bull Nose

1	Burner height from furnace hearth	1125 mm in the Socking Zone 1600 mm in the Preheating Zone
2	Flue duct size	26600 L x 1100 W x 1650 mm H
3	Flue Duct Area	1.815 m <sup>2</sup>
4	Overall dimension of the furnace	13510 L x 10640 W x 5750 mm (Max) H
5	Effective dimension of the furnace	11000 L x 9700 W x 2400 mm (max) H
6	Pusher limitation	100 tonnes
7	Mill limitation	30- 32 billet (35-38 tonnes/ hour)
8	Draft size inside furnace	1000 x 470 approx
9	Damper size and details	1850 H x 1250 W x 127 mm T

Table 1: Furnace details

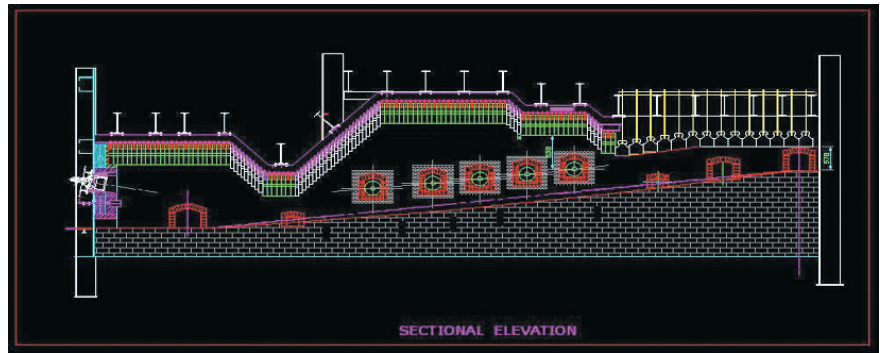
## SPECIAL SECTION

It was observed that the Bull Nose construction and design were the reasons for majority of the failure. Due to gaps in the bull nose the cast steel hangers, which were holding the refractory bricks, were getting heated quickly, the temperature of the hanger and roof near the bull nose was alarmingly above the standard.

### Combustion Equipment

It was observed that the present recuperator is made of plain tubes and was only giving a maximum air pre-heat temperature is 1900°C.

In order to achieve a continuous production of 35-tonnes/hr in the furnace the heat load of the furnace was calculated and found to be insufficient. Heat load of the furnace was increased and



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so was the type of burners in the furnace. The blower size was also found to be undersized for a production of 35 tonnes/hr accordingly the air and oil pipeline also had to be modified. There was no

temperature control system in the due to which the flow of the fuel was not being regulated in the furnace.

### Modifications Made in the Furnace

The soaking and heating zone of the furnace were completely redesigned. The bull nose of the furnace was replaced with a camel hump design. Side burners were given in the heating zone instead of top burners. The design of the hanger was changed and state of the art refractory lining was used instead of the conventional lining for the roof.

To increase the firing rate in the furnace Encon high velocity burners of size 4A were used in the sidewalls instead of 4 IIP-Encon 5A burners and 5 IIP-Encon 4A burners on the top of the furnace, the burners in soaking zone remained the same.

The firing rate was increased from 1350 ltrs/hr to 1665 ltrs/hr. The blower capacity and the size of air and oil pipeline were also changed accordingly. Level 1 temperature controls were provided with which the quantity of air and oil were altered according to the temperature feedback from the furnace.

By carrying out the above changes ISWP is deriving the following benefits:

- Fuel consumption has come down to 32.6 ltrs/tonne of steel produced.
- Scaling is down to 1per cent
- There has been no failure in the furnace for almost 3 years the furnace has been operational, and
- The furnace is constantly producing steel at the rate of 35 tonnes/hr.

(Contact: Mr Puneet Mahendra, Encon Thermal Engineers Pvt Ltd, 297, Sector 21-B, Faridabad, Haryana 121 001. Mobile: 099714-99079. Tel: 0129-4041185, 4047847. Fax: 91-129-4044355. Email: pm@encon.co.in) ■

#### Before



#### After



#### Roof



#### Side Walls



#### Bull Nose Modifications