

→ Reference sheet.



REBOX® oxyfuel solutions in reheating. Oxyfuel combustion in 48 pit furnaces.



- Summary**
- 35% increased heating capacity in existing furnaces
 - Reduced fuel consumption by 35%
 - NO_x emissions below 150 mg/MJ (fuel: Oil)
 - After conversion to flameless oxyfuel, the heating time decreased by 50% compared to the original air-fuel case.

Customer Ovako, Hofors works, Sweden.

Background Ovako is a leading European long special steel products company. It supplies 2 million tonnes annually of low alloy and carbon steel to rolling bearing, heavy vehicle, automotive and engineering industries. The Hofors works is complete with steel-making, ingot casting, billet and heavy bar mills as well as tube and ring-rolling mills. They set out in the early 1990s to reduce the emissions of NO_x, but also to lower fuel consumption and raise heating capacity. The first oxyfuel installation took place in 1994 and Ovako has since then, over a 12-year period, continuously revamped a total of 48 pit furnaces into all oxyfuel operation. The pit furnaces have been rebuilt from being groups of four pits connected to one recuperator into separately regulated pit furnaces. In a second step all combustion systems were converted into flameless oxyfuel to further improve heating uniformity and decrease NO_x emissions.

- Customer objectives**
- Low NO_x emissions
 - Reduced fuel consumption
 - Increased heating capacity
 - Standard solution for all furnaces

Leading-edge technology Using REBOX® oxyfuel combustion substantially increases the thermal efficiency of a furnace. The main reasons for this is that the radiant heat transfer properties of the furnace gases produced by oxyfuel combustion are significantly better than those of air-fuel. Also, due to the absence of nitrogen in the combustion mixture, the volume of exhaust gases is reduced substantially, thus the total heat losses via the exhaust gases are also reduced.

As a result of the improved thermal efficiency, the heating rate and therefore productivity are increased, and less fuel is required to heat the product to a given temperature, i.e. specific fuel consumption is reduced. This helps to make a valuable contribution to reducing the overall environmental impact of the company's operations on the local environment.

Installation/scope

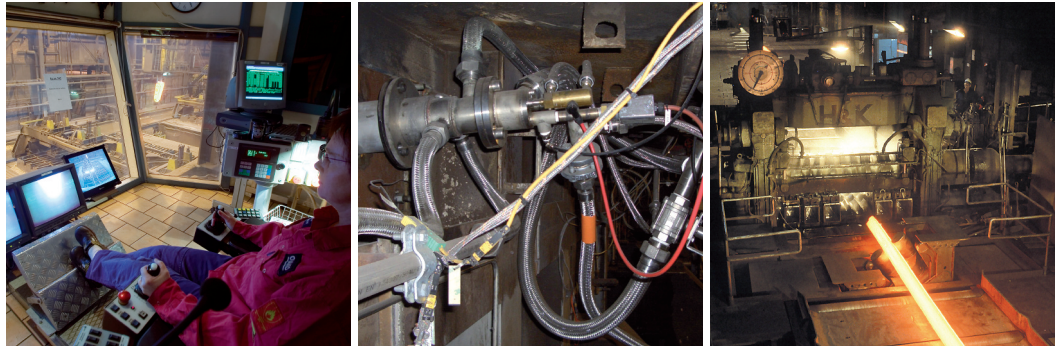
- Each pit furnace has one oxyfuel burner of 0.8 MW capacity
- Total power installation of 38 MW in the 48 pit furnaces
- Water cooled flameless oxyfuel burners
- Flow trains for oxygen and fuel
- The customer removed recuperators and reused the flue gas channel. The furnaces were revamped with new refractory.

Results

- 35% increased heating capacity in existing furnaces
- Reduced fuel consumption by 35%
- NO_x emissions below 150 mg/MJ (fuel: Oil)
- After conversion to flameless oxyfuel, the heating time decreased by 50% compared to the original air-fuel case.

Customer benefits

- Increased production capacity and flexibility in existing furnace
- Reductions of CO, CO₂ and NO_x to allow continued production
- Reduced fuel consumption and no electricity for any air blowers
- Reduced overall flue gases by 80%
- Simple retrofit since powerful and compact oxyfuel burner technology. No need for recuperators or air blowers.



REBOX® oxyfuel solutions

In more than 110 fully converted reheating and annealing furnaces, Linde's REBOX® oxyfuel solutions provide more throughput and flexibility at lower total costs.

- Up to 50% more furnace throughput capacity
- Up to 50–60% specific fuel savings
- More uniform heating and reduced scale formation
- Reduced emissions of such as CO₂ and NO_x

The broad REBOX® technology and application experience combined with long and detailed customer process experience results in fast and safe project implementation, also as turnkey and with guaranteed performance.

Linde AG

Linde Gases Division, Seitnerstrasse 70, D-82049 Pullach, Germany
Phone +49.89.74 46-0, Fax +49.89.74 46-12 30, www.linde-gas.com/rebox