



REBOX[®] HLL

SYS increases capacity, saves fuel and reduces emissions at its reheating furnace.

Benefits at a glance

- Improved fuel efficiency resulting in significant fuel savings
- Increased production capacity
- More uniform heating of the blooms
- Reduced flue gas volumes and NOx emissions
- Low investment cost with continued use of existing air-fuel equipment
- More flexible operations with on-demand activation of REBOX HLL
- Ease of operation with high safety standards
- Less maintenance

The customer

Siam Yamato Steel Company Ltd. (www.syssteel.com) is the largest producer of structural steel in Thailand. The company manufactures and distributes hot-rolled structural steel products for the domestic construction industry and for export. Siam Yamato Steel (SYS) specialises in H-beams, I-beams, channels, angles, cut beams and sheet piles. At the company's two plants in Mueang, Rayong, Thailand (SYS1 and SYS2), with melt shops and hot rolling mills, SYS fabricates approximately 1 million tonnes of steel every year. The company was founded in 1992 and is based in Bangkok, Thailand.

The challenge

SYS was keen to revamp its walking beam furnace (SYS1). The aim was to optimise energy consumption, reduce emissions and increase capacity. Specifically, SYS wanted to increase the nominal heating capacity of cold-charged blooms.

The solution

SYS turned to its long-standing partner Linde to support its revamp plans. In consultation with Linde, SYS decided that Linde's REBOX HLL installation was the best fit for its productivity needs. Building on the experience it has gained serving steel customers for more than two decades, Linde developed REBOX HLL specifically to improve the flexibility of reheating furnaces by supporting performance ramp-ups on demand. It is a simple, cost-effective way of optimising reheating furnaces that does not require major changes to the furnace infrastructure so customers can continue to use their existing combustion system. In addition, Linde tailored its REBOX HLL solution to the service cycles at SYS to maximise cost efficiencies.

“REBOX® HLL has enabled us not only to achieve our main aim of energy savings, but also to lower emissions and enhance quality. This revamp project for our walking beam furnace was a clear success – with Linde delivering on all of its performance guarantees.”

Sitichai Keamanuchet, Rolling Mill 1 Department Manager

The technology

Linde thus installed REBOX HLL in the SYS1 walking beam furnace. This entailed mounting oxygen lances in the furnace walls next to the conventional air-fuel burners. These are then used to inject oxygen at high velocity into the furnace, where it replaces most of the air used for combustion. Up to about 75% of the combustion air (and thus the nitrogen “ballast”) is replaced with oxygen in the zones targeted by the high-level lance.

REBOX HLL automatically and dynamically adjusts the oxygen enrichment set-point to the actual burner power so that the oxygen level always matches the customer’s precise process needs. REBOX HLL can thus reduce oxygen consumption for a given output volume.



The oxygen flow control panel, controlling the flow of oxygen into the furnace.

The elimination of nitrogen increases thermal efficiency, also decreasing exhaust gas volumes and nitrogen oxide (NOx) emissions. In fact, it cuts exhaust gas volumes per MW by more than 50%. Improved heat transfer also helps to reduce energy consumption, with the actual saving depending on the product type, temperature and production capacity. In addition, REBOX HLL enables more uniform heating and has thus improved billet quality at SYS. REBOX HLL can be turned off at any time, enabling the furnace to go back to its normal air-fuel operating mode. The ability to ramp up performance on demand gives SYS the flexibility it needs to accommodate fluctuations in throughput, for instance. The REBOX HLL installation at SYS marks a number of world firsts.

Benefits of REBOX HLL at SYS

Not only has it set a new benchmark for fuel efficiency, it is also the first installation worldwide to replace the through-lance oxygen cooling flow with an annulus-based air-only cooling system. This customised design means that REBOX HLL is tailored to the specific service and out-of-service cycles at SYS, allowing the company to capitalise on favourable energy prices and maximise cost efficiencies. Further highlights include:

- 10% increase in production capacity for blooms
- Up to 34% reduction in fuel consumption for blooms at high production capacities
- Up to 29% reduction in fuel consumption for beam blanks at high production capacities
- Flue gas volume reduction of more than 50% with a clear drop in NOx emissions



The user interface for the control system, designed with input from SYS.

Linde AG

Gases Division, Carl-von-Linde-Strasse 25, 85716 Unterschleissheim
Phone +49 89 31001-0, www.linde-gas.com/metals