Making our world more productive

REBOX®

Maximising efficiency and flexibility in reheating furnaces.

Growing market pressure for steelmakers.

Steelmakers face intense market conditions and have to search for ways to remain competitive. Looking at the value chain of steel production, the reheating process step is a key success factor in the drive for optimisation. Linde has the skills and the expertise in gas applications to optimise reheating and take it to the next level.

The situation today – challenges facing steelmakers

- Minimise energy consumption
  Reducing energy consumption in traditional combustion processes is difficult as large amounts of heat are lost through flue gases
- Comply with environmental standards
  It is becoming increasingly difficult for companies to maintain a small environmental footprint and improve efficiency using traditional combustion and oxyfuel technologies
- Meet quality demands
  Reheating operations need to be adapted flexibly and rapidly to meet constantly changing steel specifications and increased quality requirements
- Use fuels with low calorific values
  Fuels with low calorific values are difficult to combust efficiently using air as an oxidant when working in high-temperature processes, such as reheating of steel
- React to market challenges
  Steelmaking processes have to be highly flexible to meet continuously changing market requirements

Improve the efficiency of your reheating operations with our oxyfuel solutions.

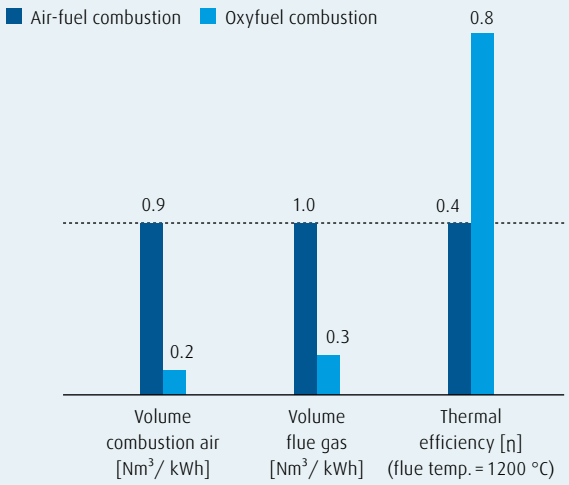
Linde has developed two leading technologies to optimise reheating furnaces. If you would like maximum benefits with minimum changes to your existing operation, we recommend increasing the oxygen content using high velocity lances. Alternatively, for customers who want to maximise the benefits of oxygen and are willing to replace the combustion system, we have developed flameless oxyfuel.

Conventional oxyfuel combustion

Using oxygen instead of or in addition to air offers a number of advantages.

- For instance, oxygen eliminates the nitrogen ballast of air and thus increases the energy efficiency of the furnace.
- It also raises the concentration of CO_2 and H_2O in the furnace atmosphere. And since these gases are mainly responsible for thermal radiation, oxyfuel significantly increases thermal efficiency and heat transfer.

Improved efficiency with oxyfuel combustion



Flameless oxyfuel combustion

Flameless oxyfuel shares the same benefits as conventional oxyfuel but incorporates several important advantages. As the technology utilises high velocity oxygen lances, flue gases are recirculated, creating a diluted combustion zone. This results in lower peak temperatures and lower thermal NOx. At the same time, the flame has a high momentum and a large volume, which ensures proper mixing of radiating gases and greater temperature uniformity inside the furnace.

Our solution – the REBOX® family.
Customised to your needs.

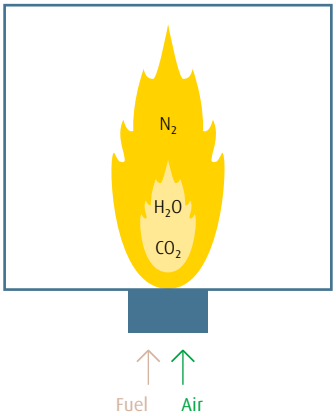
REBOX® is not a "one size fits all" solution but a portfolio of approaches tailored to different furnace and application requirements. REBOX® solutions can be incorporated into new and existing furnaces without increasing the existing footprint. They are compatible with all conventional fuels and most types of furnace, from large pushers and walking beams through rotary hearths to various batch furnaces. Our REBOX® flameless oxyfuel and REBOX® HLL applications are dedicated solutions for steel reheating furnaces. And because safety is our number one priority, our specialists always ensure that our technology complies with all relevant safety standards and norms.

REBOX® flameless oxyfuel

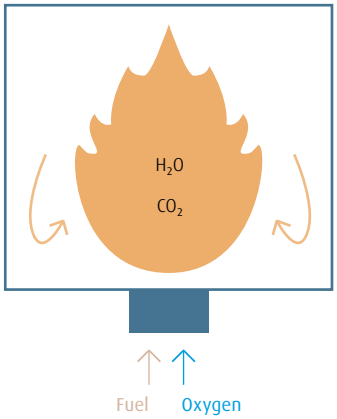
Ideal for:
REBOX® flameless oxyfuel solutions are targeted at operators of continuous and batch-type reheating furnaces looking to maximise production capacity.

How it works:
This flameless oxyfuel combustion system replaces existing burners and uses 100% oxygen instead of combustion air.

Air-fuel combustion

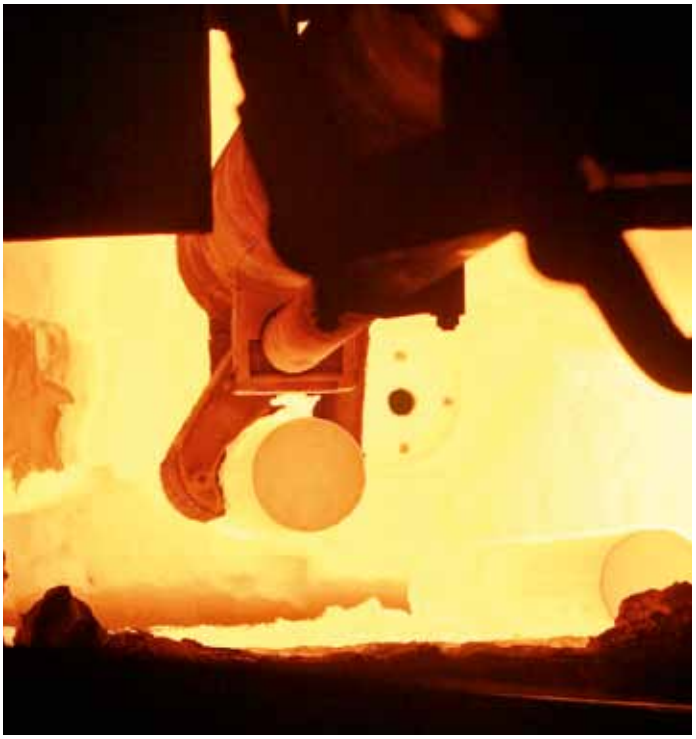


REBOX® flameless oxyfuel



Benefits of REBOX® flameless oxyfuel

- More than 50% throughput gains due to improved radiation and low flue gas volumes
- Lower flue gas temperatures and volumes allowing a shorter dark/recuperative zone
- Significant reduction in fuel consumption (up to 50%) by eliminating nitrogen ballast
- Lower NOx emissions and fuel-based SOx and CO_2 emissions
- Fuels with low calorific values can be burnt more efficiently using pure oxygen, enabling it to be used even in high temperature processes



Extraction of reheated material from a furnace using REBOX® technology

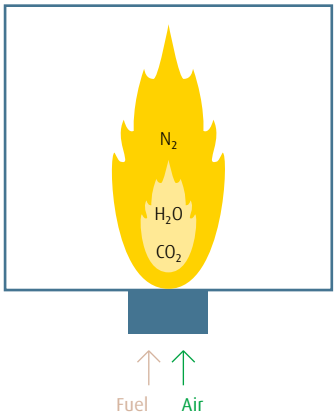
Roller hearth heating furnace with REBOX® oxyfuel solution including ceramic oxyfuel burners and Linde control system

REBOX® HLL

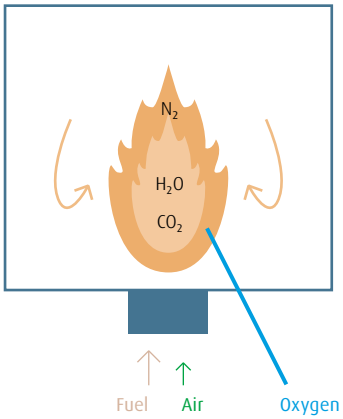
Ideal for:
REBOX® HLL is designed for customers looking for a simple, cost-effective way of optimising reheating furnaces that can be deployed on demand and does not require major changes to the existing furnace infrastructure.

How it works:
Oxygen lances are mounted in the furnace walls next to your conventional burners (see graphic below). These are then used to inject oxygen with high velocity and replace the majority of air used for combustion. The REBOX® HLL system can be turned off at any time, enabling the furnace to revert back to its previous operating mode.

Air-fuel combustion



REBOX® High Level Lancing (HLL)

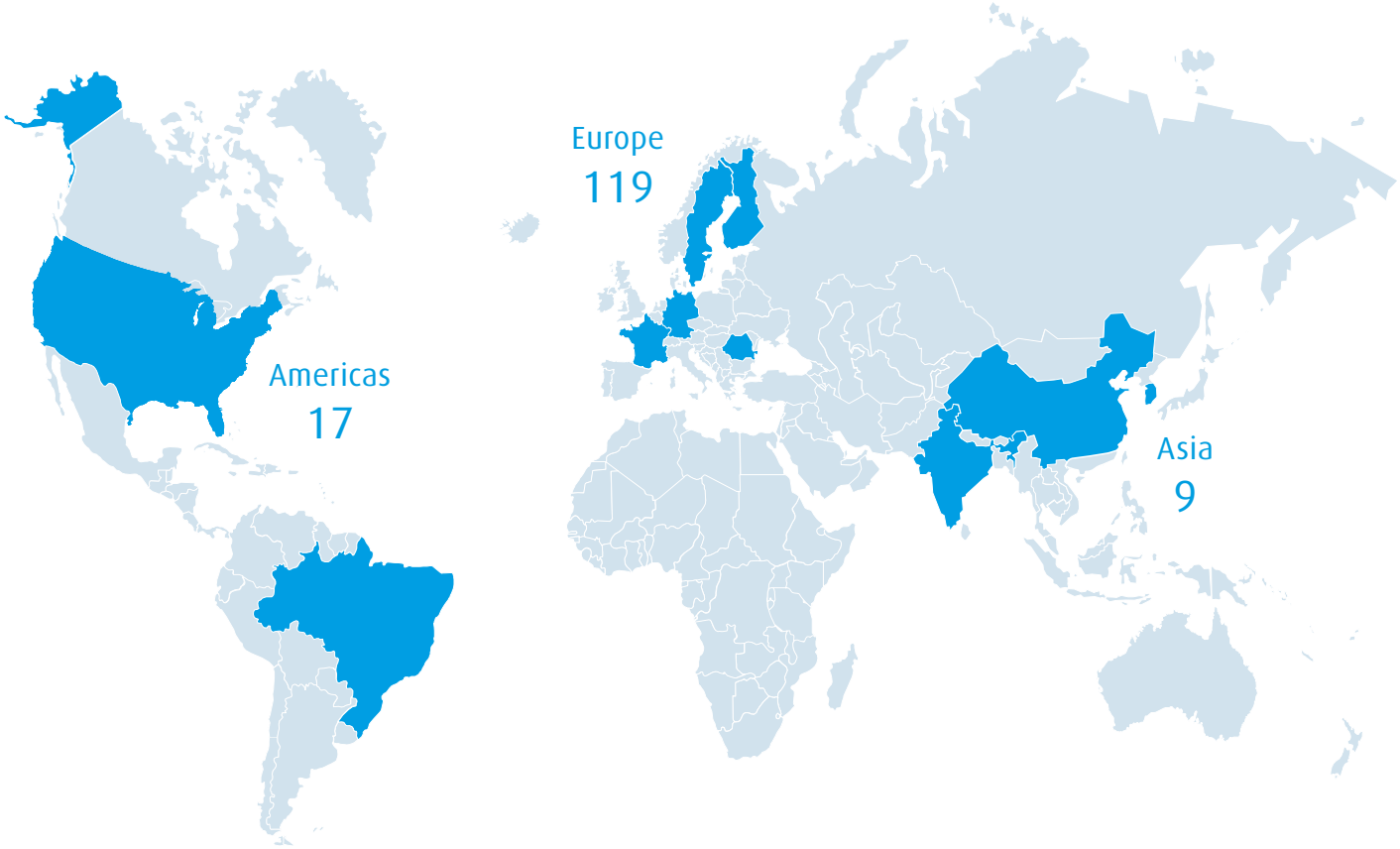


Benefits of REBOX® HLL

- Up to 25% reduction in fuel consumption
- More homogenous heating due to flameless high impulse HLL combustion
- Higher thermal efficiency and heat transfer in the installed zone
- Up to 30% less NOx emissions per installed zone due to reduced nitrogen ballast and recirculated flue gas which effectively lowers flame temperature
- Can be switched on and off only when beneficial for you

Hands-on experience and extensive customer insights.

Number of installed REBOX® systems



Trusted, proven performance all over the world

Having successfully delivered more than 140 REBOX® oxyfuel systems since 1991, we are helping to boost furnace reheating processes all over the world. Our REBOX® oxyfuel system has become a trusted and recommended solution in the steel production industry.

Leading steel producers rely on REBOX®

Today, many leading steel producers rely on our REBOX® oxyfuel systems. REBOX® technologies reflect our commitment to technical excellence and innovative drive – a commitment to keep our customers competitive today and in the future. If you want to keep pace with tomorrow's competition, you need a partner that delivers outstanding quality and is determined to optimise processes and productivity each and every day.

Close ties with the steel industry

We have worked closely with the steel industry for many years, installing a wide range of systems and gathering hands-on experience and extensive knowledge of our customers' processes. These close customer relationships help inspire our innovative drive.

How we work.

REBOX® HLL installed in a furnace

Our experts talking to customers

Continuous innovation in our R&D centres

Our People. Our Spirit.

Our team bundles the deep and valuable knowledge of gas and combustion experts, furnace specialists and engineers who learned their trade within the steel and metallurgical industries. This combination of backgrounds and the deep process know-how ensures that the right mix of knowledge and experience is always available to you. In close interaction with you, our team assesses each new potential REBOX® installation and draws up the design and the guaranteed performance improvements that will be achieved. Today, over 140 REBOX® installations have been delivered successfully. This has been made possible by a great team with in-depth experience, and thanks to our close interaction with our customers and our professional response to individual needs.

Dedicated to innovation

With R&D centres in Europe, North America and China, Linde Gas is leading the way in the development of state-of-the-art application technologies. As a technology leader, we are constantly working on solutions for higher efficiency to help our customers overcome their challenges. We also test and customise all of our innovations at these centres before delivering them to your site.

Providing turnkey solutions

Backed by our expertise in the steel and gases business, we are well positioned to optimise furnace reheating processes. We want our customers to feel confident at every stage of a project. That is why we work closely together to make sure your solution is tailored to your individual needs.

We have the experience and organisational capabilities to deliver complete turnkey solutions, along the following processes:

- Initial consultation and detailed site analysis, including calculations and simulations
- Lab-scale demonstration of technologies
- High-level solution proposal
- Fine-tuning of designs and commercial offer
- Solution engineering and pre-testing of components
- Installation and commissioning according to your specific safety standards and norms
- Performance testing
- Fine-tuning of control equipment
- Safety assessments and training
- Maintenance and operational support

Performance you can count on

We have developed a state-of-the-art simulation and modelling tool that enables us to give you precise indications of the performance gains you can expect with REBOX®. Choosing Linde is a risk-free investment in your facilities.

Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde – ideas become solutions.

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