→ Product brochure

THE LINDE GROUP

Linde

Solutions for growth.

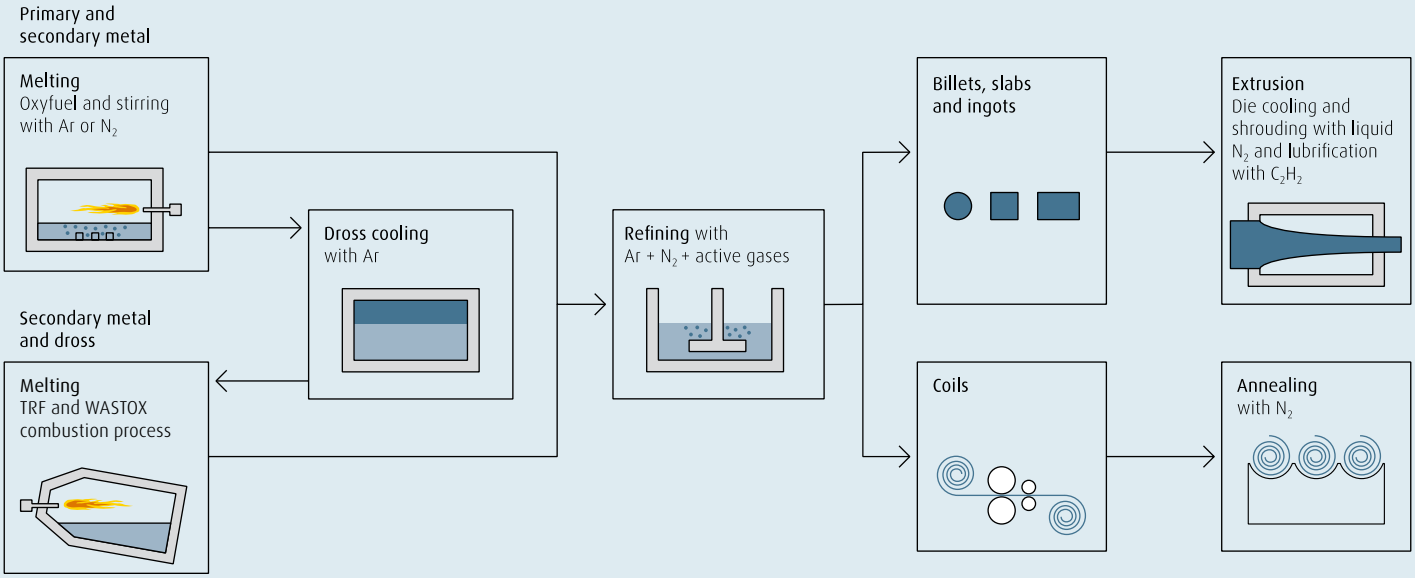
Boosting capacity and efficiency in the aluminium industry.

Continuous improvements and lower costs.
Cutting-edge gas solutions increase productivity in the aluminium process chain.

Linde is the leading supplier of industrial gases and gas solutions for the aluminium industry. Constantly evolving and refining our technologies and consolidating our position at the forefront of innovation, we meet the growing need for increased productivity and yield, reduced costs, enhanced quality and greater environmental sustainability.

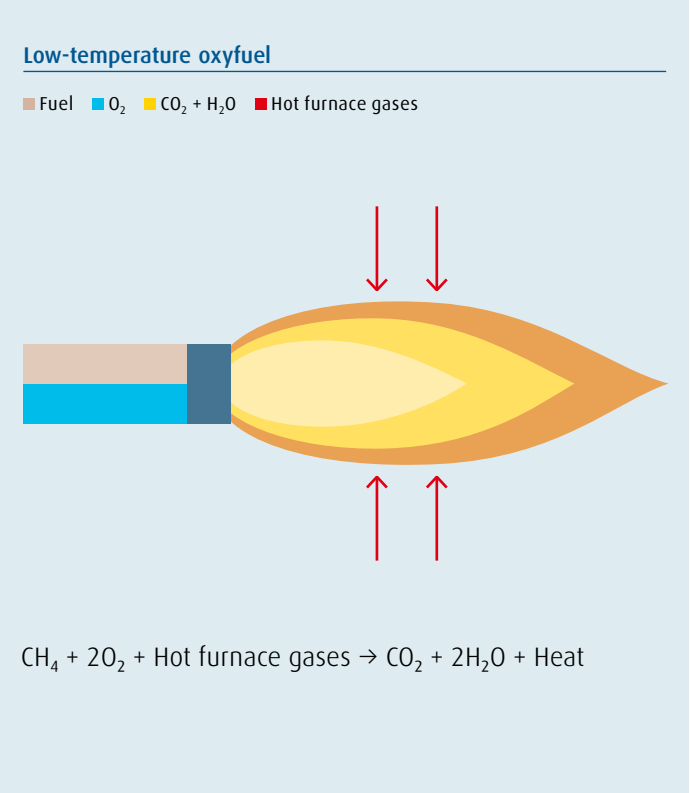
Our industry-leading portfolio ranges from gases and equipment to process consulting, safety and support services. At all steps in the aluminium process chain – from melting and dross handling to refining, rolling, reheating, extrusion and annealing – we apply our unmatched technical competence and process know-how to create added value for our customers and ensure maximum return on investment.

Leading gas solutions for the aluminium industry



We assist our customers in the use of oxygen to enhance the combustion process, increase efficiency and reduce emissions. Our oxyfuel solutions include a wide range of oxyfuel burners and technologies. In over 200 installations, these solutions have increased melting rates by as much as 100%, reduced fuel consumption by up to 50% and cut flue gas and emissions by anything up to 90%.

We also employ a wide range of inert gases to optimise results and cut production costs. Gas purging in refining improves the quality of the final product by degassing, removing inclusions and homogenising. Other practical examples of how we put inert gases to good use include annealing, dross cooling and extrusion. A protective nitrogen atmosphere is used to anneal aluminium coils, thus reducing oxidation and discolouration. And for dross cooling, an inert argon atmosphere enhances the metal yield by preventing oxidation. Liquid nitrogen has also been shown to improve quality and productivity in extrusion processes such as die cooling and shrouding.



In low-temperature oxyfuel combustion, the furnace's flue gases are mixed into the flame to achieve a dilution effect that both lowers the flame temperature and disperses the energy effectively throughout the entire furnace volume.

Linde's patented range of low-temperature oxyfuel burners are compact and powerful. The modular design facilitates inspection, service and upgrades.

Leading oxyfuel solutions for more capacity and reduced costs.

Linde's oxyfuel solutions include a wide range of oxyfuel burners and technologies designed to suit the different processes and requirements of aluminium melting. Removing nitrogen from the combustion and heat transfer process has several advantages, which combine to ensure higher production output in new or existing furnaces, reduced fuel consumption, improved process control and lower emissions. Our long experience with oxyfuel for aluminium melting enables us to provide our customers with suitable combustion solutions that meet individual demands.

Low-temperature oxyfuel

Low-temperature oxyfuel (LTOF) was developed for aluminium melting in reverberatory furnaces. It is based on flameless oxyfuel combustion, which is created by diluting the flame with the furnace gases – which are free of the nitrogen ballast in ambient air. The flame dilution also disperses the combustion gases throughout the furnace for more effective and uniform heating and melting of the aluminium, also avoiding hot spots and dross formation. The flame contains the same amount of energy as conventional oxyfuel flames but has a lower temperature. This substantially reduces the creation of NOx.

We have already successfully installed LTOF in over 20 melting furnaces spanning reverberatory melting furnaces, tiltable rotary furnaces, holding furnaces and alloying furnaces. These installations confirm that LTOF offers excellent enhancements in aluminium processing.

The benefits of LTOF

- Increased productivity
- More homogenous heating of the furnace and charge during melting
- 50% reduction in fuel consumption / CO_2 emissions
- Flue gas volume reductions
- Positive impact on yield
- Ultra-low NOx emissions meeting highest environmental standards

AIROX combustion technologies.

LTOF burner (see left page).

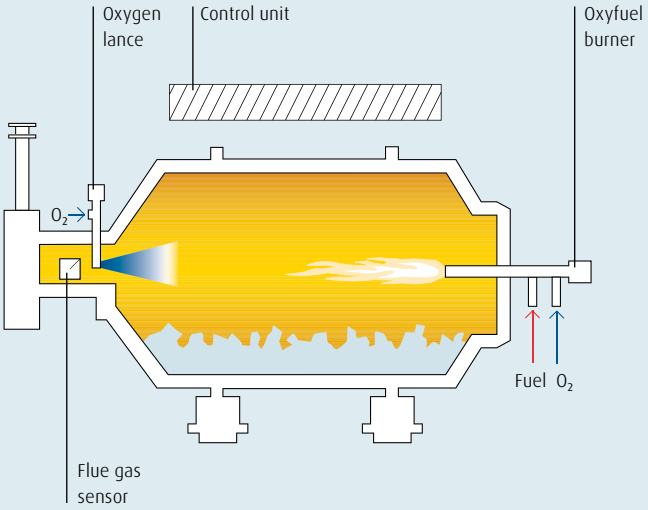
AIROX® combustion technologies and air combustion

With AIROX® combustion technologies, furnace operators can easily switch to oxygen or oxygen-enriched gases during the melting process and back to air during the holding phase. This results in greater melting capacity and flexibility as well as lower emission rates and energy consumption. These are key success factors for light metal foundries, extrusion companies and foil producers who use reverberatory furnaces for both melting and holding.

AIROX benefits

- Increased productivity
- Greater flexibility
- Flue gas volume reductions
- 30% reduction in fuel consumption / CO_2 emissions

WASTOX combustion process



WASTOX combustion process turns unwanted contaminants into valuable fuel.

WASTOX combustion process and an oxyfuel burner in a double-pass furnace at Kuusakoski Oy, Finland.

WASTOX® combustion process for efficiency and emission benefits.

The secondary aluminium industry is challenged to find economical, environmentally sound ways of melting contaminated scrap. Emissions generally limit productivity, restricting the choice of raw material. Our WASTOX® combustion process answers these challenges, using oxygen lances to combust emissions within the furnace.

The oxyfuel burner works in tandem with the oxygen lances to ignite the combustibles. WASTOX not only keeps emissions below the increasingly stringent statutory levels, it enables cheaper raw materials to be used without impacting on productivity. It also reduces fuel costs as the contaminants provide fuel for the melting process.

Benefits of WASTOX combustion process

- → Reduction of emissions, esp. total organic carbon (TOC)
- → Increased productivity
- → Lower fuel consumption
- → Higher organic content in the feedstock
- → Simple installation and operation in any furnace

Comparison of combustion processes – pilot plant tests in a rotary salt furnace

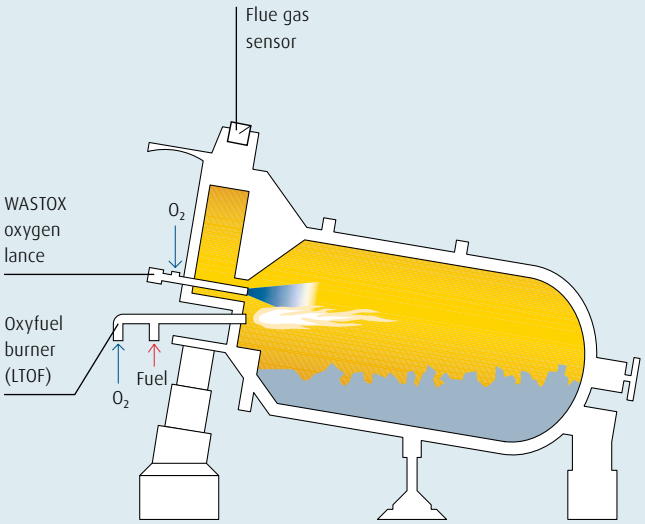
	Hydrocarbon (VOC)*
Airfuel burner	20–50%
Oxyfuel burner, λ =1.3	0.5–1%
Oxyfuel burner + WASTOX combustion process	< 0.01%

* Emissions as percentage of carbon input. Reference: VAW aluminium AG, TMS Light Metals, 1999

"One of the beauties of the WASTOX combustion process is that it turns unwanted contaminants into valuable fuel. Not only do we boost production with WASTOX, we also save costs."

Ronny Olausson
Plant Manager Stena Aluminium AB, Sweden

Oxyfuel solutions for tiltable rotary furnaces



Advanced oxyfuel and WASTOX combustion processes provide unique processing capabilities for contaminated aluminium scrap.

Stena Aluminium AB, Sweden, recycles scrap in two TRFs equipped with Linde's oxyfuel and WASTOX technology.

Innovative lead in oxyfuel for scrap and dross processing. Tiltable rotary furnace (TRF).

Tiltable rotary furnaces (TRF) are ideally suited to oxyfuel combustion where highly economical recycling of aluminium is required. Oxyfuel and WASTOX have been shown to offer considerable performance enhancements here. Process efficiency and cost effectiveness can be increased even further by converting to low-temperature oxyfuel combustion – as demonstrated by a recent Linde TRF reference project.

Linde's oxyfuel combustion technologies are suited for dry and wet salt methods of aluminium melting. A Linde oxyfuel burner generates sufficient heat to quickly melt the dross and scrap. WASTOX can be integrated to facilitate the melting of low-grade aluminium scrap. The oxygen turns the contaminants into valuable fuel while minimising emissions. Molten aluminium is tapped and waste products are dumped by tilting the furnace. The ability to tilt the furnace shortens production cycles by saving valuable time normally spent on charging, tapping and cleaning.

The benefits of oxyfuel in TRFs

- Improved recovery yield
- Cheaper raw materials
- Lower fuel consumption
- Increased productivity
- Lower emissions

Features

- Outstanding process control
- Oxyfuel combustion system for optimal performance
- WASTOX combustion process
- Highest engineering standards

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.

Linde AG
Gases Division, Carl-von-Linde-Strasse 25, 85716 Unterschleissheim, Germany
Phone +49.89.31001-0, info-metals@linde.com, www.linde-gas.com/aluminium

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