

Solutions for growth. Boosting capacity and efficiency in the aluminium industry.

Linde Gas

*Linde*





## 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 innovations, we meet the growing need for increased productivity and yield, reduced costs, enhanced quality and greater environmental awareness.**

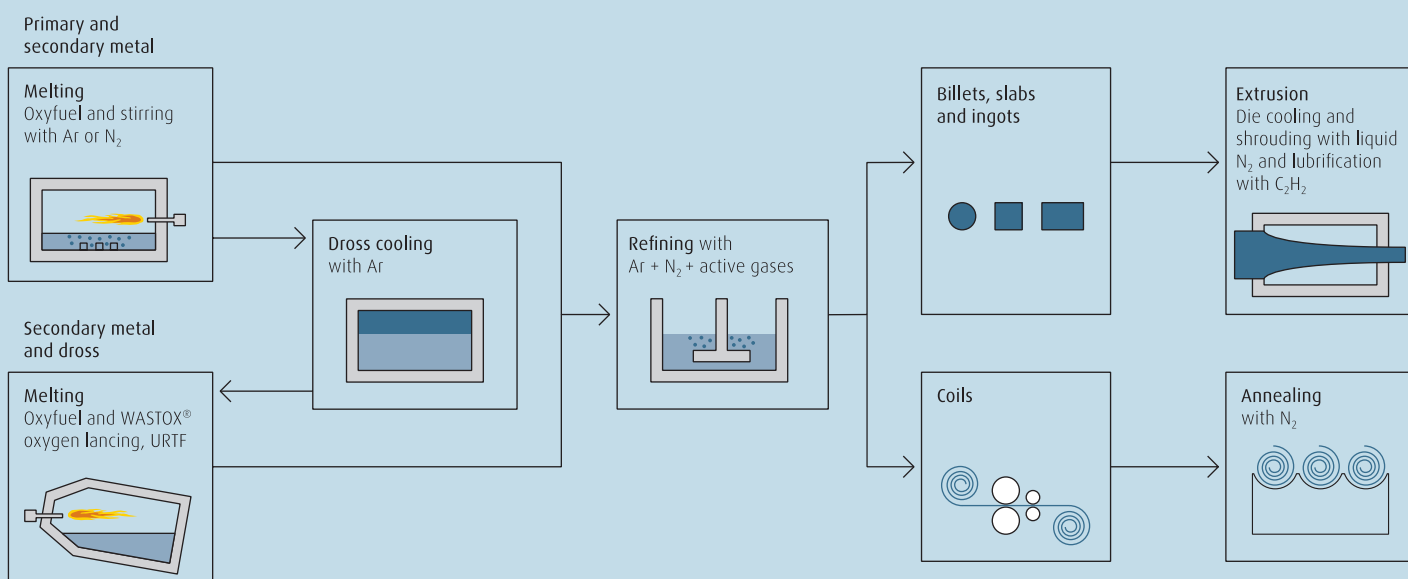
Our industry-leading portfolio ranges from gases and equipment to process consulting and services. At all steps in the aluminium process chain – from melting and dross handling to refining, extrusion and annealing – we apply our unmatched technical competence and process know-how to create added value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

### **More information**

Would you like to know more about our solutions for the aluminium industry? Then just visit our website and read everything about the benefits of using our technologies plus the latest news and information about our events, references etc.:

[www.linde-gas.com/aluminium](http://www.linde-gas.com/aluminium)

## Leading gas solutions for the aluminium industry



Linde focuses on assisting its customers in the use of oxygen to enhance the combustion process, increase efficiencies and reduce emissions. Our oxyfuel solutions include a wide range of oxyfuel burners and technologies. In over 130 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 shown to improve quality and productivity in extrusion processes, such as die cooling and shrouding.



Inert gases are used to improve process results, yields and appearance.

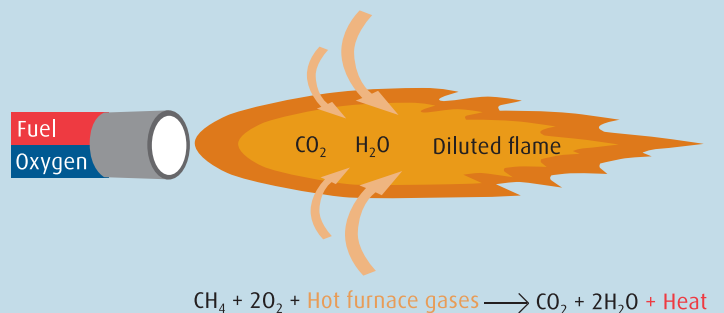
# Leading oxyfuel solutions for more capacity and reduced costs.

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 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

Our latest developments include the low-temperature oxyfuel combustion technology, in which the flame is diluted by the furnace flue gases, lowering the flame temperature. This brings about a more homogenous heating during the melting and a higher power input, leading to increased melt rates, less dross and, at the same time, to ultra-low NO<sub>x</sub> emissions.

Sapa Heat Transfer AB (part of the Elkem Group) in Sweden employs low-temperature oxyfuel combustion to increase the melting capacity, reduce dross and achieve ultra-low NO<sub>x</sub> emissions.



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



AIROX® installation at SAG, Austria

#### **FLEXFLAME™ variable oxyfuel flame**

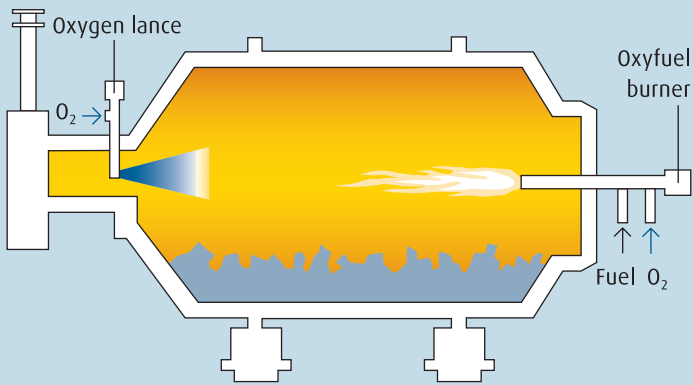
The dual-mode option of the FLEXFLAME™ oxyfuel burner makes it possible to heat even a fully charged furnace. The compact, short flame ensures optimal initial heating while the conventional long flame effectively heats the entire furnace volume during the remaining melt cycle. FLEXFLAME™ is particularly used in rotary and reverberatory furnaces, also placed as roof burners.

#### **AIROX® combined oxygen and air combustion**

With the AIROX® burner, the furnace operators can easily switch between oxygen or oxygen-enriched gases during the melting process and air during the holding phase. This results in greater melting capacity and flexibility as well as lower emission rates and energy consumption, which is equally important for light metal foundries, extrusion companies and foil producers who use reverberatory furnaces for both melting and holding.

#### **Oxyfuel benefits**

- Melting rates increased by as much as 100%
- Fuel consumption reduced by up to 50%
- Flue gas and emissions lowered by up to 90%
- Compact, rugged and powerful oxyfuel burners



WASTOX® oxygen lances turn unwanted contaminants into valuable fuel.



WASTOX® oxygen lances and oxyfuel burner in a double-pass furnace at Kuusakoski Oy, Finland.

## WASTOX® oxygen lancing for greater combustion efficiency and cleaner air.

### Benefits of WASTOX® oxygen lancing

- Possibility to use contaminated, low-grade scrap
- Control and reduction of emissions
- Lower energy consumption
- Simple installation and operation in any furnace



“One of the beauties of WASTOX® 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

The secondary aluminium industry is challenged to find economic, environmentally sound ways of melting contaminated secondary scrap. Emissions generally limit productivity, restricting the choice of raw material. Linde's WASTOX® system provides a powerful answer to these challenges. It uses 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 emission levels 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.

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

	Hydrocarbon (VOC)*
Airfuel burner	20–50%
Oxyfuel burner, $\lambda = 1.3$	0.5–1%
Oxyfuel burner + WASTOX®	< 0.01%

\*) Emissions as percentage of carbon input

Reference: VAW aluminium AG, TMS Light Metals, 1999

# Innovative lead in scrap and dross processing. URTF – Universal Rotary Tilttable Furnace.

## The benefits of URTFs

- Improved recovery yield
- Cheaper raw materials
- Lower fuel consumption
- Reduced residue disposal costs
- Reduced salt costs
- Extremely high productivity
- Absolute flexibility (low-salt or salt-free processing)

## Features

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

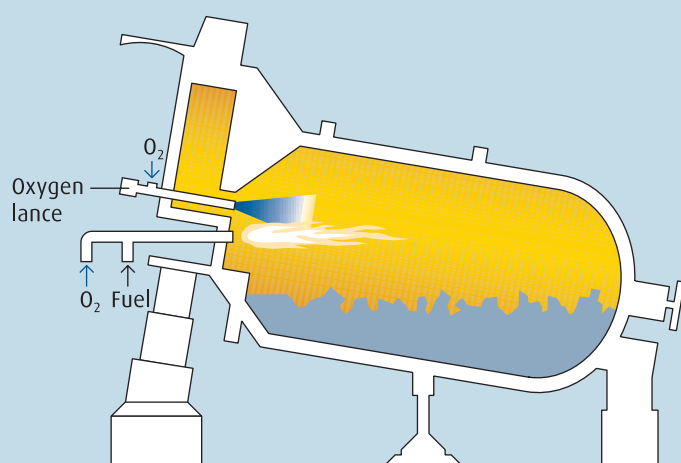
The Universal Rotary Tilttable Furnace (URTF) was developed to meet the challenges of highly economical aluminium recycling. To create the URTF, Linde joined forces with Hertwich Engineering (part of the SMS group) and CORUS Aluminium Voerde to leverage their core competencies in terms of equipment and environmentally sound aluminium recovery.

Conventional rotary furnace methods of recovering aluminium from dross and scrap require huge amounts of salt. A typical dross requires half a ton of salt for every ton of dross. More than a ton of salt cake is produced for every ton of dross. This residue is a growing environmental and health concern. It is also a significant cost factor in the aluminium production process.

Based on the dry salt method of melting aluminium, the URTF offers substantial benefits over rotary salt furnaces. An oxyfuel burner generates sufficient heat to quickly melt the dross and scrap. WASTOX® oxygen lancing 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 directly from the furnace while waste products are dumped by tilting. The ability to tilt the furnace shortens production cycles by saving valuable time normally spent for charging, tapping and cleaning.

The minimisation of salt requirements brings many benefits. Not only does it dispense with the costs involved in adding salt and disposing of salt residue, it reduces emissions, increases capacity and boosts yield.

The URTF at Stena Aluminium AB, Sweden, recycles scrap while reducing costs for salt and residue disposal.



By using advanced oxyfuel and WASTOX® oxygen lancing technologies, the URTF provides unique processing capabilities for contaminated aluminium scrap. The URTF is available in sizes accommodating between 5 and 23 tons of charge weight.

# Getting ahead through innovation.

With its innovative concepts, Linde Gas 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 Gas 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 Gas – ideas become solutions.**

## Linde AG

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