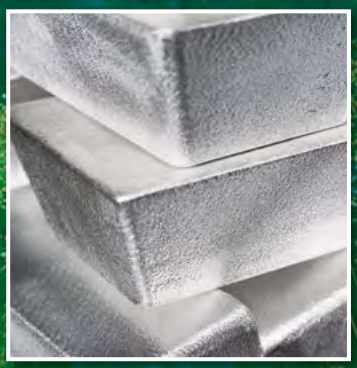
INDUCTION FURNACES

OTTOJUNKER

GREEN FURNACE TECHNOLOGY



FOR CARBON-FREE MELTING OF ALUMINIUM

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Induction furnace systems for the aluminium

OTTO JUNKER Group

Green Furnace Technology

OTTO**JUNKER is one of the world's most successful manufacturers of complex industrial furnace systems, especially for the metal-processing industry.**

Our group of companies offers a comprehensive portfolio of services in the fields of industrial furnace systems for melting, heat treating and recycling as well as highly efficient power-to-heat systems for generating heat economically and ecologically.

Decades of experience combined with an excellently-equipped technology center guarantee the highest innovation potential.

Our systems and services stand for economical and sustainable production processes.

Various melting processes are used in the aluminium industry, which differ in their source of energy, efficiency and environmental compatibility.

By opting for induction technology, our customers significantly contribute to reducing the use of fossil fuels, lowering CO_2 emissions, as well as to transforming the metal-processing industry in general. Furnace systems powered by renewable energy even operate completely CO_2-free.

Induction furnace systems

Cutting-edge technology for the aluminium industry

Thanks to the specific combination of different OTTO**JUNKER technologies, our systems are the first choice for a wide range of applications in the aluminium industry.**

Melting and recycling

- Milling chips
- Shavings (in briquette form)
- Foil packages
- Lumpy material
- Returns
- Ingots / slabs

Alloying and holding

- Pure and ultra-pure aluminium
- Work-hardened alloys
- Heat-treatable alloys
- Master alloys
- Super alloys
- Grain refinement alloys

In terms of efficiency, environmental compatibility, safety and long-term economic efficiency, inductively-heated melting furnaces offer significant advantages over gas-fired ones because the charge material is heated directly. They contribute to improving quality, cutting costs and making production sustainable. Furthermore, they represent a future-oriented technology in the melting process.

Comparison of different melting furnaces

	Induction furnaces		Gas-fired furnaces	
	Coreless furnace	Channel-type furnace	Hearth furnaces	Shaft-type furnaces
Useful capacity	0.2 – 70 t	3.0 – 55 t	5.0 – 90*** t	2.0 – 10 t
Connected load	200 – 14.000 kW	850 – 4.800 kW	-	-
Melting capacity	0.3 – 26 t/h	2.0 – 11 t/h	1.0 – 25*** t/h	0.4 – 7 t/h
Energy consumption	530 kWh/t	430 kWh/t	530*/680 kWh/t	600 - 700 kWh/t
Holding mode	Suitable	Suitable	Suitable	Limited
Metal losses	0.1 – 1.5 %	0.1 – 1.5 %	1.0 – 4.5 %	1.0 – 4 %
Feedstock	All	Chips limited	Chips limited	No chips**
Mode of operation	Discontinuous	Quasi-continuous	Quasi-continuous	Continuous
Alloy change	Easy	Difficult	Difficult	Difficult
Alloying tasks	Very good	Good	Possible	Unfavorable
Temperature and analysis accuracy	Very good	Good	Moderate	Moderate

* when using recuperation or regenerative heating | ** only possible using additional unit (furnace well with electromagnetic pump)
*** Main useful capacity range of hearth furnaces: 5.0 - 40.00 t | Main melting capacity range of hearth furnaces: 1.0 – 6.0 t/h

Medium-frequency coreless induction furnaces

Precise melting processes for flexible production requirements

The technical and economic advantages of OTTO **JUNKER** medium-frequency coreless induction furnaces have led to a constantly growing utilization in the aluminium industry.

The coreless induction furnace can be operated with a liquid heel or completely emptied after each heat.

Low metal losses, precise temperature and process control and adjustable bath movement are decisive advantages of medium-frequency coreless induction furnaces when melting aluminium materials.

The high-performance furnace systems are used in particular to produce high-quality alloys and to recycle chips.

Features of OTTOJUNKER medium-frequency coreless induction furnaces

- **Metal loss < 1%**
  even with very small-sized charge material
- **Energy consumption < 500 kWh/t**
  thanks to OTTO**JUNKER**'s energy-saving coil
- **Markedly lower emissions**
  CO_2-free / practically no NOx emissions
- **Stirring without heating**
  Stirring movement decoupled from heat input
- **Highly suitable for alloying tasks**
- **No undesirable substances introduced**
  e.g. due to furnace atmosphere
- **Extremely compact design**

Medium-frequency coreless induction furnaces

First-class components and well-thought-out designs

Multi-frequency and phase shifting technology

Controlled bath movement for targeted circulation without heating

The direction and intensity of the bath movement can be adjusted as required with the help of the phase displacement technology, as with an electric motor, independently of any increase in the temperature of the melt. This is particularly advantageous when grain refinement alloys are produced.

Multi-frequency technology allows the operating frequency to be changed during the melting process. For example, the appropriate frequency of 200 Hz is used for melting down the charge material. When alloying additives or chips are added, the system automatically switches to a lower frequency (e.g. 100 Hz) to generate higher turbulence in the melt bath. This makes it possible to melt very small aluminium fragments, such as chips, with minimal losses (less than 1 % for dry chips).

Energy saving coil

Extremely stable induction coil reduces coil losses

OTTO**JUNKER** has optimized the current-carrying surface to reduce coil losses, resulting in an energy savings potential of approx. 40 kWh/t for aluminium.

In addition, the induction coil is very stable thanks to the use of fiberglass strips which prevent it from opening up at high power densities. The use of oxygen-free copper profiles and stainless steel cooling coils at both ends ensures excellent magnetic field guidance. Bolted, optimally-cooled yokes prevent eddy currents from fanning out at the ends.

IGBT-frequency converter

Power factor (cos phi) of 0.99

The maximum availability of the frequency converter is guaranteed due to reliable self-protection against peak values and load variations in current and voltage during operation.

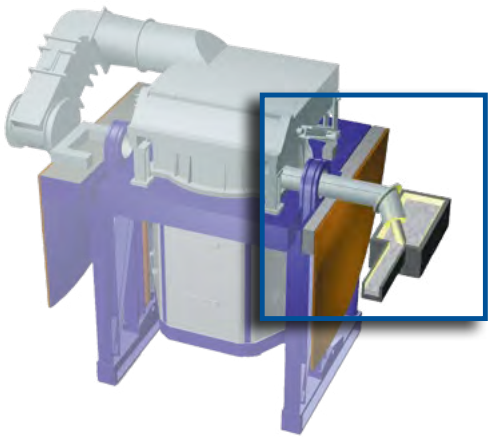
A constantly high power factor (cosine phi) of 0.99 at the converter input results in low electricity costs across the entire performance range.

The use of a parallel resonant circuit converter means that the load on the converter from the active current is low, resulting in a highly reliable system.

Tilting bearing

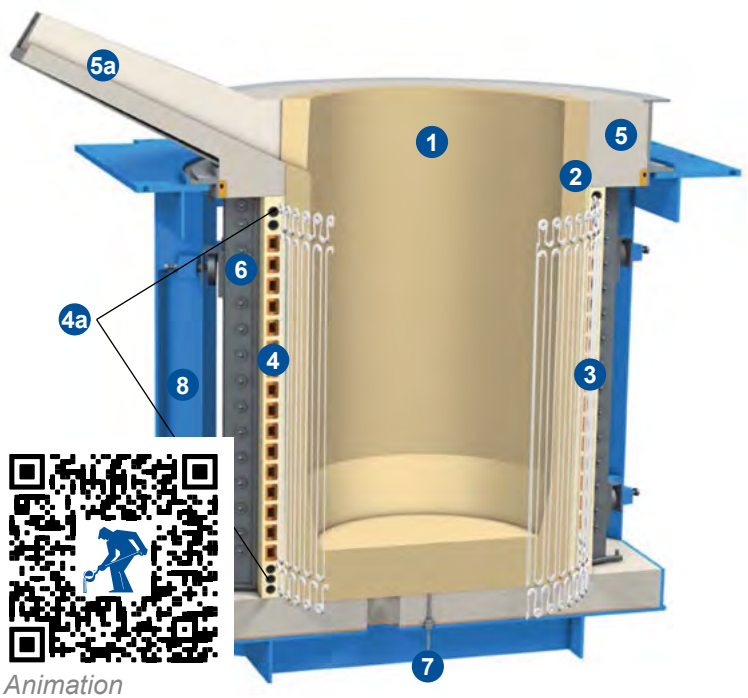
Metal discharge through the tilting bearing, for melting and pouring under protective atmosphere

For melting and casting in an inert gas atmosphere – without having to rely on costly vacuum technology – OTTO**JUNKER** has developed a special solution: the metal is discharged through the tilting bearing. The molten aluminium is not discharged via a pouring spout, but rather through a conduit that is arranged in the axis of rotation of the induction furnace. On leaving the pipe, casting takes place in the next process step – also in a controlled atmosphere.



Medium-frequency coreless induction furnaces

Design and function



Animation

1. Ceramic crucible
2. Insulation layer
3. Permanent lining with embedded OCP sensor cable
4. Power coil
4a. Cooling coil
5. Furnace head
5a. Pouring spout
6. Yoke
7. Earth leakage monitoring spider
8. Coil cage

Design of the body of a coreless induction furnace

Medium-frequency coreless induction furnaces

Sizes

Sizes MFT for aluminium				
	Ingots		Chips	
Capacity [kg]	Max. connected load [kW] 250 Hz, 750 °C	Max. melting rate [kg/h] 250 Hz, 750 °C	Max. connected load [kW] 100 Hz, 750 °C	Max. melting rate [kg/h] 100 Hz, 750 °C
250	200	450	-	-
350	300	630	-	-
400	260	490	120	220
750	480	900	220	410
1,000	650	1,200	300	550
1,500	980	1,800	450	850
2,100	1,400	2,600	600	1,140
2,750	1,800	3,350	800	1,490
3,500	2,300	4,300	1,000	1,850
4,500	2,900	5,450	1,200	2,270
5,500	3,600	6,750	1,600	3,010
7,500	3,000	5,640	2,000	3,780
10,000	4,000	7,520	3,000	5,600
14,000	4,500	8,370	4,000	7,530
16,000	6,000	11,510	4,000	7,500
20,000	8,000	15,130	6,000	11,250
25,000	8,000	14,540	6,000	11,190
30,000	10,000	19,190	6,000	11,380
40,000	12,000	23,760	10,000	19,250
50,000	12,000	22,570	10,000	18,620
70,000	14,000	26,320	12,000	22,370

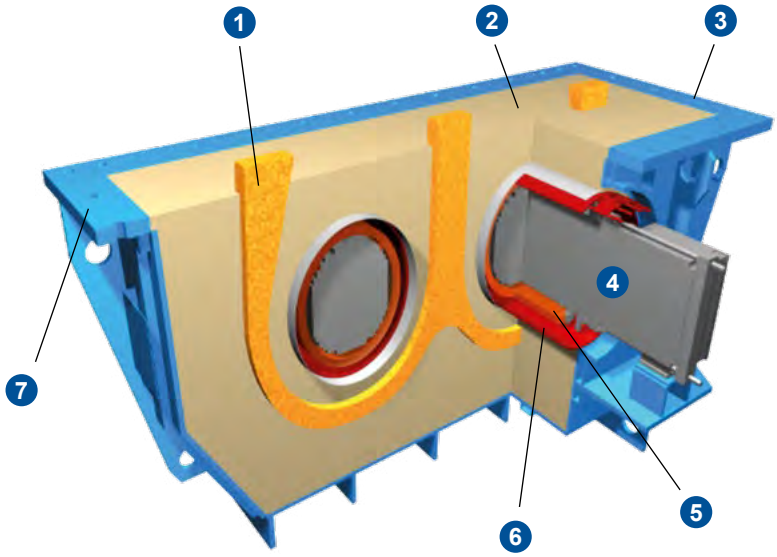
Channel-type induction furnaces

Fully adaptable furnace design

Channel-type induction furnaces are used to melt aluminium ingots and bars as well as lumpy charge material due to their high electrothermal efficiency and adaptable geometry. They offer high temperature stability and process reliability, especially when charging discrete parts and ingots.

Features

- Adaptable furnace geometry
- High electrothermal efficiency
- Controllable furnace atmosphere
- Low operating costs



1. Melt
2. Ceramic lining
3. Inductor casing
4. Transformer core
5. Coil
6. Protective cylinder
7. Connecting flange

Design of the body of an induction channel furnace

Storage furnaces

Producing castings on a large scale

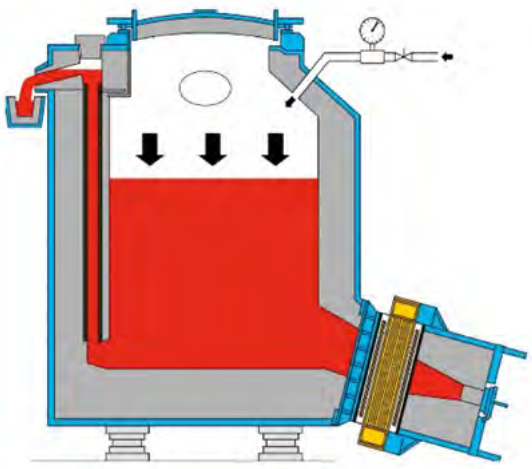
Used for the mass production of castings made of aluminium-silicon alloys for the automotive industry, these furnaces store the molten metal delivered and hold it at exactly the required temperature.

Key features include homogeneous temperature distribution in the melt and efficient and economical holding at temperature The closed furnace vessel prevents the unwanted absorption of gas. The inductive heater ensures minimal metal loss.

The storage furnace for aluminium consists of a ceramic-lined, closed cylindrical furnace vessel with a flange-mounted channel inductor. The furnace is filled with molten metal from the in-house foundry or from external suppliers via the filling port on the side. It is emptied by applying pressure.

Features

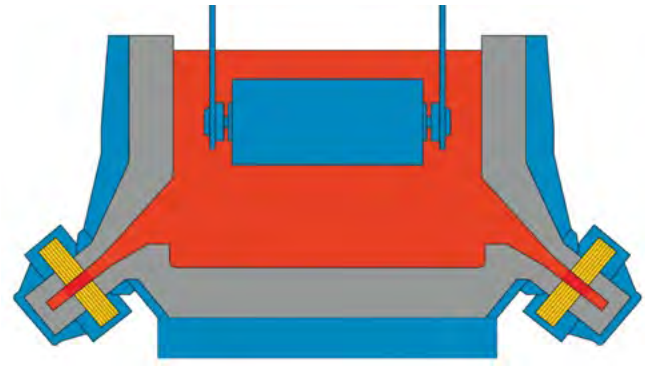
- Precise temperature control
- Clean metal
- Easy to clean
- Even temperature distribution
- Minimum metal loss



Strip coating pots

Coating steel strips effectively

For coating steel strips with Zn, ZnMg, ZnAl, AlSi or other alloys, we supply ceramic-lined coating pots equipped with air- or water-cooled channel inductors. They enable high strip speeds while maintaining the highest surface quality.



Features
- Precise temperature control
- Accurate bath level measurement
- High quality strip surface
- Precise pot positioning

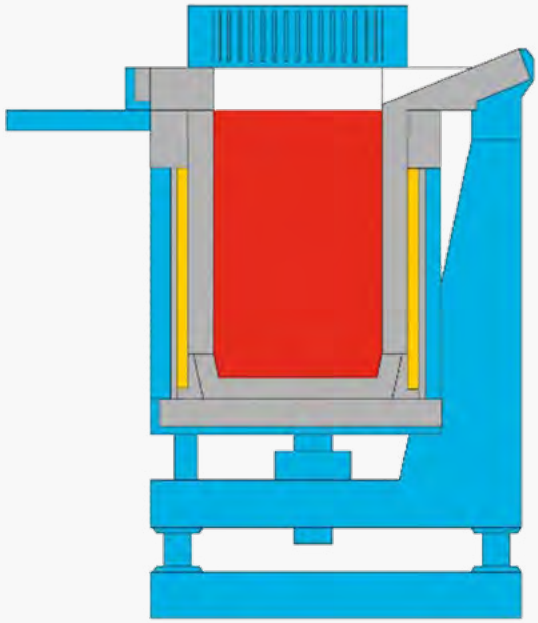
Efficient melting solutions

... for aluminium coating lines

The coreless induction furnace is used as a premelter for special coating materials to replace the material removed during the strip coating.

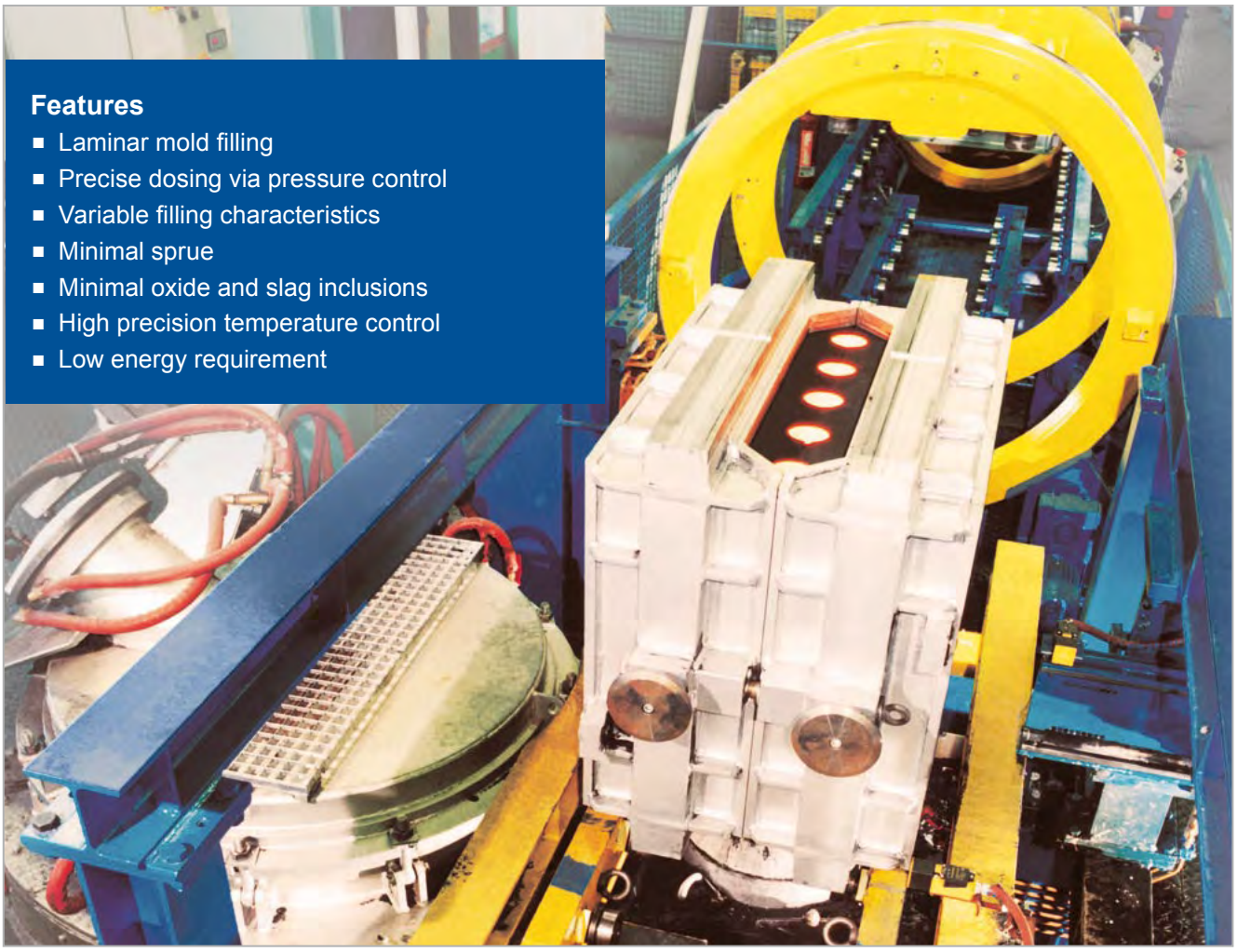
The melting and holding unit with inductive heater is particularly suitable for the coating material AlSi as well as Galvalume®. The melt is transferred to the coating pot by tilting or using the overflow principle and a heated launder.

Features
- Suitable for batch and continuous operation
- Intensive mixing
- Precise temperature control
- High power density



Low-pressure casting furnaces

Filling sand molding machines with liquid aluminium



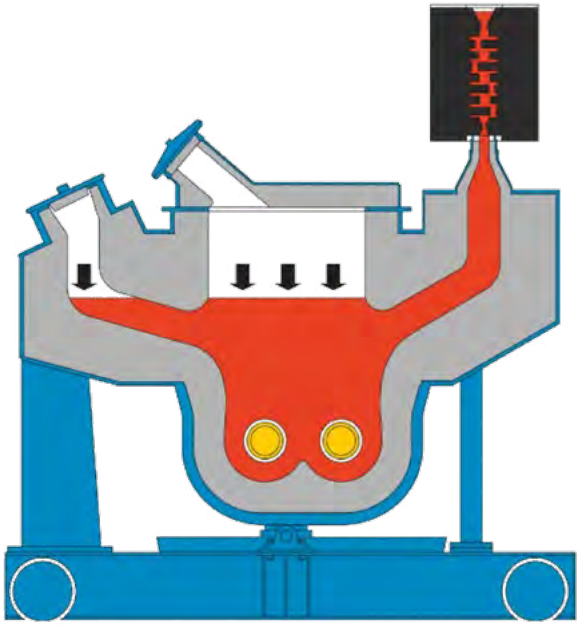
Features

- Laminar mold filling
- Precise dosing via pressure control
- Variable filling characteristics
- Minimal sprue
- Minimal oxide and slag inclusions
- High precision temperature control
- Low energy requirement

We manufacture low-pressure casting furnaces with channel or crucible inductors for filling sand molding lines with molten metal in aluminium or iron/steel foundries.

Their technology is precisely tailored to the requirements of box-bound, high-throughput molding lines.

The furnaces hold the melt at exactly the required temperature and release it under constant, precisely defined conditions. In this way, it enters the die or sand mold directly from below in a controlled manner and with little turbulence.



Rotary kiln

Removing organic components from aluminium scrap

Rotary kiln for removing organic components

Aluminium scrap containing organic components causes high metal losses during the melting process. Therefore, such components must be removed to ensure an efficient material cycle.

Pyrolysis is the only way to remove the organic components that is otherwise inseparable from the aluminium.

For optimum results, OTTO JUNKER Solutions GmbH offers electrically-heated and hybrid rotary kilns.

In tests with UBCs (used beverage cans), we were able to increase the metal yield by 21.4 % through pyrolysis.

Before

After

Features

- Recovery of valuable metals from composite materials
- Low melting losses thanks to reduced oxide formation
- Low additional energy consumption due to energy recovery from the organic fraction

Rotary kiln and coreless induction furnace

A combination with maximum benefits

OTTO JUNKER Solutions uses coreless induction furnaces as melting units. The 70 t jumbo melting furnace was developed for aluminium applications. Operated as a Duomelt system, this melting furnace replaces the gas-fired melting furnace widely used in the industry. The newly added scrap is stirred down directly, thus minimizing metal loss through oxidation.

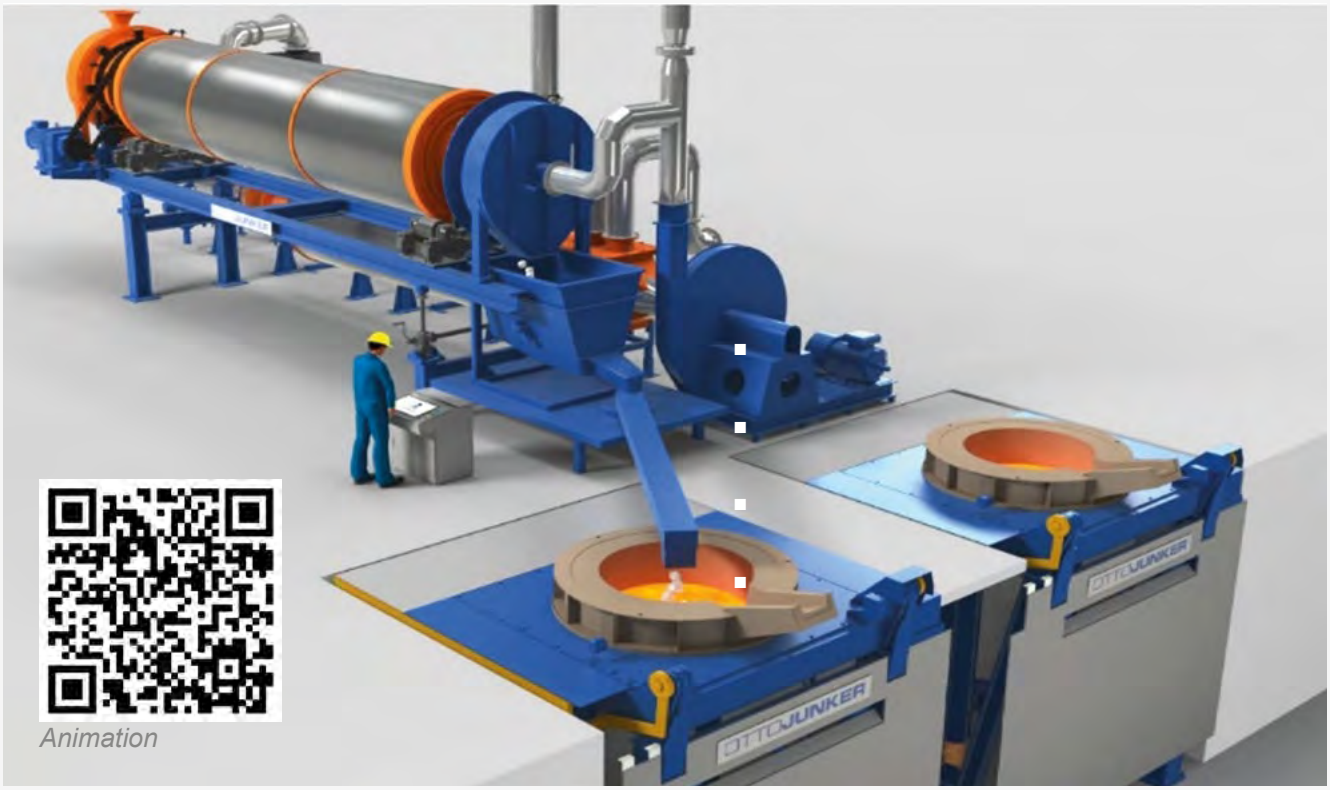
However, the greatest benefit lies in the combination of rotary kiln and induction furnace. Organically contaminated aluminium is freed of organic material in the rotary furnace, preheated and then fed into the induction furnace. This results in energy savings of 37 %.

At a glance

- **External thermal pre-treatment in the rotary kiln**
- **Melting in the coreless induction furnace**
- **Material throughput scalable from 0.1 t/h to 20 t/h**

Features

- Reduced scaling reactions in the melting process
- Higher metal yield
- Up to 37 % energy savings through preheating
- Use of the energy from the organic components
- Perfectly coordinated systems



Animation

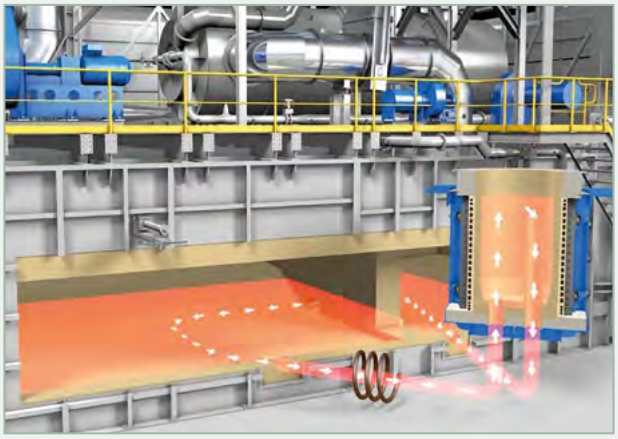
Metal Flow Heater

Converting gas-fired melting furnaces to hybrid operation

The aluminium industry uses natural gas-fired melting furnaces on a large scale. The Metal Flow Heater makes it possible to convert these furnaces for hybrid operation using a combination of gas and electricity. This inductively-heated system was developed by OTTO**JUNKE**R in collaboration with Speira GmbH.

An inductor is flanged to the side of the gas-fired hearth furnace. An electromagnetic pump takes the melt from the hearth furnace through the inductor and back into the furnace. The material is heated as it passes through the inductor.

Gas is only required for the initial start-up phase of the furnace. Once the aluminium has melted, the process can be carried out fully electrically. Alternatively, the throughput can be increased by combining gas and electric heating.



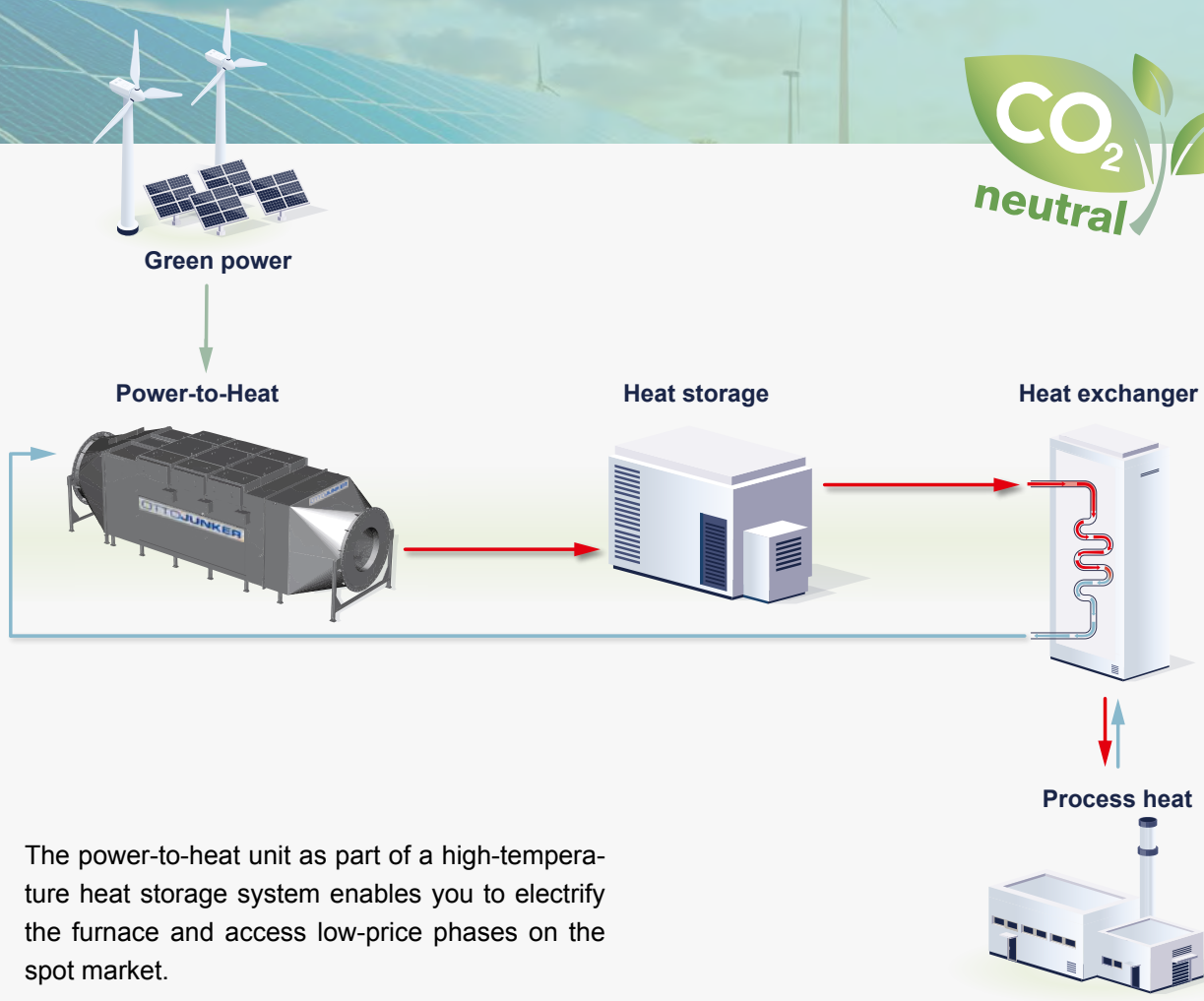
Animation

Features

- Climate-neutral production through the use of “green” electricity
- Lower investment costs compared to an electrically-heated furnace
- High product quality maintained
- Retrofittable

Power-to-heat and heat storage

Electrification of heat treatment furnaces



The power-to-heat unit as part of a high-temperature heat storage system enables you to electrify the furnace and access low-price phases on the spot market.

Electric resistance heaters heat air to up to 1,200 °C and store it in ceramic storage units. Process heat is continuously supplied by the heat storage system instead of a natural gas burner.

Features

- Converting to electric heating while saving energy costs
- Lower CO_2 emissions
- Adapts production to the challenges of the energy transition

Power-to-Heat system

Contact

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