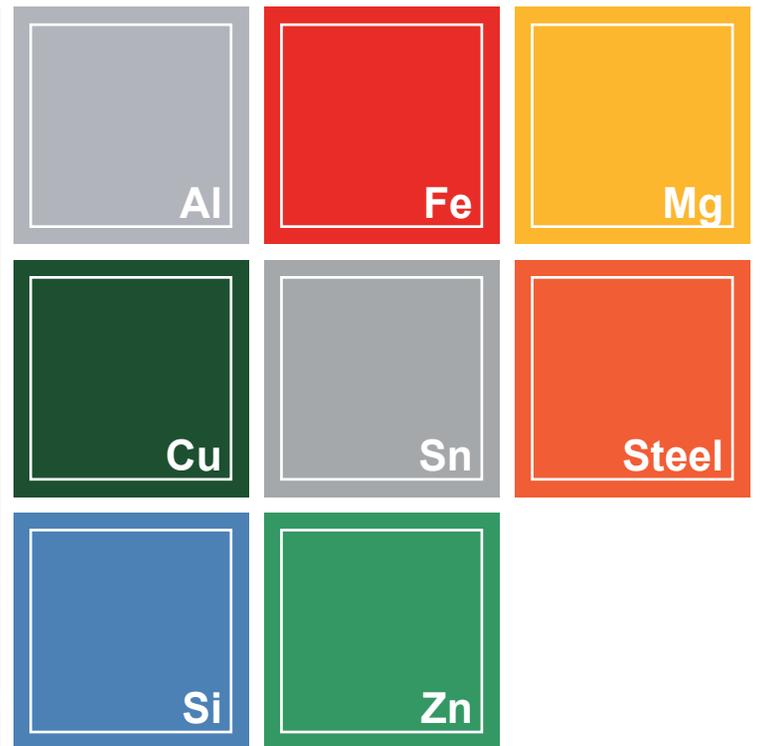
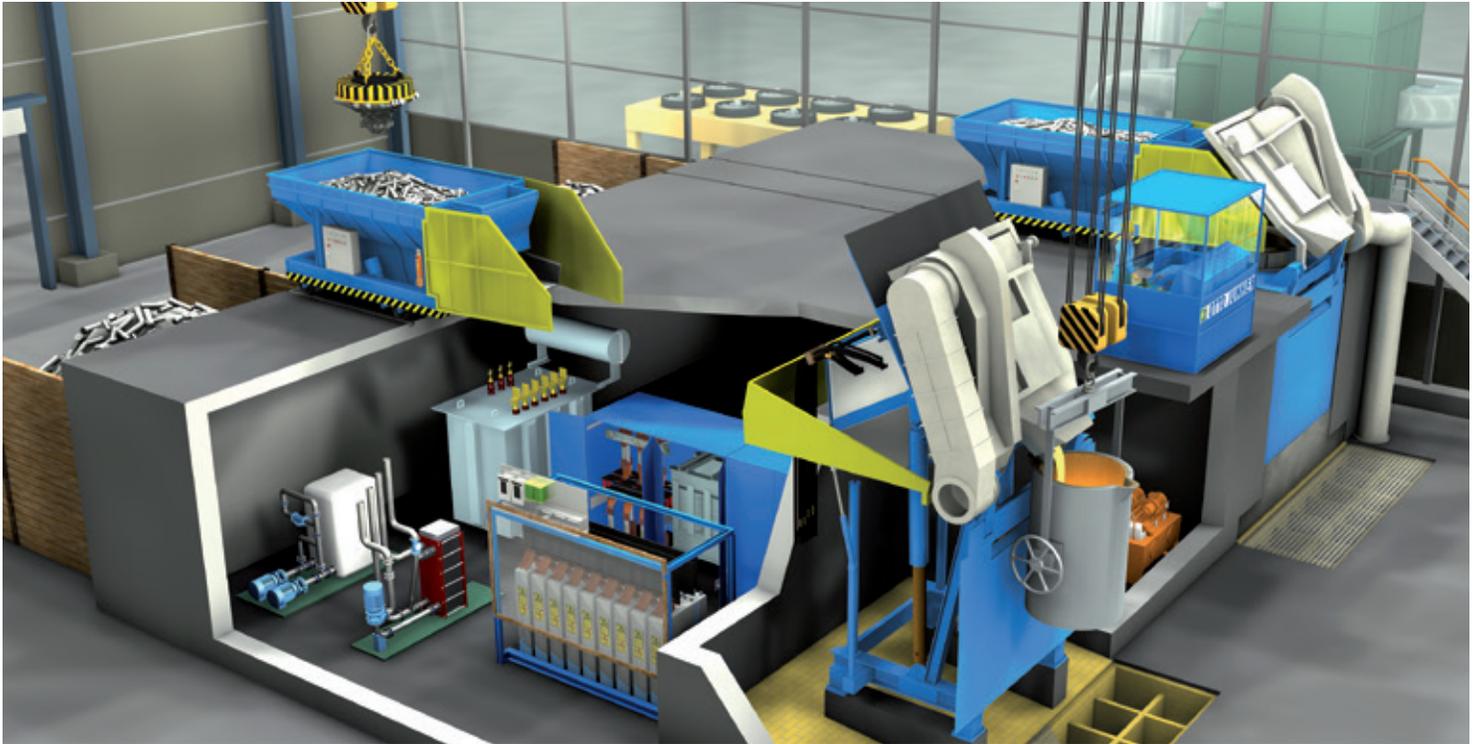


MEDIUM-FREQUENCY CORELESS INDUCTION FURNACES



**...FOR POWERFUL, FLEXIBLE
AND EFFICIENT MELTING**

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WE
UNDERSTAND
METALS

Features and advantages



Powerful 9,000 kW cast iron melting furnace



Furnace platform of an MFT Ge 8,000 / 6,000 kW unit



DUOMELT MFT Ge 12,000 / 9,000 kW installation

The technical and economic benefits of OTTO JUNKER medium-frequency coreless induction furnaces have led to their increasingly widespread use in the foundry and semi-finished products industries. Their basic advantages lie in the **direct** input of heat into the metal, as well as in the selectively controlled bath movement and the metallurgically neutral melting regime.

Technical features

- Close temperature and process control
- High analysis accuracy and reproducibility
- High melting rates thanks to high power density
- High operating flexibility / easy changeover between different metal types and grades
- Suitability for melting with or without heel
- Ability to handle a broad diversity of charge materials
- Selective metallurgical melt management

Economic features

- Low energy consumption
- Low melting loss
- High plant availability
- Easy operation and maintenance
- Low building cost thanks to compact design
- Minimum erection time due to pre-assembled equipment modules
- Low labour costs by automated melting operation

OTTO JUNKER equipment is designed and built to comply with all relevant safety and environmental codes and regulations.

Medium-frequency coreless induction furnaces have evolved into the universal metallurgical solution for **melting, holding and pouring** a diverse range of metals.

Design and operation

An advanced high-power medium-frequency coreless furnace system consists of the following components:

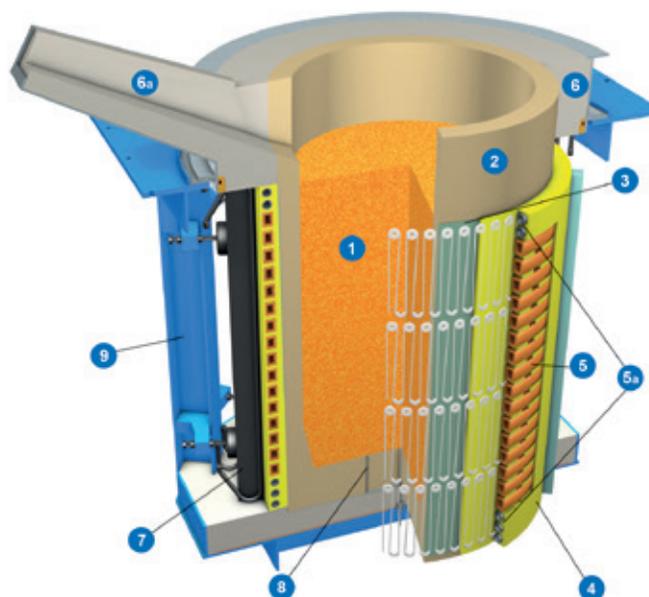
- **Melting furnace**, comprising
 - ▶ Furnace body including coil
 - ▶ Furnace tilting cradle (optional backward tilting)
 - ▶ Hydraulic power pack
 - ▶ Pit guard
 - ▶ Operator control desk
 - ▶ Exhaust hood
- **Electric power supply system**, comprising
 - ▶ Rectifier transformer
 - ▶ Frequency converter
 - ▶ Capacitor rack
 - ▶ Power cables
- **Process control system**, comprising
 - ▶ Weighing system
 - ▶ Operator control cabinet
 - ▶ JOKS melt processor
 - ▶ Crucible monitoring system
- **Auxiliary and ancillary equipment**, e.g.
 - ▶ Water recooling system with air cooler / cooling tower
 - ▶ Dust collection system
 - ▶ Charging equipment
 - ▶ Charge make-up system
 - ▶ Crucible ejector system

Coil and coil assembly

OTTO JUNKER coils reflect our many years of experience. Each coil is carefully manufactured from high-grade materials. Extensive testing ensures compliance with our exacting quality standards. Our coils are designed and built to provide a **high efficiency**, exceptional rigidity and reliable protection against voltage flashovers and thermal overloads. The cooling coil arranged above / below the active coil as well as the yokes surrounding the coil are dimensioned and built to achieve a substantial reduction in magnetic leakage fields which thus remain well below **acceptable workplace thresholds**.

The coil assembly is designed to ensure

- Reliable fixing of the coil in place, both radially and axially
- Dependable protection of the coil from mechanical damage and metal spatter
- Easy access to the coil for maintenance and repairs
- Effective reduction in noise emissions
- Reliable protection of operators from magnetic field exposure



- 1 molten metal bath
- 2 refractory crucible
- 3 heat insulation layer
- 4 permanent lining with embedded OCP sensor cable*
- 5 power coil
- 5a cooling coil
- 6 furnace top
- 6a pouring spout
- 7 yoke
- 8 earth rod for earth leakage monitoring
- 9 coil cage

* embedded OCP sensor cable (heavy duty jacketed glass fibre)

Coil assembly with OCP

Frequency converter system

Parallel oscillating circuit converters of OTTO JUNKER's proprietary design have been purpose-developed for use in induction melting equipment and are noted for their safe and reliable performance even in extreme load conditions. The **ZEUS** digital converter control unit ensures a **maximum power output** throughout the entire heat cycle. The system



provides a perfect adjustment for mains voltage fluctuations and changing load conditions.

Characteristic features of the parallel oscillating circuit converter:

- Robust d.c. link circuitry with smoothing reactor for high operating reliability
- **Small load on the power inverter** since it must handle only the active current (not the furnace current which is higher by a factor of 5 to 10)
- High electrical efficiency
- Low mains pollution
- 6, 12 or 24-pulse design options
- Easy maintenance and access

The rectifier and inverter bridges employ water-cooled high-power thyristors (SCR).

Apart from this thyristor solution (SCR), OTTO JUNKER employs innovative transistor technology (IGBT) for the inverter section while retaining the proven parallel oscillating circuit principle for reduced inverter loads.

Additional features of the IGBT converter:

- Outstanding inherent protection against current, voltage and temperature peaks
- Consistently high power factor (cosine phi) approaching 1.0 at the converter entry
- Less exacting requirements on cooling water due to indirect cooling



Frequency converter system for 12,000 kW



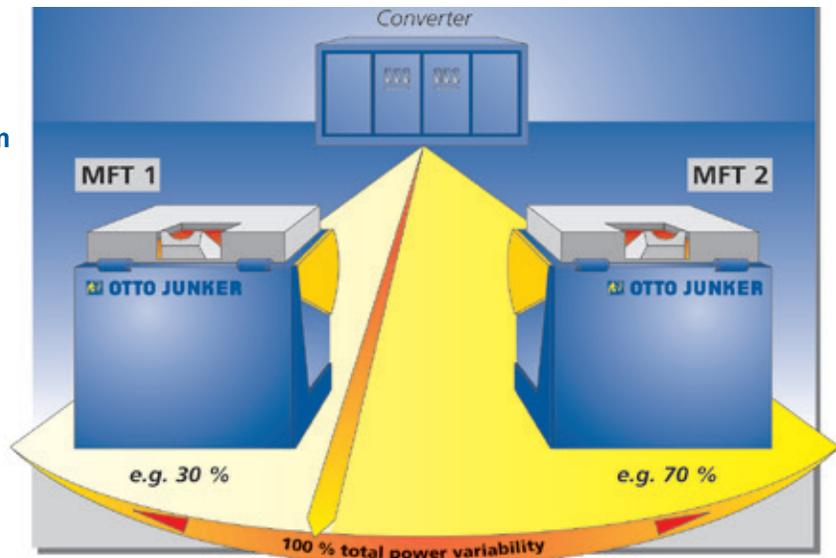
IGBT converter for 3,000 kW

Optimized metallurgical process management

DUOMELT system

Stepless distribution of frequency converter output between two furnaces operating in tandem

- Full use of 100 % power rating at all times
- Shorter idle times for higher melting rate
- Simultaneous melting, holding and pouring
- Maximum flexibility
- Electronic control eliminates switching pauses



DUOMELT principle

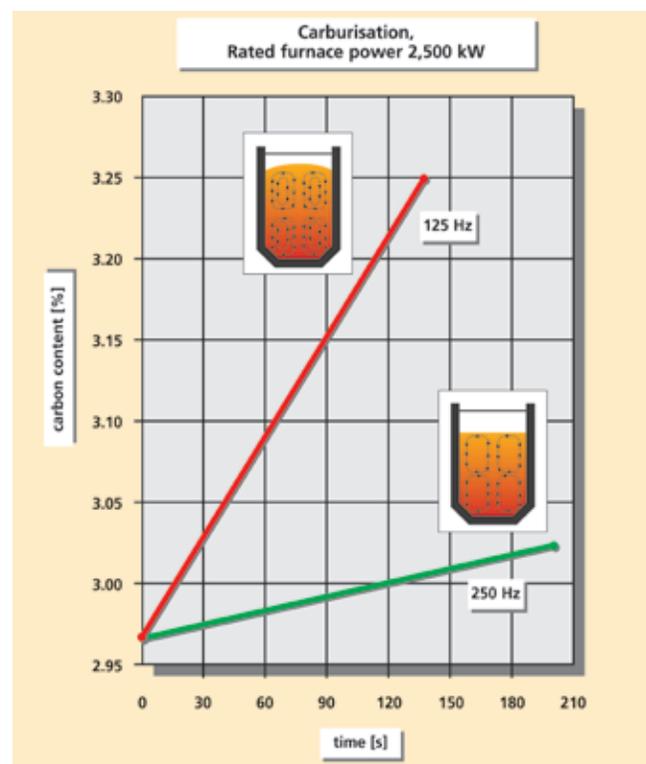
DUOCONTROL

Computer-controlled switching of power output between two furnaces operating in tandem

- Shorter idle times for higher melting rate
- Simultaneous melting, holding and pouring

Variable bath movement

- **Multi-frequency technology** permits changes in operating frequency in the course of the melting cycle. For example, an appropriate frequency of 250 Hz is used for melting the charge material down. For the introduction of carburising agents and alloying additives, the system is automatically switched to a lower frequency (e.g., 125 Hz) so as to increase the bath movement. This shortens the treatment cycle time significantly.
- **Multi-phase stirring technology** creates a bath flow that is adjustable in direction and intensity. This is achieved with the aid of multiple coil sections operating on phase-displaced variable power.



Multi-frequency technology

JOKS TouchControl

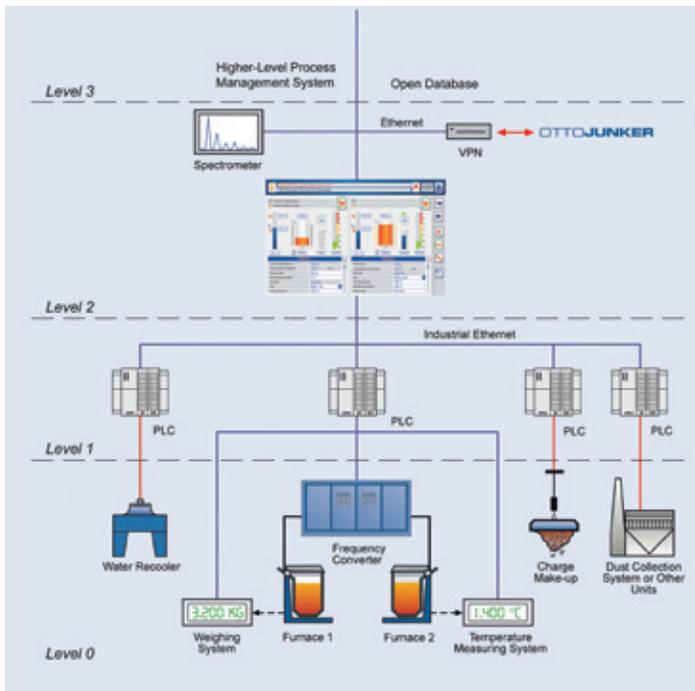
JOKS, the **J**unker **O**fen **K**ontroll **S**ystem, optimizes process control and ensures reliable and dependable monitoring of your complete melting operation.

It controls all functions and process sequences automatically. **JOKS** handles the exchange of data and information with higher-level control systems, records and evaluates the operating data and makes them available via open interfaces.

The scope of HMI functions comprises

- ▶ Automation
- ▶ Monitoring
- ▶ Recording

The system can handle the complete process chain from charge make-up, charging and melting to analysis correction and operation of all auxiliary units and peripheral equipment.

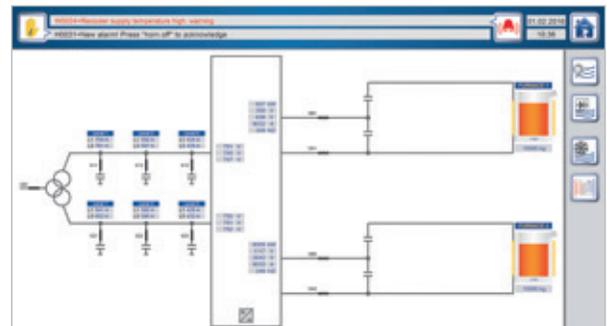
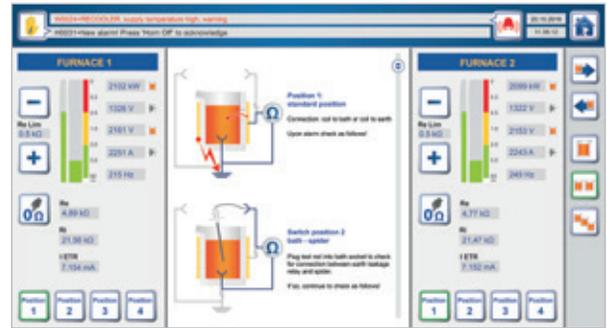


JOKS diagram



Additional software packages available!

- JOKS charge make-up
- JOKS analysis (spectrometer connection)
- JOKS maintenance



Water recooling system

Our furnace and switchgear cooling circuits are built to ensure an effective heat dissipation for optimum reliability of the melting process.

Cooling systems can be alternatively configured with a plate heat exchanger for connection to the cooling tower, a closed cooling tower circuit, or an air cooler. Customer-specific solutions are likewise feasible. The latter also include the use of equipment for **heat recovery**.

A prerequisite for the use of air coolers is a reliable frost protection capability. OTTO JUNKER's **Frost Proof*** solution has proven its effectiveness on numerous installations and permits trouble-free operation of air coolers even in winter without any additional heating or anti-freeze agents (e.g., glycol).

* patented

The water recooling system is operated either in normal mode or – at lower outdoor temperatures – in a special operating mode in which the entire air cooler contents is automatically drained into an intermediate tank which closes the cooling circuit.

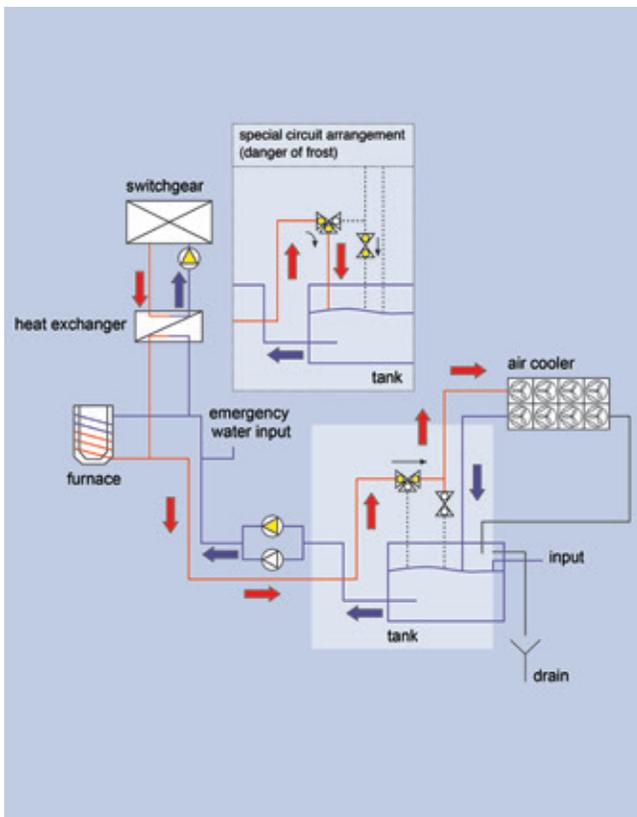
Options:

Key advantages of the Frost Proof system:

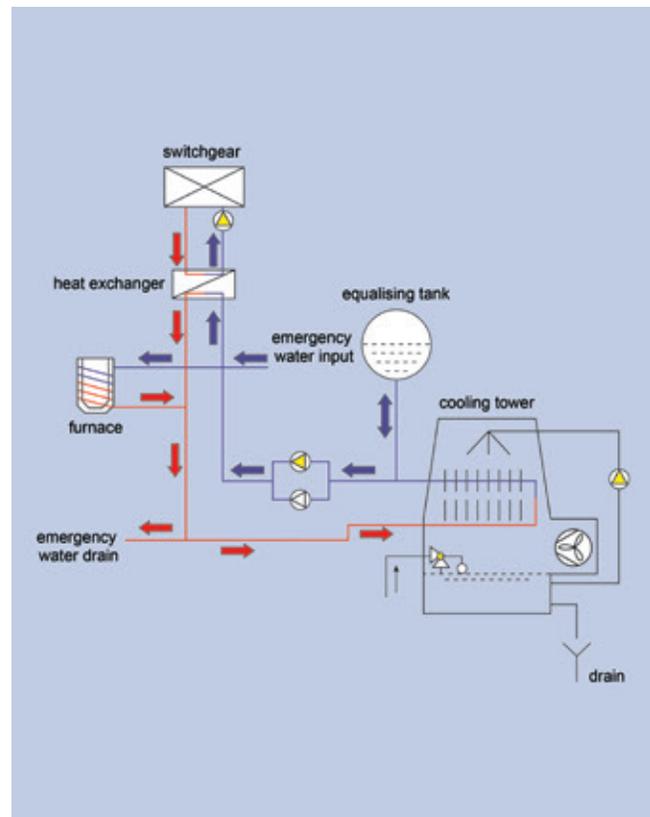
- No risk of equipment freeze-up
- No need to check glycol concentration or to monitor additional heating equipment
- No cost of glycol or heating energy
- No glycol enters and pollutes the waste water in case of emergency water input.

Key advantages of Smart Recooling Control SRC:

- Converter driven cooling pumps
- Control related to expected furnace power by JOKS melting processor
- Energy-saving for recooling unit up to 30 %

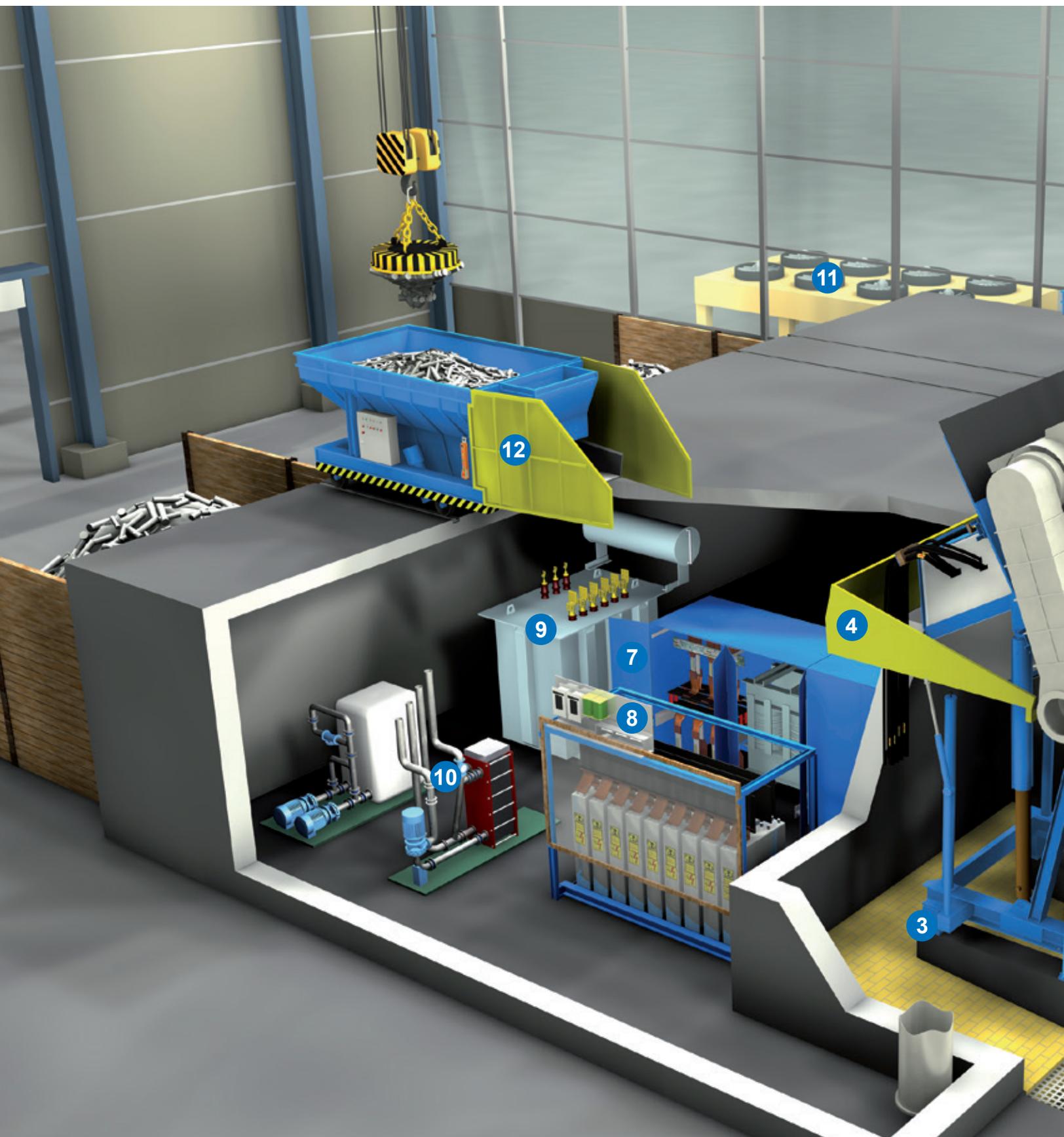


Water recooling system with air cooler



Water recooling system with cooling tower

The overall plant





- 1 Furnace
- 2 Exhaust hood
- 3 Weighing system
- 4 Pit guard
- 5 Hydraulic power pack
- 6 Control stand with operator desk
- 7 Frequency converter (DUOMELT)
- 8 Capacitor rack
- 9 Transformer
- 10 Water recooling system
- 11 Air cooler
- 12 Charging machine
- 13 Dust collection system
- 14 Emergency collecting pit

Exhaust hoods

OTTO JUNKER offers the **DUSTCONTROL** extraction hood system in two options: single tilting axis or double tilting axes. Irrespective of the furnace position, the **DUSTCONTROL** hood collects all dusts and gases released throughout the melting process and delivers them reliably to the filter system.

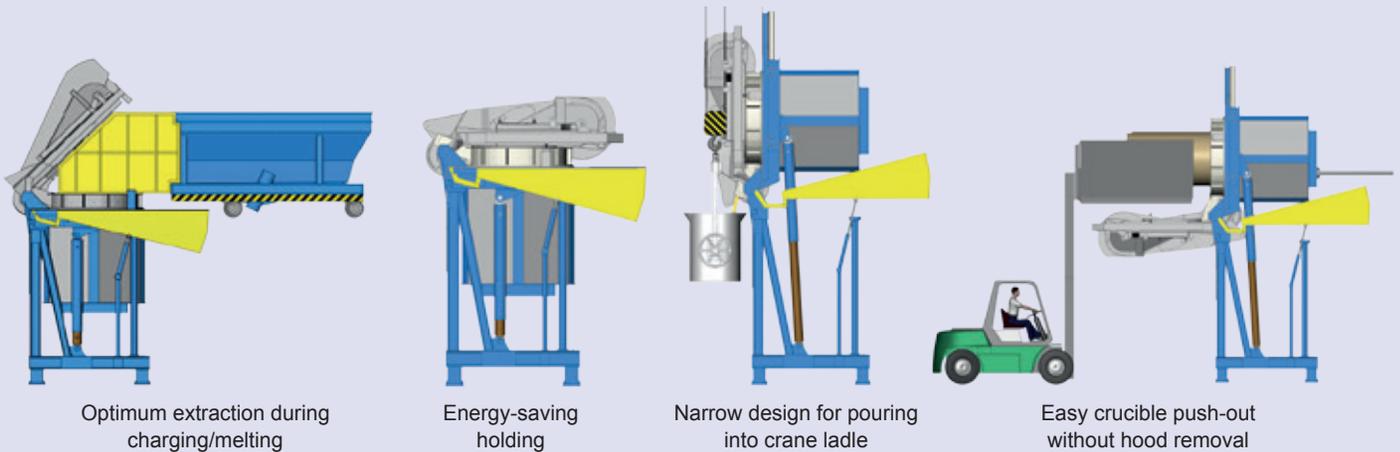
Key features of the DUSTCONTROL system:

- High collection efficiency thanks to low flow resistance and favourable exhaust conditions
- Flat design and low space requirements facilitate ladle handling
- Reduced ambient heat loads in operating areas

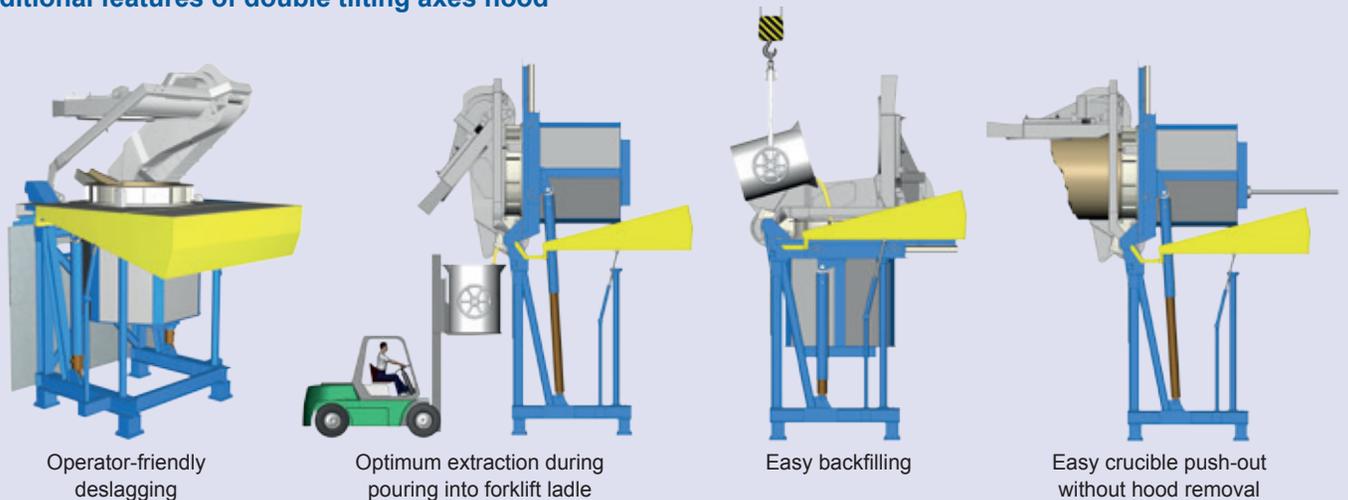


Workplace dust concentrations and emission levels are kept clearly below applicable legal thresholds.

Features of single tilting axis hood



Additional features of double tilting axes hood



Safety package

Yokes for precision guidance of electromagnetic fields

Optimization of magnetic field by numerical calculation and simulation

- Selective dimensioning and arrangement of yokes and screening elements

Noise protection

Design for reduced noise emissions

- Firmly braced induction coil
- Decoupling and resilient mounting of components
- Installation of noise-absorbing materials

Pit guard*

Automatic furnace pit fencing

- Three-sided guard frame
- Gas pressure springs with protective cylinder for pit guard raising and lowering

Optical coil protection system - OCP*

Temperature measurement between crucible and coil

- Improved protection against operating disruptions, equipment damage and operator injuries
- Early warning of impending critical temperature conditions
- Very high resolution and temperature accuracy
- Temperature profile logging and visualisation over the entire crucible campaign
- Direct optical temperature measurement not based on electrical circuitry

Earth fault monitoring

Protective system detecting electrical fault voltages

- Contact system with earth rods embedded in the furnace bottom
- Monitors furnace insulation resistance against earth
- Crucible monitoring

Emergency tilting* and emergency water input system

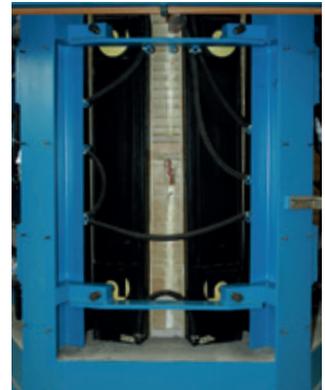
Emergency emptying and emergency cooling in case of power failure

- Emergency emptying options: Hydraulic pump, nitrogen-operated or manual
Emergency power generator, 24 V DC backup pump
- Emergency water input and drainage by solenoid valve opening when de-energized

Additional safety features

- Furnace operator control stand*
- Emergency collecting pit*
- Charging machine*
- Exhaust hood*

* quoted as optional safety features



Furnace sizes and types

Cast iron and steel

Medium-frequency coreless induction furnaces have evolved into the dominant type of melting furnace in today's foundries, demonstrating their exceptional metallurgical capabilities thanks to the special technologies employed. High power densities of up to 1,000 kW per metric tonne of iron ensure high melting rates from a compact-sized installation. Even high-performance moulding lines can thus be supplied with high-grade metal on a continuous basis.

Where two furnaces are combined with one common frequency converter (DUOMELT / DUOCONTROL) or three furnaces with two converters (TRIOMELT), a medium-frequency coreless induction furnace can also serve as a holding furnace.



MFT Ge 16,000 / 8,000 kW



Compact MFT Ge 500 / 250 kW system

Photo by: ACTech GmbH

Furnace sizes: MFT furnace type for cast iron and steel

Capacity (kg)	Power, max. (kW)	Melting rate, max. (kg/h)
500	500	950
750	750	1,400
1,000	1,000	1,900
1,500	1,500	2,850
2,000	2,000	4,000
3,000	3,000	6,000
4,000	4,000	8,000
5,000	5,000	10,000
6,000	6,000	12,000
8,000	8,000	16,000
10,000	10,000	20,000
12,000	12,000	24,000
16,000	14,000	28,000
18,000	16,000	32,000
25,000	20,000	40,000



MFT Ge 10,000 / 8,000 kW

Copper and copper alloys

The specific benefits associated with the inductive transfer of energy and the metallurgically neutral process performance are of particular importance in melting, alloying, refining and pouring as well as in holding the various copper materials at temperature.

Coreless induction furnaces are employed as a technologically and economically efficient solution in conjunction with

- Horizontal and vertical continuous casters
- Sand casting and centrifugal casting machines
- Chip recycling equipment
- Remelting and alloying plants

Specific design features of the coreless furnace, such as the arrangement of pouring and filling systems in the furnace's pivot bearing, are key to the success of this furnace type for demanding high-grade copper melting applications.

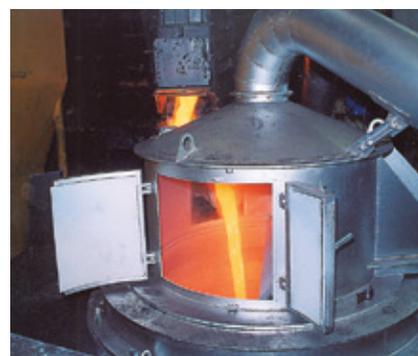
Furnace sizes: MFT furnace type for copper

Capacity (kg)	Power, max. (kW)	Melting rate, max. (kg/h)
600	400	1,000
900	500	1,250
1,200	600	1,500
1,800	900	2,200
2,400	1,200	2,900
3,600	1,400	3,600
4,800	1,600	4,100
6,000	1,800	4,600
7,200	2,000	5,100
9,600	2,500	6,400
12,000	3,000	7,700
14,400	3,500	9,000
16,000	4,000	10,300
20,000	5,000	12,800
30,000	6,000	15,400

For chip melting a reduced power density is recommended.
The melting rate for brass 60 is approx. 40 % higher.



50-tonne MFT furnace serving a vertical continuous caster



Transfer from melting furnace to holding and pouring unit



Furnace with pouring tube

Aluminium

Low melting loss, accurate temperature and process management plus a variable bath movement control capability are among the key benefits of medium-frequency coreless induction furnaces for melting aluminium and its alloys.

These high-power furnaces are used especially for the production of high-grade alloys and in chip recycling applications.

Fields of application:

- Horizontal and vertical continuous casting
- Sand casting
- Chip and foil recycling
- Remelting and alloying

Furnace sizes: MFT furnace type for aluminium

Capacity (kg)	Power, max. (kW)	Melting rate, max. (kg/h)
200	150	300
300	200	400
400	300	500
600	500	900
700	600	1,100
1,000	900	1,700
1,400	1,000	2,000
1,750	1,400	2,700
2,100	1,800	3,500
2,800	2,400	4,700
3,500	2,700	5,300
4,200	3,000	5,900
5,500	3,500	6,900
7,500	4,000	7,800
9,000	4,500	8,800

For chip melting a reduced power density is recommended.



MFT AI 1,000 / 750 kW



DUOMELT MFT AI 2,800 / 2,000 kW system



Automatic charging of ingots and returns

Special applications

OTTO JUNKER medium-frequency melting furnaces are perfectly suited for melting and holding any type of metal or other electrically conductive material.

Custom-designed OTTO JUNKER furnace systems have been used successfully for the melting of

- Magnesium
- Cobalt
- Nickel
- Silicon
- Silver

Further to the above, OTTO JUNKER also offer the medium-frequency coreless induction furnace as a vacuum furnace.



Induction furnace for magnesium



Special crucible for magnesium



Coreless vacuum induction furnace

Our service portfolio

As your competent partner for all capital investment, maintenance and upgrading issues relating to medium-frequency coreless induction furnaces, we are pleased to provide you with the following services:

- Planning and implementation of complete melt shop solutions
- Advice on melting plant selection and dimensioning
- Return-on-investment estimates
- Engineering, construction and installation of furnace systems
- Upgrades and revamping projects
- After-sales service and 24-hour support
- Equipment optimization to reduce energy consumption and environmental impact





Illustrations and texts may represent options or extras.

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OTTO JUNKER GMBH
Jägerhausstr. 22
52147 Simmerath
Germany

Phone: +49 2473 601-0 | Fax: +49 2473 601-600
E-Mail: sales@otto-junker.com

WWW.OTTO-JUNKER.COM



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