



# ELOTHERM LongLine™

Induction Solutions: Tube plants



# SMS GROUP

## Leaders in plant construction and machine engineering

The SMS group unites global players in the construction of plants and machines for the processing of steel and NF metals, operating under the roof of SMS Holding GmbH. It consists of the two business areas, SMS Siemag and SMS Meer, as well as industrial participations. SMS Holding GmbH is responsible for strategic planning and control. The sole owner of the SMS group is Siemag Weiss GmbH & Co. KG, the holding of the Weiss entrepreneurial family.

### **FAMILY-OWNED AND WORLDWIDE PRESENT**

As a family-owned company, the SMS group has built on solid values and a culture of responsibility for four generations. It holds a strong market position, while its decentralised structure ensures a fast and efficient response to individual customer demands. The SMS group combines the flexibility of company units that operate as medium-sized enterprises with the broad resources of an internationally active company – all to the benefit of the business partners. The decentralised corporate culture ensures that not only the individual units, but also the employees always think and act in an entrepreneurial manner.

### **BUILDING ON A STRONG BASIS**

A long-term view, careful financial management, the focus on values, plus an understanding of the cycles of the machine and plant construction market have guided the group's strategic planning for decades. Also high on the agenda are investments in the areas of energy and environment technology, service and modernisation of plants as well as on-the-job training and qualification of core employees. On this basis, the SMS group creates tailor-made plant solutions which enable its business partners to keep well ahead of the competition.

**SMS**  **group**



### **SMS MEER BUSINESS AREA**

The SMS Meer Business Area bundles its activities in the fields of steelmaking plants and continuous casting technology (long products), tube plants, long product rolling mills, forging technology, nonferrous metals plants, heat treatment technology and service. Starting with advisory services, followed by implementation and commissioning, and finally modernisations – the employees of the business area always combine their specialist knowledge with approachability and flexibility.

### **TOP QUALITY**

The innovative solutions provide our customers with measurable benefits in their challenging markets. Whether steel for automotive parts, pipelines, heavy structural profiles, wheels for high-speed trains or aluminium for façade structures: the machines and plants tailored by the SMS Meer Business Area ensure the cost-efficient and flawless production of the necessary components.

### **INDIVIDUAL SOLUTIONS**

The SMS Meer Business Area concentrates the competence of globally successful specialist firms under one roof to create a unique, full range of supplies and services for metal processing and associated fields. In doing so, the employees focus consistently on the needs of their business partners. They find individual solutions and fulfil the plant operators' expectations, both flexibly and reliably. This is verified by 17000 successful reference projects the world over – in the last 50 years alone.



# SMS ELOTHERM

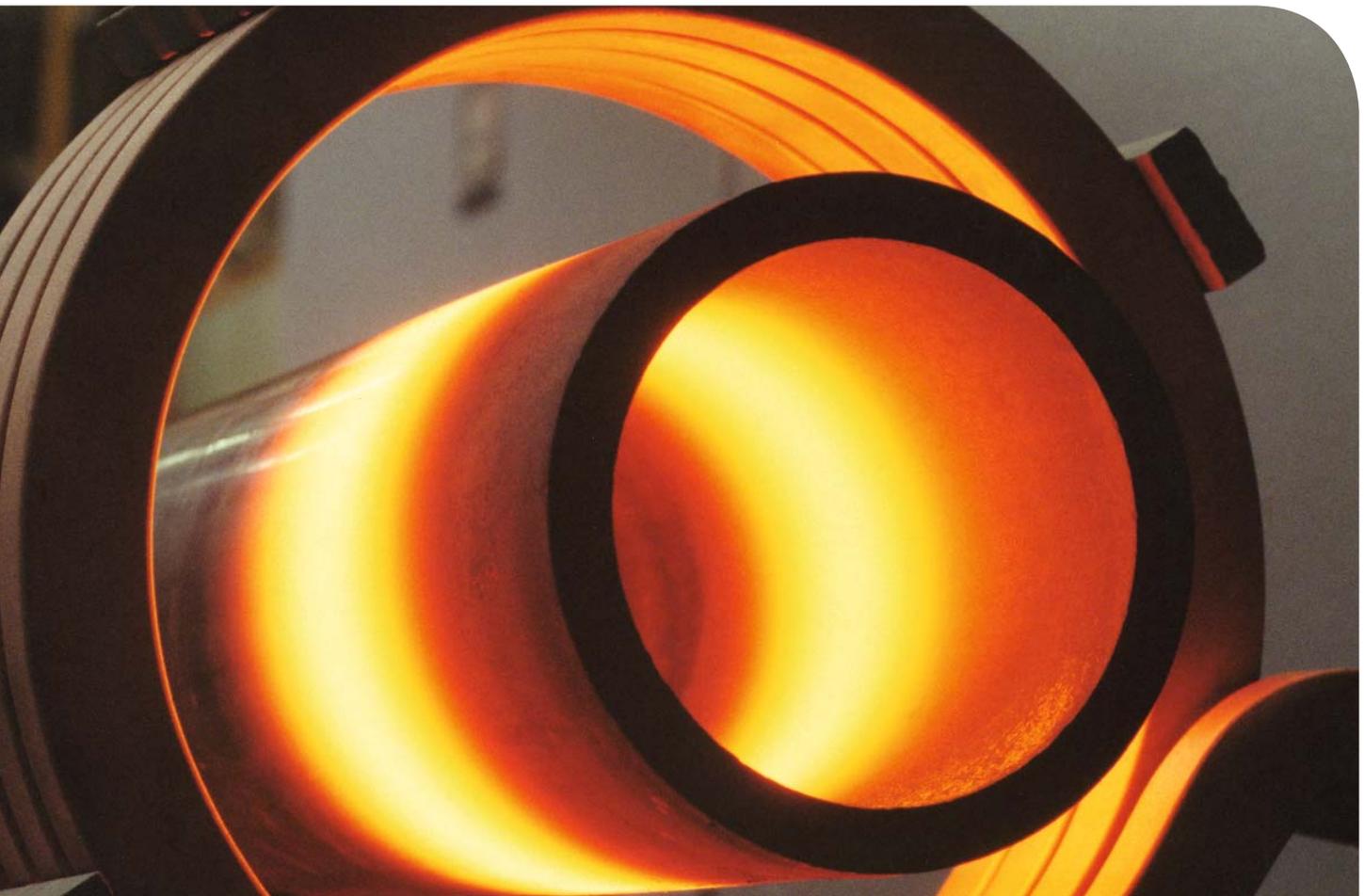
Your partner for induction heating solutions

With its developments and system solutions, Elotherm has set standards in induction technology for decades. The medium-sized internationally operating company is part of the SMS group. As a technology leader, Elotherm combines all competences when it comes to induction.

- Induction heating of metals for forging and rolling
- Induction hardening and quench & temper
- Induction welding, annealing and special technology for tubes
- Continuous induction strip heating
- Induction kinetics

## **CUSTOMIZED SYSTEMATIC SOLUTIONS**

Elotherm's technology is based on compatible modular plant components, which can be efficiently combined into individual configurations. This enables economic industrial heating solutions – irrespective of whether it is a single unit or a complete manufacturing line.



# CORE COMPETENCES

All your benefits at a glance

## CLEAN, ENERGY-EFFICIENT INDUCTION TECHNOLOGY

When applying the induction heating method a metal workpiece is exposed to an electromagnetic alternating field by means of a current-carrying coil. As a result, eddy currents are generated in the material in a non-contact manner and heat is resulting. This process can be influenced in a product-specific way.

## INDUCTION SOLUTIONS FOR ALL TUBES

For modern tube production, the induction heating and welding technology is a precondition to high productivity, quality and profitability. In the field of tube plants, Elotherm has many years of experience combined with latest process know-how. Based on this, Elotherm develops and provides solutions all along the entire tube manufacturing chain, i.e. perfectly integrable and in a cost-efficient manner.

## INTEGRATED OFFER

Elotherm combines all competences of the induction technology under one roof and thus offers its customers tailor-made, integrated services from one source with a responsible contact person. The spectrum of services ranges from giving advice via engineering, plant construction up to commissioning, training courses and comprehensive customer care.

## SOLUTIONS FROM A SINGLE SOURCE

Together with our sister companies of the SMS group, we offer our customers integrated solutions for the whole process chain.

## TECHNOLOGY LEADER WITH OUTSTANDING PROCESS COMPETENCE

- Experience spanning more than 75 years
- Innovative system partner for the automotive and supplier industry as well as the steel, rolling mill and pipe production industry
- More than 6000 plants worldwide in continuous operation for decades
- Sales and service around the globe
- Fast delivery by local manufacturing and stock-keeping facilities

## INDIVIDUAL CUSTOMER CONFIGURATIONS

- High efficiency thanks to modularized plant components
- Tailor-made manufacturing solutions

## ENERGY-EFFICIENT, ECONOMIC INDUCTION

- Minimized energy consumption through intelligent technologies
- Sustainable and eco-friendly due to reduction of CO<sub>2</sub>
- Quick change of production and increased productivity
- Low manufacturing costs
- Integrated effective power measurement for efficient quality control

## IN-HOUSE INDUCTOR AND CONVERTER MANUFACTURING

- All competences under one roof
- Optimal technical interfaces to existing customer systems
- Individual design and layout to attain optimum results
- Innovative converter development with low and resource-saving energy demand

## PRECISION IN PROCESSING

- All relevant certificates, e.g. VDA, DIN/ISO
- Continuous project and quality management from the initial enquiry through field service

# ADVANCEMENT

## all along the line

### ALL COMPETENCES COMBINED

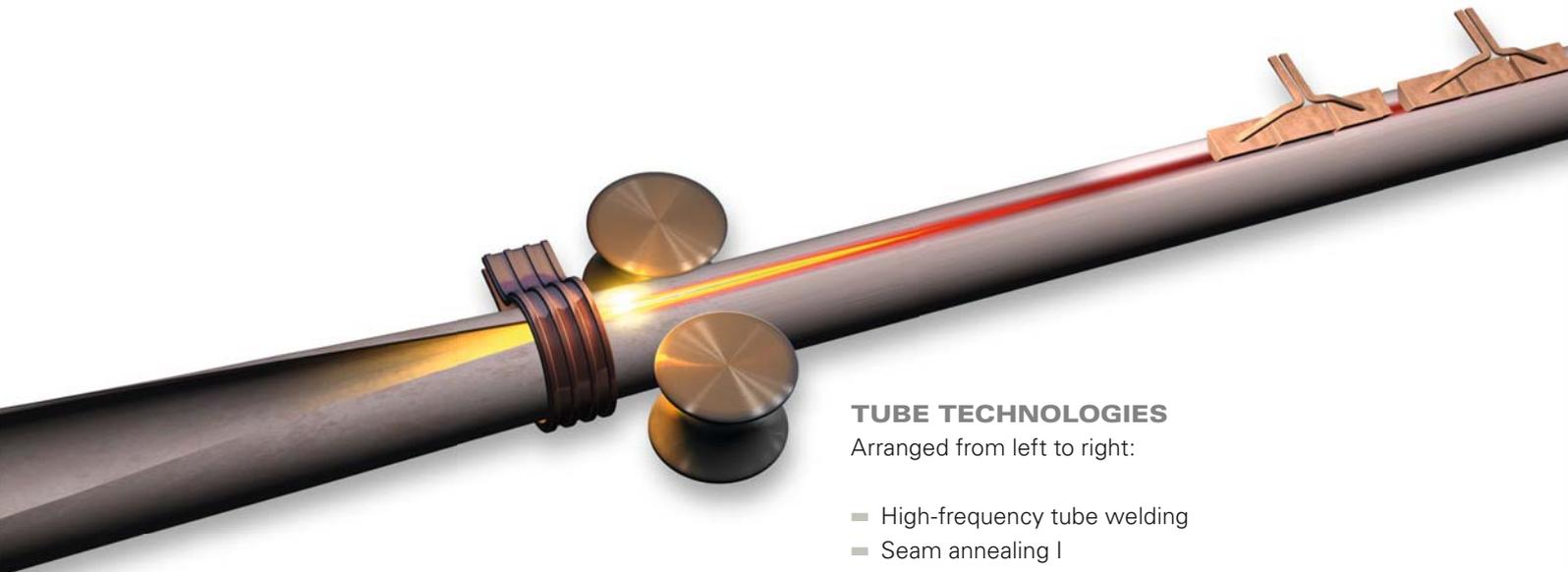
High frequency welding equipment for longitudinally welded tubes and heating plants for seamless tubes of different steel alloys, stainless steels and NF metals. One of the biggest advantages for the customer is the overall competence of Elotherm for stable processes harmonized with each other.

### HIGHEST ENERGY EFFICIENCY

Elotherm has improved the heating process continuously and has implemented it in a highly efficient way. Heat is generated directly in the workpiece, whereby the heating time of the tubes is reduced. Induction systems can be immediately adapted to product changes, for example for diameter or wall thickness changes. With new converter technologies, the induction systems of Elotherm require less energy than comparable facilities.

### ECO-FRIENDLY TECHNOLOGY

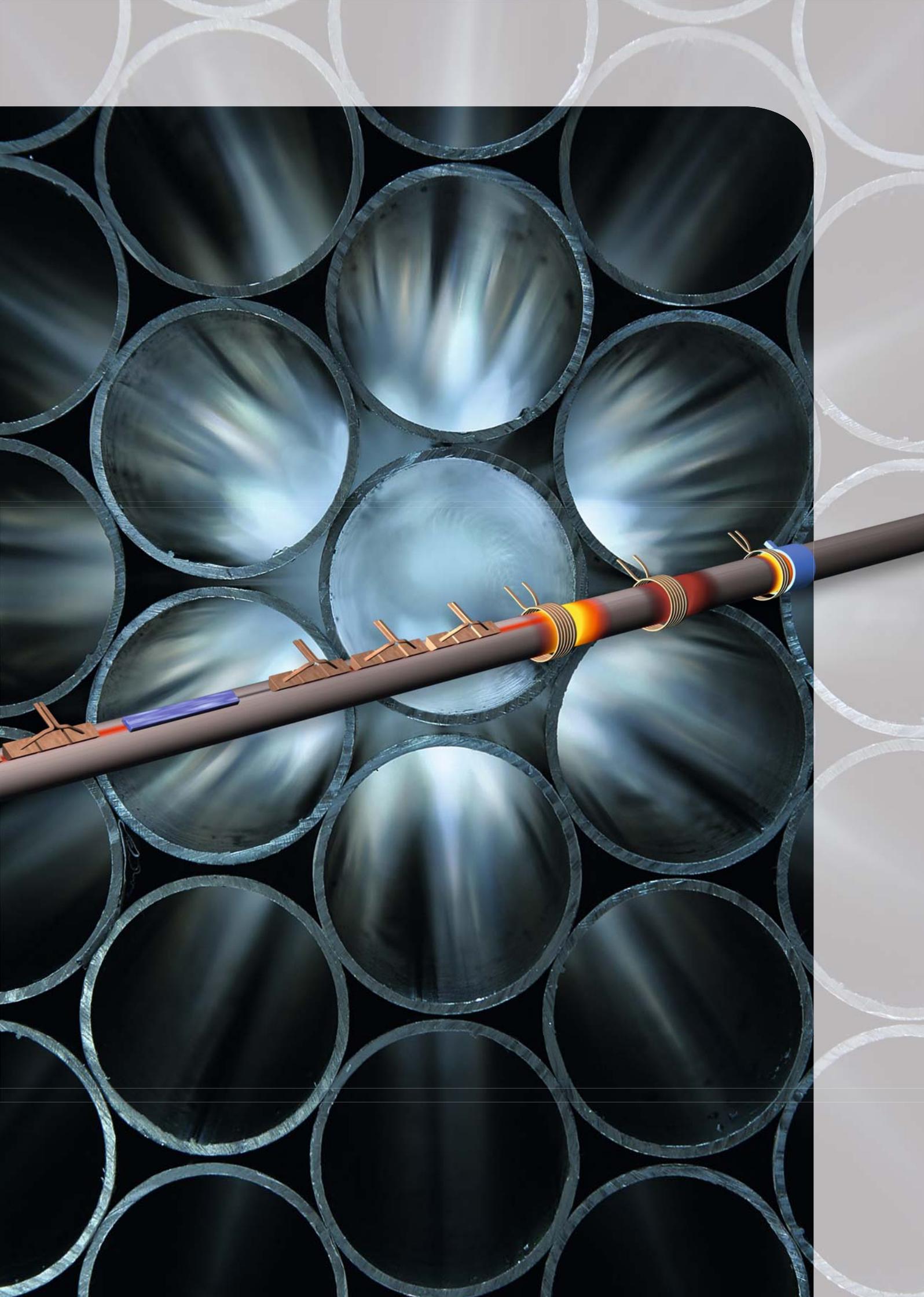
In general, induction heating and welding is a clean process. Compared to furnaces operated with fossil fuels, no polluting emissions are generated when the induction technology is applied.



### TUBE TECHNOLOGIES

Arranged from left to right:

- High-frequency tube welding
- Seam annealing I
- Quenching
- Seam annealing II
- Annealing
- Coating
- Quenching and tempering



# HIGH-STRENGTH RESULTS

## Induction welding with EloWeld™

### SECURE WELDING CONNECTIONS

Owing to an improved starting material and an increased weld seam quality, the properties of longitudinally welded and heat-treated tubes are comparable with those of seamless tubes and take their place in many areas. During longitudinal seam welding an endless strip is formed to a tube in a continuous rolling process. The opposite strip edges are heated via an inductor up to the melting point by means of a high-frequency alternating current and then joined by upsetting rolls. In this way, the high-quality weld generated does not need any additional material.

### HIGH SPEED

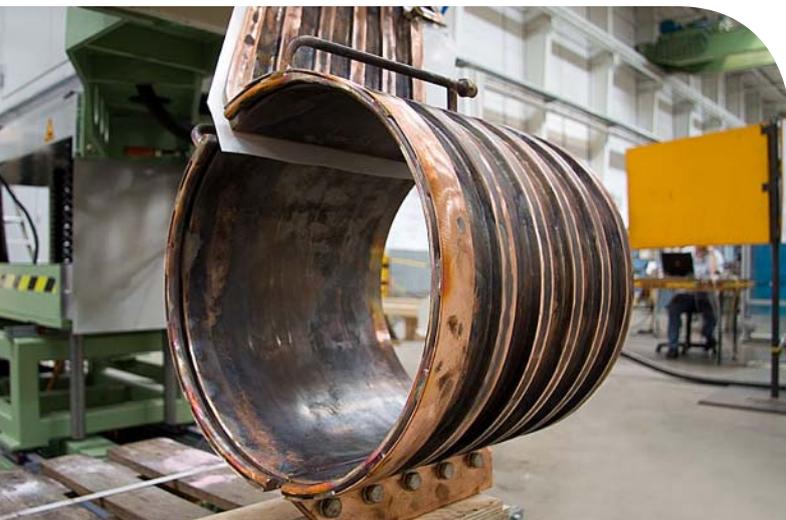
With the EloWeld™ HF welding systems, production speeds of more than 200m/min can be realized.

### MODULAR DESIGN

The EloWeld™ series is provided with modular design so that it can be suited to individual needs in a cost-effective way. Key elements are the parallel or series oscillating circuit converter as energy source with a variable frequency range, the inductor adapted to the tube or the profile shape and a quality securing and user-friendly control system.

### TECHNICAL DATA

Tubes and profiles can be produced with an external diameter from 6 to 660mm and a wall thickness from 0.12 and 25.4 mm.





### LARGE PRODUCTION SPECTRUM

EloWeld™ tube welding plants set standards in terms of the dimensional range, the wall thicknesses and the material variety and they are capable of processing steel and stainless steel, aluminum, brass, copper and zinc.

- High welding speeds
- Universally applicable
- Modular, user-friendly concept
- Safe operation and high availability

### KEY FEATURES

### APPLICATION EXAMPLE

Tube welding plant

Annual capacity:	more than 400000t
Tube diameter:	244 to 660mm
Wall thicknesses:	4.0 to 24.0mm
Steel grades:	up to X80, N80
Standards:	API 5CT, API 5L



# PERFECT SEAMS

## Induction seam annealing with EloSeam™

### UNIFORM STRUCTURE

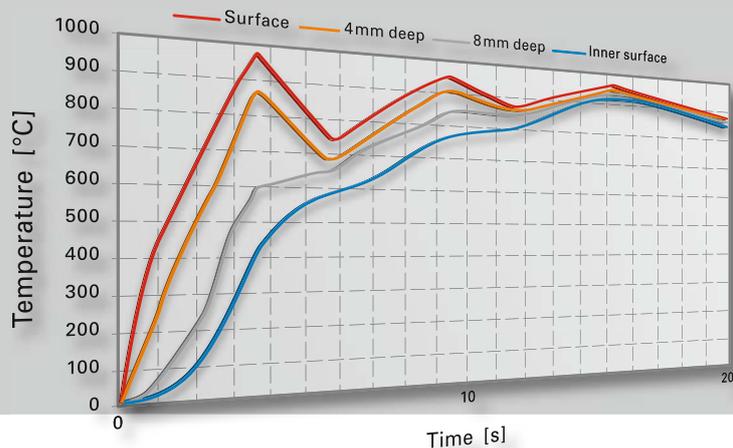
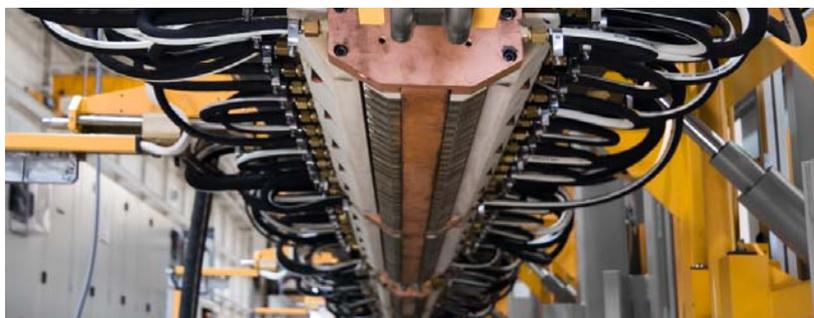
EloSeam™ for induction seam annealing of longitudinally welded tubes reliably ensures a uniform structure in the area of the weld seam. The micro-structure created in ferritic steels during welding is thus normalized. The result: high-quality tubes with homogeneous material properties.

### INCREASED ENERGY INPUT

Ferrite plates (concentrator plates) are inserted into the water-cooled inductors. As a result, the power input is specifically concentrated on the seam area and effectiveness or efficiency of the inductors increases. The input of energy is controlled such that surface overheating is prevented.

### SUITABLE DIMENSIONING

Thanks to the modular structure of EloSeam™, the annealing section can be designed and dimensioned exactly to the requirements of the tube plant. This ensures thorough heating.



### APPLICATION EXAMPLE

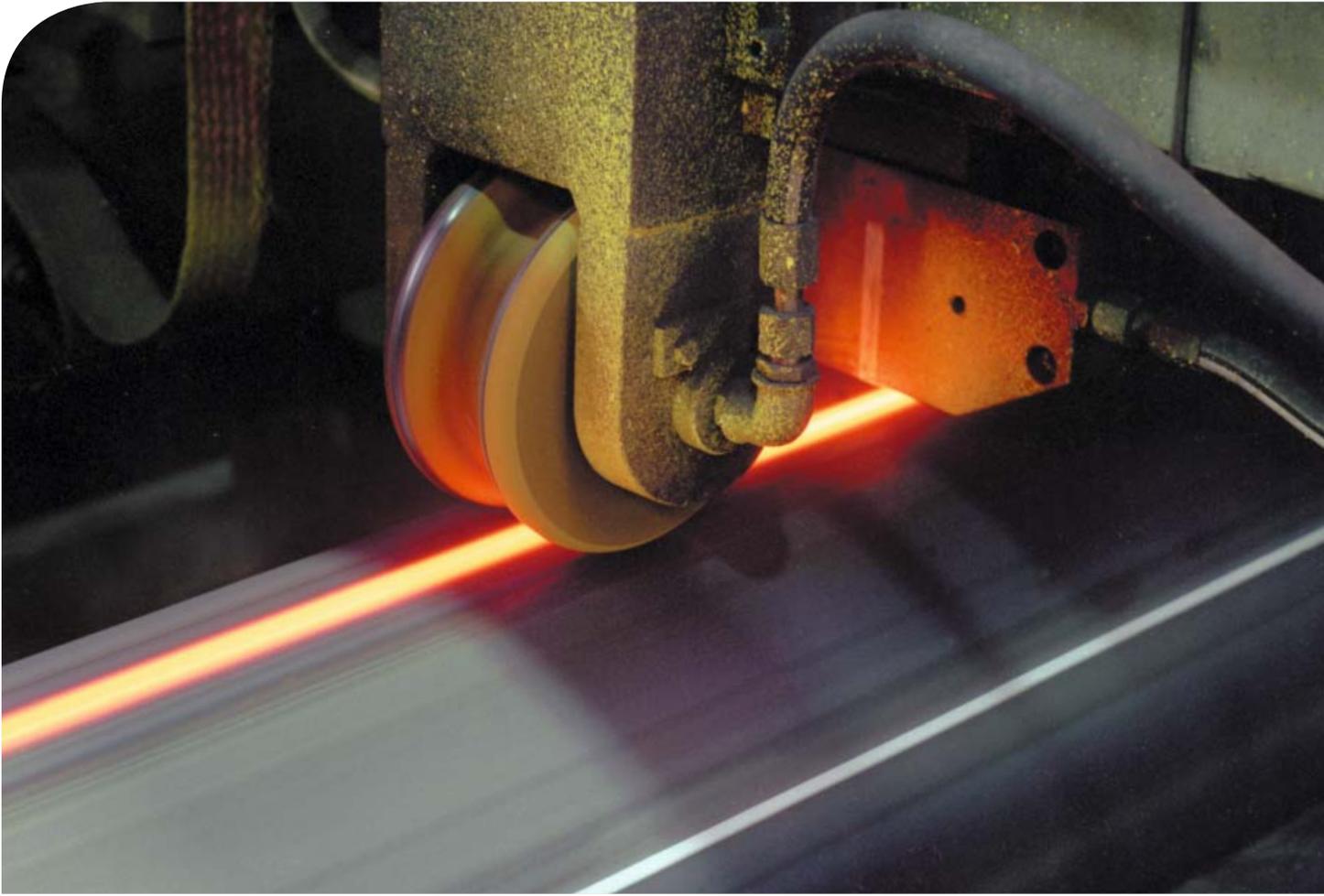
Heating curve of seam

Workpiece: Tube

Diameter: 339.7 mm

Wall thickness: 12.19 mm

Feed: 19.8 m/min



- High process reliability
- Exact power input
- Individual and economic adaptation
- Less required space

#### KEY FEATURES

#### AUTOMATIC TRACKING

To sense the proper position of the weld seam, a pilot line is applied. A tube drift can be detected and the EloSeam™ control system automatically carries out a correction of the inductor position. This ensures that a precise annealing process is constantly achieved.

#### TECHNICAL DATA

IGBT oscillating circuit converters with an output between 500 and 3500kW. External tube and profile diameters in sizes ranking from 25 to 660mm and a wall thickness of up to 25mm can be processed.

# EXCELLENT FEATURES

## EloTube™ for tube heating and coating

### **BLACK-ANNEALING**

Thanks to its adaptability, the modular system EloTube™ presents outstanding qualifications for black-annealing under normal oxygen atmosphere. Here, the advantages of EloTube™ play a major role: a flexible and cost-effective adaptability as well as a highly flexible metallurgical influence of the microstructure.

Black-annealing with EloTube™ can be used for normalizing and homogenizing as well as recrystallization, stress-free, soft and full annealing.

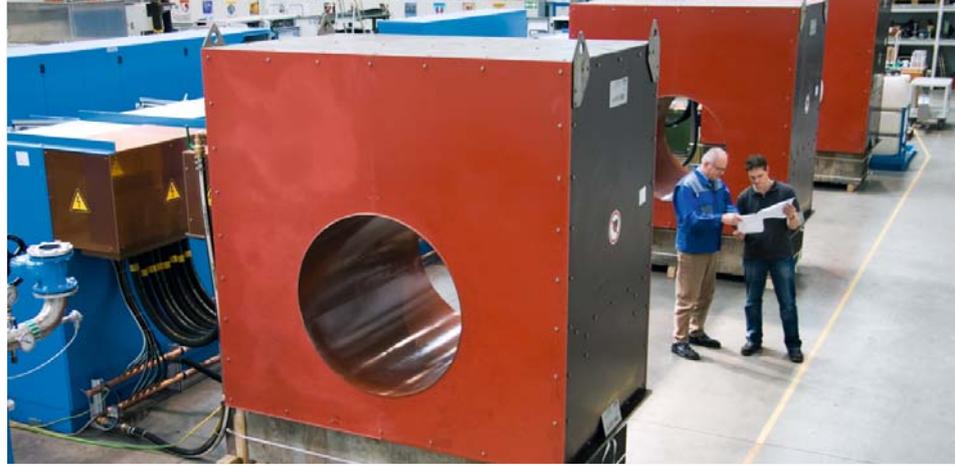
### **TECHNICAL DATA**

IGBT converters with an output between 50 and 4500kW. Workable tube diameters from 1" to 56" mm up to wall thicknesses of 36 mm.

### **BRIGHT-ANNEALING: SHINING RESULTS**

Bright-annealing also benefits from the modular system EloTube™. The power input of induction technology ensures high heating speed and provides a targeted effect of recrystallization annealing under protective gas atmosphere. Stainless steel tubes are annealed for example in a temperature range from 1050 to 1300 °C.





The consequences: the weld seam becomes corrosion-resistant and the tube is metallurgically prepared for additional drawing and rolling operations. In this process, the tubes keep a metallic shiny surface.

Depending on customer requirements, Elotherm provides the quartz glass as well as the retort systems. Preferred in practice is the more robust and unbreakable retort system with water-cooled stainless steel cylinder which is filled with protective gas.

**COATING:  
AT HIGH SPEED**

For the coating facilities in tube plants, exact preheating at high throughput speeds is ensured with EloTube™. Automatically controlled frequency variations meet all changing requirements.

EloTube™ is suited for lacquer and plastic coatings in hose extrusion and coiling processes.

Another coating method is Fusion Bonded Epoxy coating (FBE). In this powder coating method under the influence of heat, a precise process control by EloTube™ with induction preheating and powder melting plays a decisive role.

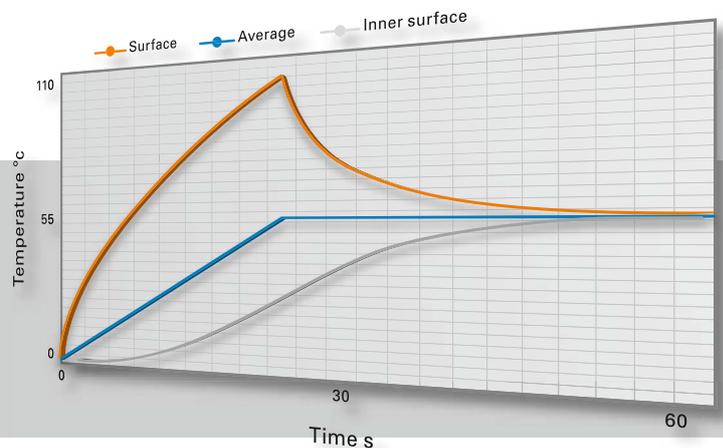
- Modular system engineering for profitable solutions
- High-precision process control
- Maximum productivity
- Flexible application possibilities

**KEY FEATURES**

**APPLICATION EXAMPLE**

Heating curves of the tube for drying

Workpiece: Tube  
 Diameter: 1626 mm  
 Wall thickness: 32.0 mm



# DUAL ANNEALING LINE WITH COOLING ZONE

Induction solid-wall pipe annealing with EloTube™  
combined with EloSeam™ seam annealing

## HOMOGENOUS MATERIAL PROPERTIES

Weld seam and solid-wall pipe annealing are increasingly gaining in importance on the market. During the HF welding process the coolant return is secured by modern backflow preventers. This enables us today to reliably adjust a uniform structure in the weld seam and over the pipe cross-section during heating of solid-wall pipes even when tubes with a diameter of less than 30 mm are used.

## COMPACT PLANT STRUCTURE

For solid-wall pipe and induction weld seam annealing, a single power unit enables a cost-effective plant structure and optimal adaptation to individual annealing requirements.

Key elements are a common cooling water system, a plant control system, a power transformer and a capacitor cabinet.

Modern modular EloMat™ LLC converters with variable frequency range are available as energy source.

The machine is designed for the receipt of round coils and line inductors with field concentrators adapted to the weld seam.

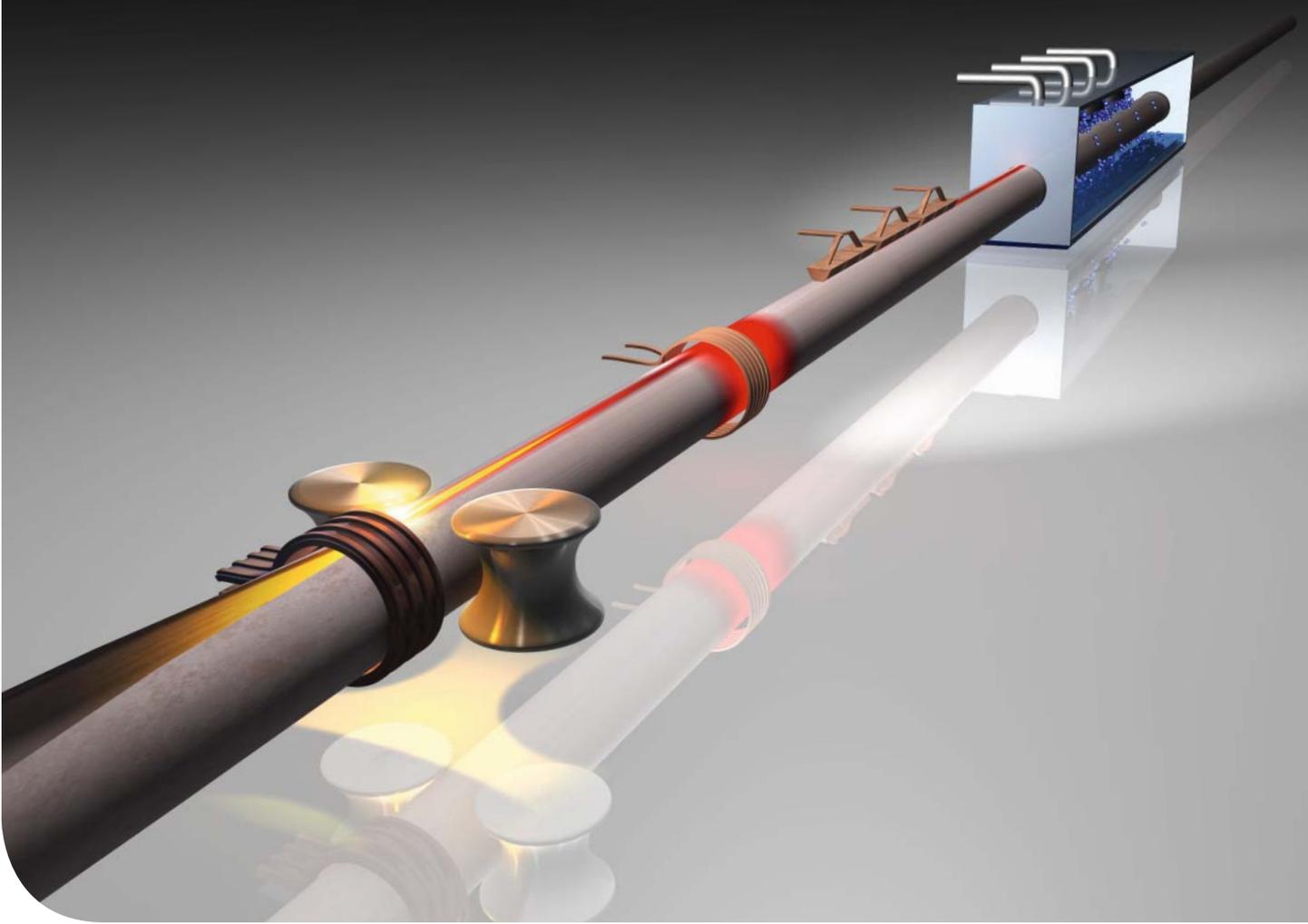
## TECHNICAL DATA AND DESIGN

Tubes and profiles with external diameters of approx. 12 to 30 mm for solid-wall pipe heating and 30 to 150 mm for induction weld seam heating. Available output sizes of LLC converters in IGBT transistor technology from 400 kW to 3600 kW. Cooling section with/without forced cooling and final cooling station with integrated water sprinklers.



## APPLICATION EXAMPLE DUAL ANNEALING LINE

Workpiece:	Tube
Diameter:	20 mm
Wall thickness:	2.6 mm
Feed:	30 m/min



### **EFFICIENT ENERGY UTILIZATION**

Round coils for a diameter range up to approx. 30mm operate with high effectiveness. For field concentration, ferrite plates are employed when weld seam annealing inductors are used.

Power input is individually calculated and controlled to ensure that overheating of the tube surface is prevented.

Regardless of the load conditions, the LLC converter power units provide a constantly high power factor ( $\cos > 0.95$ ), i.e. even in the partial load range. For a significant reduction of harmonics of the electric grid, LLC converters in 12-pulse design are recommended.

- High process reliability
- Economically applicable
- High availability and flexibility
- Demand-oriented power input
- Small proportion of reactive power
- Compact space-saving design
- Adjustable for tempering, normalizing, stress-free and full annealing
- No inductor change required

### **KEY FEATURES**

# KEY TECHNOLOGIES

## Special induction applications

### **CUSTOMER-SPECIFIC SOLUTIONS**

As system partner, Elotherm provides harmonized solutions for all induction applications. Therefore, the customer can rely on a responsible contact person and uses the advantages of a consistent system technology. That is why the portfolio includes also induction solutions for tube bending as well as pipe bend and pipe end heating which all require special knowledge.

### **PIPE BENDING REDUCES FOLLOW-UP COSTS**

The induction process of Elotherm enables that seamless pipe bends with straight tube legs but also with multiple and three-dimensional bends are produced efficiently. Bending takes place in an automated, continuously developing process, whereby bending temperature, cooling and feed are controlled depending on tube material, bending radius, diameter and wall thickness.

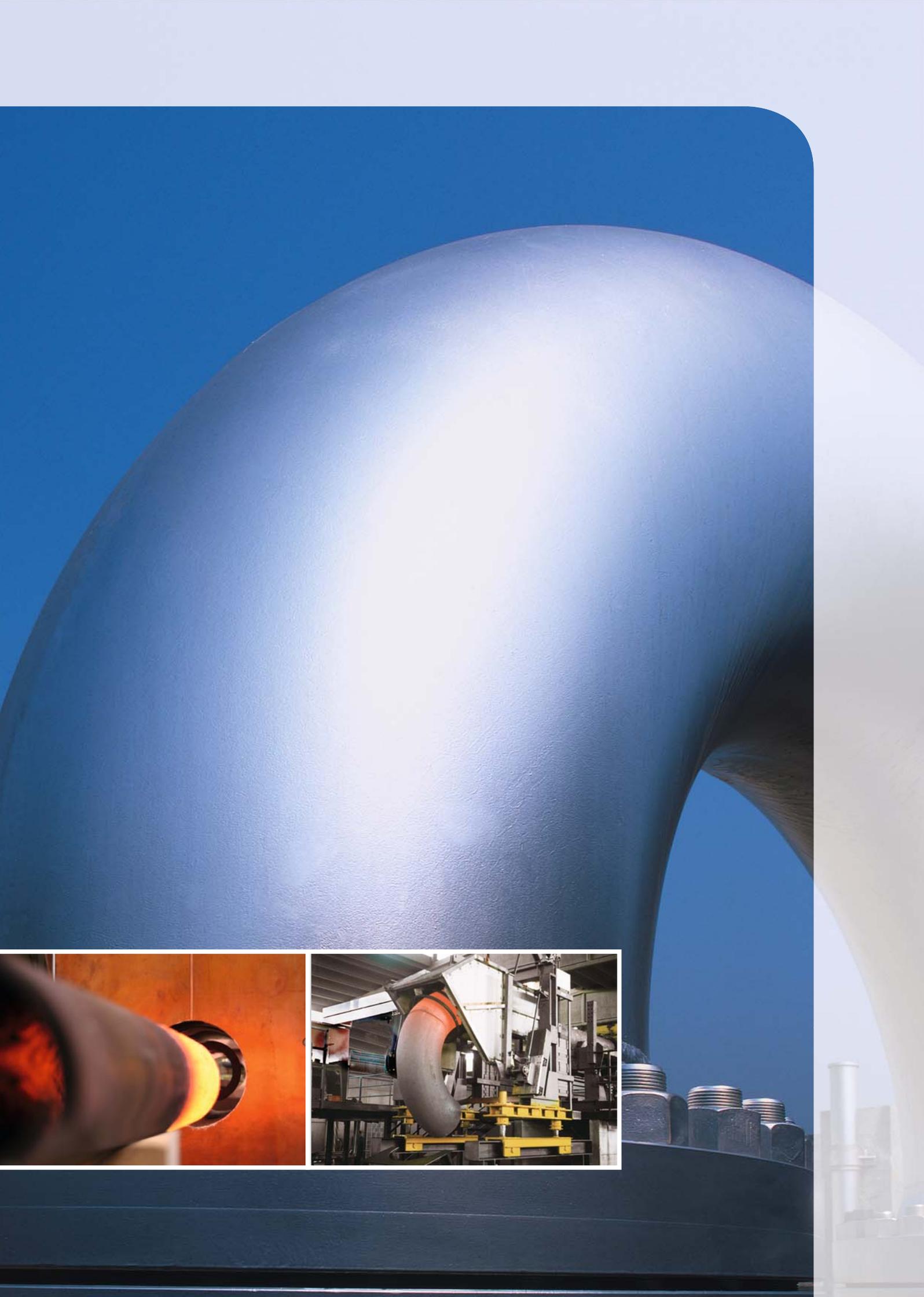
High-strength grades can also be processed on the plants of Elotherm. Tubes bent with induction heating save complicated welding work and can do without labor and cost-intensive monitoring of the weld seams – here, especially in case of power station pipes.

### **PIPE BENDS WITH CONSTANT WALL THICKNESSES**

The production of pipe bends is based on the „Hamburger Verfahren“ (‘‘Hamburg technology’’) with hot forming via a bending mandrel. The aim is pipe bends with consistent wall thicknesses. To achieve this, Elotherm provides induction plants where the bending material is heated exactly in a defined area by induction coils.

### **VERSATILE PIPE END HEATING**

The modular plant concept of Elotherm for pipe end heating is almost impossible to beat for flexibility. Depending on production capacity, it can be configured with up to eight single stations – in single and multiple coil design and can be applied for stress-free annealing, for normalizing and for heating of upsetting presses. The plants of Elotherm are suited for heating of defined lengths with different end geometries such as pipe ends, profile and railroad track ends or bar and shaft ends.



# CONVERTERS AND INDUCTORS

## Knowing what is important

### COMPETENCE FOR BETTER EFFICIENCY

Converter, oscillating circuit, inductor – together they are the heart of each induction plant. These factors substantially determine the process reliability and economy for the customer. For that purpose, Elotherm has brought together all core competences under one roof – from in-house development to in-plant production.

### OPEN TO THE FUTURE

The modular design and standardizations of the EloMat™ converters make sure that efficiency, durability and serviceability are achieved. For any application, the EloMat™ converters for LLC, series and parallel oscillating circuits provide an optimum power source. Frequencies up to 600 kHz and outputs up to 4500 kW for each converter unit are realized by advanced transistor vector groups. EloMat™ converters stand out thanks to their modern digital control and a user-friendly operating concept. Very flexible interfaces enable a harmonic integration into process control systems and higher-level plant controls.

### PERFECT WORKPIECE ADAPTATION

Inductors of Elotherm are combining highest precision and high efficiency with process reliability. As interface between machine and workpiece, surrounding round, shape or line inductors are used. Calculation and simulation programs developed by Elotherm ensure application-specific implementations and proper dimensioning and thus a high level of process quality.

- Converters and inductors of our own manufacture
- Durable, easy-to-service components
- Future-oriented continuous development through our own research

### KEY FEATURES



# SERVICE

For top customer satisfaction

## CUSTOMER-ORIENTED ORGANIZATION

For the service area, Elotherm has created an organizational structure which optimally supports the customers. In addition, Elotherm provides a worldwide service network which is continuously further extended. Current locations are in Germany, Brazil, China, France, India, Mexico and North America. The result for the customers: highest availability and shortest reaction times.

## SERVICE FROM PLANT MANUFACTURER

The service customers of Elotherm benefit from an in-depth know-how of the plant manufacturer. The advantages:

- Rise in productivity
- Increase in plant availability
- Improvement in product quality
- Reduction in operational costs
- Safeguarding of plant value
- New fields of application for older facilities

## ALL-INCLUSIVE SERVICE OFFERING

Depending on customer needs, Elotherm provides appropriate services. Similar to the actual plants, the customer can economically use individual or several harmonized modules.

- Assembly and commissioning
- Production assistance
- OEM spare parts service
- Consignment stores
- Repairs
- Maintenance
- Operating advice
- Modernizations
- Maintenance services
- Quality checking
- After-sales service
- Training courses
- Service hotline



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**MEETING your EXPECTATIONS**