

ELOTHERM

SMS group

ForgeLine™

Induction Heating: Forge



SMS GROUP

Leaders in plant construction and mechanical engineering

The SMS group ranks among leading companies in the field of plant construction and mechanical engineering for the industrial processing of steel, aluminum and nonferrous metals. It consists of the two Business Areas SMS Siemag and SMS Meer. Both areas offer integrated solutions for metallurgical process technology, casting and rolling technology as well as other shaping and refining processes.

FAMILY-OWNED AND WORLDWIDE PRESENT

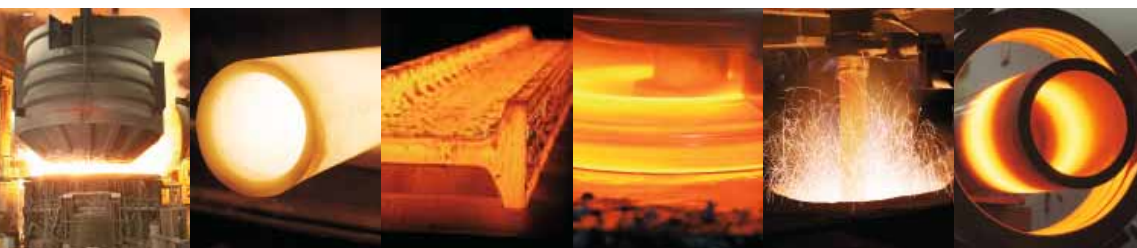
As a family-owned company, the SMS group has built on solid values and a culture of responsibility for four generations. It holds a strong market position while its decentralized structure ensures a fast and efficient response to individual customer demands. The SMS group combines the flexibility of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

BUILDING ON A STRONG BASIS

A long-term view, careful financial management, focus on values, plus knowledge about the cycles of the machine and plant construction market have, for decades, informed the group's strategic planning. Also high on the agenda is investment in the areas of energy and environment technology, service and modernization 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 the customers to keep well ahead of the competition.

**SMS
SIEMAG**

SMS group



**SMS
MEER**

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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
- Laser technology
- 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

RAPID AND PRECISE HEATING

When applying the induction heating method, a metal workpiece body is exposed to an electromagnetic field in a non-contact manner by means of a coil. As a result, eddy currents are generated in the material which produce heat, i.e. directly in the workpiece itself. Therefore, the workpiece heating is not limited to heat transfer as in a conventional furnace. Consequently, induction heating times are very short and the temperature can be set precisely.

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.

RISE IN QUALITY, REDUCTION OF COSTS

In modern forges, induction heating plants are standard equipment for billet and bar heating. Because induction furnaces have a proven record of reducing the manufacturing costs and improving the quality of forged products, they largely replace conventional furnaces. Elotherm is the market leader in the sector of induction heating plants for forges.

The company has contributed considerably to the progress in technical development and particularly in energy efficiency, and with its latest innovations such as iZone™, it is one of the technology leaders.

ONE-STOP SOLUTIONS

Together with other members of the SMS group we offer our customers fully integrated solutions for their entire process chain.

TECHNOLOGY LEADER WITH OUTSTANDING PROCESS COMPETENCE

- Experience spanning more than 70 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 CO₂
- Quick change of production and increased productivity
- Low manufacturing unit 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

MORE EFFICIENT FORGING

Heating as a factor for productivity and quality

WITH ForgeLine™ FOR AN ECONOMIC SOLUTION

For forges, Elotherm has developed the ForgeLine™ furnace series, offering a suitable machine for essentially any product and capacity. All furnaces feature a modular architecture, which can be quickly and efficiently configured to meet individual requirements.

CONVINCING: EFFECTIVENESS AND HEATING RATE

With the energy-efficient induction process, heat is generated directly in the workpiece. Compared to conventional heating technologies, Elotherm induction heaters are six times faster on an average.

CONSTANT WORKPIECE TEMPERATURE

Induction heating ensures constant workpiece temperatures with consistent high throughput. Unlike traditional combustion furnaces, Elotherm induction heaters can change process temperature setpoints instantly.

HIGHER-QUALITY FORGED PRODUCT

By the use of clean induction heating technology, scale formation and surface decarburization can be considerably minimized. This means: high surface quality, reduced rework, and increased forging tool life.

PRODUCTIVITY GAINS

Due to the combination of short heating path, short startup times and discharging compliant with the forging cycle, Elotherm induction furnaces typically offer an increase in production from 50 to 150 % compared to traditional furnace technology.

MAKING USE OF ALL SAVING POTENTIALS

The benefit of the induction technology is not only the fast and precise introduction of heat but also its instant shutdown to conserve valuable energy during tool and program changes. By contrast, conventional furnaces have to be operated with reduced capacity at idling speed, which negatively affects the energy balance.

- Labor savings through high degree of automation
- Small space requirement
- Eco-friendly and emission-free
- High operational reliability and availability

KEY FEATURES

FIELDS OF APPLICATION OF ForgeLine™ FURNACES

Material diameter	Throughput										Type
		Complete heating	Partial heating	Slug heating	Bar stock section heating	Bar heating	Billet heating	Forging	Hot shearing	Rolling	
20 – 100 mm	0,1 – 2,2 t/h	●	●				●				EloForge™
25 – 160 mm	0,1 – 7,2 t/h	●	●				●				EloForge™ L
50 – 240 mm	5 – 22 t/h	●	●			●	●		●		EloForge™ XL
18 – 360 mm	0,2 – 25 t/h	●		●	●		●	●	●		EloBar™
		●	●	●	●		●	●		●	EloForge™ Individual

iZone™ INNOVATION

Target-oriented and environmentally-friendly



COST-REDUCING AND CLIMATE-FRIENDLY

iZone™ is a proven Elotherm technology for increasing plant efficiency and lowering manufacturing unit costs – particularly with respect to partial throughputs. In addition, natural resources are conserved and the carbon footprint is reduced by the energy efficiency of iZone™. Elotherm's innovative converter technology with its uniformly high power factor $\cos \phi > 0.95$ contributes to this high operational efficiency.

AS MUCH AS NECESSARY, AS LITTLE AS POSSIBLE

A decisive criterion for the design of induction heating plants is the length of the required coil distance to achieve the desired maximum throughput. With iZone™ heating technology there now is the possibility of adapting the active coil distance to the required partial throughputs in a flexible manner. For each heating task, it is possible that the process is individually adapted with optimal energy efficiency by the iZone™ zone control technology.

SAME COIL TYPE

A significant advantage of iZone™ is the use of equally wound, identical coils, i.e., the coil type can be exchanged between inlet and outlet inductors as part of an active coil management, thereby increasing the coil service life, offering greater production flexibility, and reducing the number of spare heating coils

INTELLIGENT EXPERT SYSTEM

The core element of iZone™ is a database-supported expert system. On the basis of the material and machine data entered, the iZone™ control system automatically calculates the process parameters online to generate the optimal heating curve. The maximum possible process stability and energy efficiency are therefore assured.





FUTURE-PROOF EQUIPMENT, ECONOMIC MODERNIZATION

The ForgeLine™ series can benefit from iZone™ technology, offering plant operators immediate cost savings. Real-world customer data demonstrate that replacing older energy-inefficient plants with new iZone™ plant provides a short return on investment.

- High energy efficiency through zone control
- Flexibly and exactly adapted heating processes
- Trend-setting technology with expert system integrated online
- Significant cost reduction per forging
- Improved competitiveness

KEY FEATURES



HIGHLY PRODUCTIVE BILLET HEATING

TECHNOLOGY LEADER

Induction billet heating plants are a key pillar of Elotherm's product range and are continually refined and optimized. They combine the know-how from decades with the current knowledge from research and development.

COMPACT DESIGN

The heating plants of the EloForge™ type stand out for their compact design. The converter is either integrated into the substructure or installed on a separate converter cabinet. Due to their compactness and flexibility, EloForge™ heaters can be integrated perfectly in the manufacturing process.

SEAMLESS INTEGRATION

The EloForge™ heater series covers a wide material range and can be adapted to the most varied customer requirements. A modular system consisting of individually matched components enables optimal furnace adaptation to the desired process and thus a highly efficient integration of the plant into existing and newly built manufacturing lines.

COMPETITIVE ADVANTAGES FOR CUSTOMERS

Based on a continual development and optimization of the plant concept, EloForge™ operators further expand their competitive edge with regard to technology and profitability.

FEEDER SYSTEM

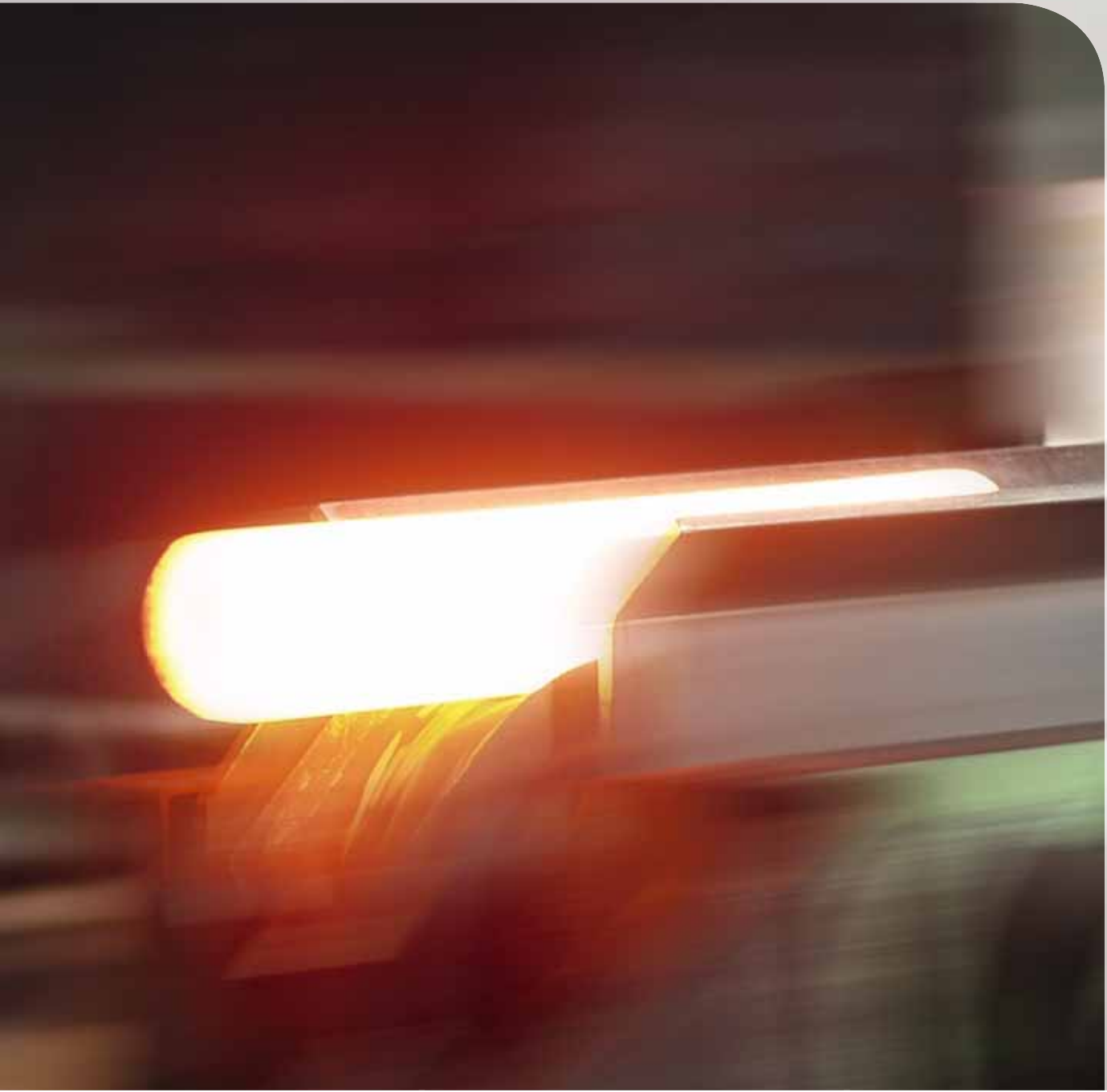
- Tilting device
- Feeder chute
- Bowl feeder
- Step feeder
- Vibratory conveying trough
- Platform chain belt

HEATING

- Billet pusher
- Inductor
- Converter
- Control system

TRANSFER

- Robot
- Extracting tongs
- Extracting chain
- Three-way switch



HIGH-TECH HEATING

EloForge™ meets your needs

SHORT CYCLE TIMES, HIGH THROUGHPUT

EloForge™ heaters fulfill all expectations of the plant operators with regard to high productivity, stable heating processes and highest product quality for forging process. By means of individually matched component groups, the heating plants for billets and bars can be adapted exactly to the requirements of the corresponding forging machines. Moreover, Elotherm heaters are known for their proven high availability and maintainability.

MODULAR SYSTEM

For EloForge™, a whole series of harmonized components are available to realize high-performance and fully automated production lines. Individual expansion options include robot systems, material magazines, material separation systems, and transfer units for downstream forming units. Bowl and step feeders, emptying systems, three-way switches or extraction tongs are available in the EloForge™ catalog.





COMPREHENSIVE FUNCTIONAL SAFETY

All plant components of EloForge™ exposed to high radiation heat loads from the workpieces are water-cooled. Additionally, the water-cooled pinch rolls are heat-resistant and made of stainless steel. To prevent spark erosion, the drives and roller axles are isolated from each other.

ADVANCED 12-PULSE TECHNOLOGY

Compared to the conventional 6-pulse infeed the integrated 12-pulse rectifier bridge modules reduce the total harmonics by approximately 80%. Hence, the 12-pulse technology minimizes the circuit feedback and contaminants of the feeding network – for the benefit particularly to IT components operated in the same grid.

- Modular design for efficient product changes
- Quick availability, universally usable
- Low operating costs
- Integrated quality control through process documentation

KEY FEATURES

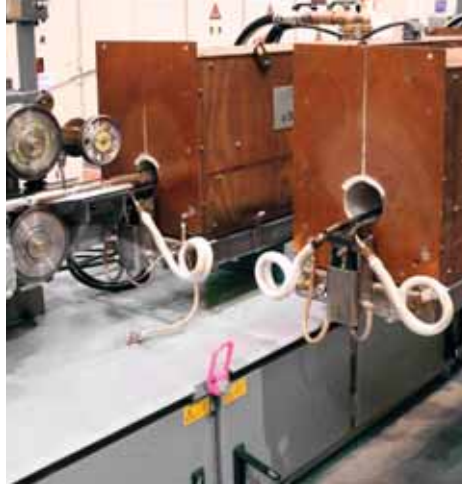
FAST PRODUCT CHANGE

EloForge™ offers various possibilities for a quick inductor change: the quick change system with roller beam or the automatic shuttle system, both with inductor sets built in parallel to each other. For everyday industrial operations such application means: product change within a very short time and thus a significant rise in production.

GAPLESS MATERIAL COLUMN INCREASES ENERGY EFFICIENCY

EloForge™ works according to the billet pusher principle. In the course of this, the material is transported in front of and between the inductors and monitored by means of a pinch roll. The heating process and the speed of the material column are monitored by the Elotherm equipment.





NO COOLING-DOWN OF MATERIAL

The material column can be operated in slow mode – for example in case of interruptions at the forging plant. This ensures that circulation material is reduced.

EMPTYING UP TO LAST BILLET

A compact emptying system enables forging up to the last billet and its application is recommended in case of frequent changes of production, large cross-sections and long inductor lines. Thanks to this equipment, the amount of test forging is significantly reduced.

INTELLIGENT CONTROL

EloForge™ provides reproducible high quality, since all data such as dimensions, throughput and the temperature of the workpiece to be heated are stored and are immediately available. The continuous feed of the material column is sensed via a feeler roller.



THE EloForge™ SERIES

Type	Diameter of round and square material	Max. Throughput	Max. Output	Frequency
EloForge™	20 – 100mm	2.2 t/h	800 kW	1 – 10 kHz
EloForge™ L	25 – 160mm	7.2 t/h	2800 kW	0.6 – 10 kHz
EloForge™ XL	50 – 240mm	22 t/h, optionally more	13500 kW	0.5 – 2 kHz



PROCESS RELIABILITY THROUGH PYROMETRIC TEMPERATURE MEASUREMENT

The temperature is measured behind the inductor by means of a pyrometer. Due to an instant online comparison of actual and desired values a quality check takes place directly. In the case of deviations the power is automatically corrected. Parts showing deviations are automatically rejected so that high process reliability is ensured for subsequent forging steps.

ECONOMIC SEMI-HOT FORGING

In certain layouts, the EloForge™ induction plants are also suitable for warm forging in the temperature ranges from 800 to 900°C. Advantages of the technology developed by Elotherm: less press forces than for cold forming and closer dimensional tolerances than with hot forming.



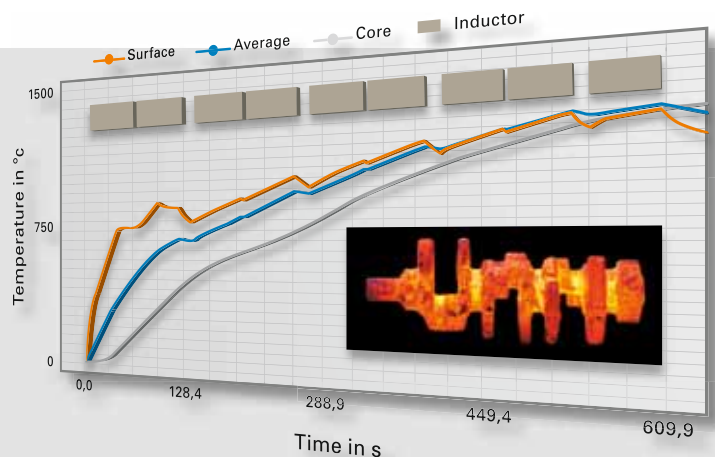
HIGH ENTHALPY THROUGH REHEATING STATION

The reheating station provides homogeneous temperature equalization within the forged material generating a temperature profile known from the gas furnace. Due to a separate converter module with adapted operating frequency the heat content (enthalpy) is increased in the forging stock which positively affects the downstream process steps.

On the basis of Elotherm's experience, 15% less pressing power is required and the service life of the dies is thus considerably increased. Particularly for the forging of crankshafts the counterweights are better shaped when reheating is practically applied, whereby time and costs required for re-machining are significantly reduced.

APPLICATION EXAMPLE

Workpiece:	6-cylinder split-pin crankshaft
Weight:	approx. 95 kg
Diameter:	136 mm
Length:	approx. 650 mm
Heating temperature:	1280 °C to 1320 °C depending on counterweight design
Temperature uniformity:	approx. +/- 10 °C
Cycle time:	approx. 28 s
Realized throughput:	approx. 12 tph



WORLD MARKET LEADER IN BAR HEATING

TOP REFERENCES WORLDWIDE

EloBar™ heating lines are in service worldwide and achieve excellent results. One of the highlights is the largest bar heating line in the world. With this plant round bar stock with a diameter of 360mm can be heated in combination with a hot shear. The fastest bar heating line installed in front of a horizontal press has also been built by Elotherm.

INTEGRABLE IN EVERY RESPECT

Owing to their compact structure and an intelligent modularity, the EloBar™ heating plants can be incorporated very efficiently into new or existing manufacturing lines. The plants can be fully integrated among others into the control systems of modern presses and hot shears. Flexibility applies also to the throughputs. Depending on customer requirement and forming unit, plants can be realized from 200 kg/h up to over 25 tph.

EXCELLENT PROFITABILITY

EloBar™ offers highest energy efficiency and productivity through the holding function and zone technique which is supported by a specially developed bar magazine with deliberate cooling functions for rapid recharging of circulation material. In addition, the shuttle system provides minimal setup times and a high availability. In this way, for example 20 inductors can be replaced in less than 3 minutes. A fully automated height adaptation of the roller table to the intake rolls of the subsequent forming unit is another outstanding characteristic of EloBar™.

FEEDER SYSTEM

- Bundle deposit
- Separation
- Hot deposit
- Bar magazine
- Cooling-down system

HEATING

- Roller table
- Inductors
- Converter
- Control

TRANSFER

- Hot-stage press
- Hot shear



ACCELERATED CYCLES

EloBar™ for bar heating

INDIVIDUALITY WITH MODULAR COMPONENTS

With its modular structure, the EloBar™ series delivers an appropriate and economical solution for any application. Due to its flexibility, the induction line can be adapted to every desired throughput.

Standard interfaces between the individual components of Elotherm and particularly to the downstream forming units continually ensure that a highly flexible and above all long-term economical upgrading capability and expandability of bar heating plants is achieved.





ECONOMICALLY ADAPTABLE

One of the special advantages of the EloBar™ series is an easy adaptability by additional system modules. This ensures that the facility can be suited to the individual requirements of the plant operator and easily retrofitted or revamped later at moderate costs. Options include among others bar magazines, hot deposits as well as hot shear systems.

QUICK INDUCTOR CHANGE

With the Elotherm shuttle system, the material cross-section can be changed within a very short time. Additionally, the shuttle allows for a parking position of the inductors for readily accessible maintenance work.

A VARIETY OF BAR MAGAZINES

For bar magazines a number of solutions are available. Moreover, magazines for the EloBar™ system are manufactured according to individual customer needs.

TECHNICAL DATA

The EloBar™ series can process round and square material with a diameter from 18 – 360 mm. An output between 80 and 8000 kW and frequencies from 0.6 to 10 kHz achieve a throughput between 0.2 and 25 tph.





SYSTEMATIC TRANSPORT

The servo-controlled group drives ensure that an exact bar feed is achieved and the press determines the bar transport speed so that a highest possible productivity is attained by this synchronized operation. In case of an operational interruption the bars are returned from the heating machine up to the hot deposit.

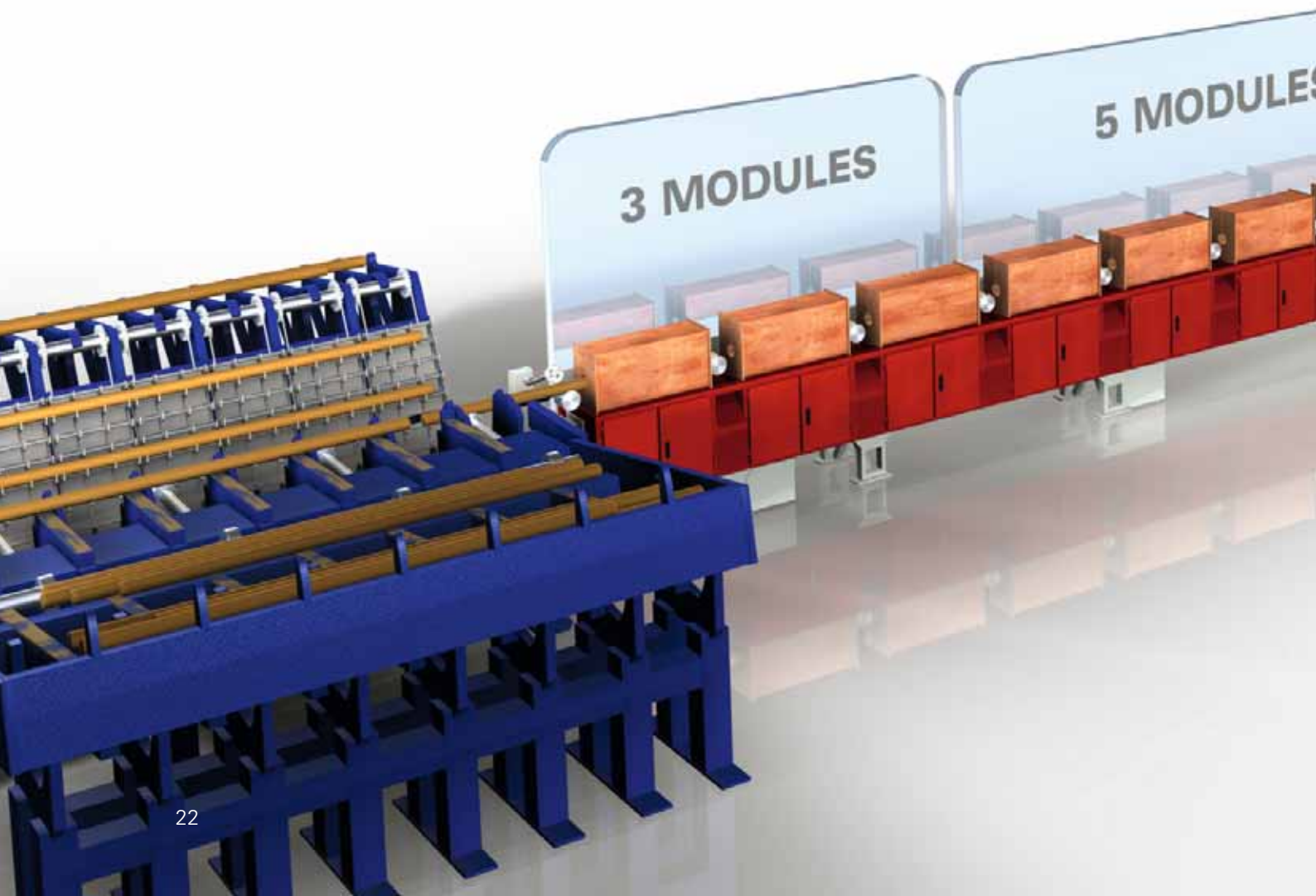
MODERN CONTROL CONCEPT

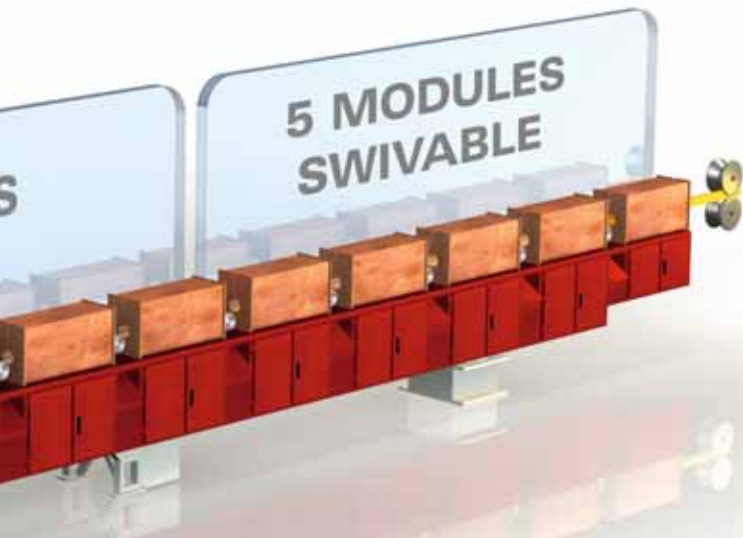
The control system regulates the automatic operation of the plant. After the material data and the desired throughput have been entered the system calculates the optimum heating strategy automatically and adjusts the plant accordingly.

The material and process data can also be taken over directly online from the forming unit via defined interfaces and the operator has direct access to the heating action.

BEST ACCESSIBILITY

All plant components have been designed by Elotherm in such a way that easy accessibility and maintainability are ensured. This applies particularly to the sub-structure as well as the drive and transport equipment. A specific swivel module enables also perfect accessibility to the forming unit for maintenance work.



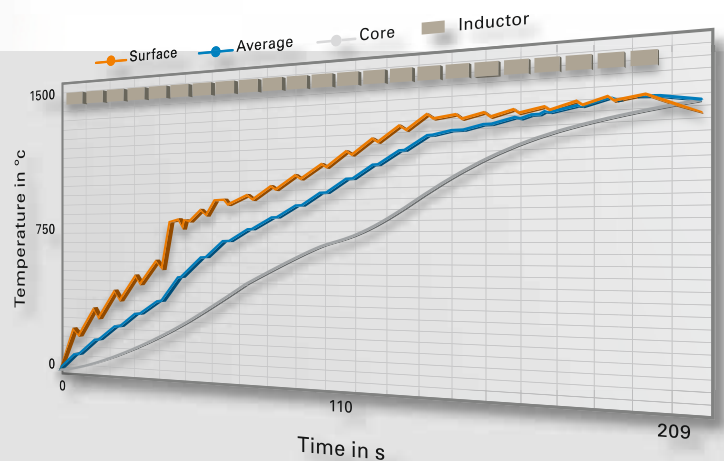


- Automatically height-adjustable roller table
- Swivel module for accessibility and maintainability
- Compact, slim design
- Control system Siemens S7

KEY FEATURES

APPLICATION EXAMPLE

Workpiece:	Flange
Diameter:	50 to 65 mm
Bar length:	Approx. 2.5 to 12 m
Rated output:	3200 + 2600 kW
Final temperature:	1250 °C
Realized throughput:	15 tph



CUTTING EDGE IN PRECISION

EloForge™: Customized for special applications

SINGLE PARTS IN THE FOCUS

For the heating of individual parts and special materials, Elotherm offers cost-effective solutions. Here the benefits of Elotherm's modular design are particularly significant. The plant operator may put together a custom-tailored plant from system modules. Certain special applications require precise individual heating of single parts or a partial heating of a bar for subsequent forming. Depending on the workpiece, Elotherm offers systems with stationary or movable inductors for manual, semi-automatic or fully automatic part loading.

LARGE VARIETY OF SHAPES

For single and end-part heating of bars, tubes or sections Elotherm provides suitable inductor shapes: round, square and U-shaped.

SAFETY FROM OVERHEATING

For single heating, multistage configurations are possible where, for example, billets of different sizes are pushed into several inductors in succession. An overheating of the tail ends is prevented by a dedicated technology.

SPECIALIZED IN THIXOFORMING

Thixoforming is a process related to die casting, enabling the manufacture of high-quality aluminum alloy components. The prerequisite for that is the thixotropic alloy condition within a minimal temperature transition zone between solid and liquid. Elotherm has developed plants for thixoforming which fulfill the temperature requirements accurate to the degree and on the basis of the patented effective power measurement.

WIDE MATERIAL RANGE

Elotherm heating plants cover almost all requirements with regard to the materials and the material and process know-how gained over many years as well as the latest results of research and development activities are particularly applied. For instance, the following materials and alloys can be heated:

- Steel
- Zirconium
- Titanium
- Copper
- Aluminum
- Niobium





CONVERTERS AND INDUCTORS

Knowing what is important

COMPETENCE FOR BETTER PROFITABILITY

Converter and inductor – together they are the heart of every induction plant. Their perfect interplay substantially determines 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

Modular design and standardizations of the EloMat™ converters make sure that efficiency, durability and serviceability are achieved. For any application, the EloMat™ converters provide an optimum power source and 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.

DURABLE INDUCTORS

Inductors or coils of Elotherm combining highest precision and high efficiency with process reliability are comprised of single housings with water-cooled, heat-resistant copper front panels. The inductors are split into coil and housing easy to repair and a power connection by means of a rail contact provides a quick and fool-proof connection. Material guide tubes (wear parts) are separate from the inductor cladding and can thus be easily maintained or replaced as needed.

- 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, France, North America, China and Brazil. 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