

A PASSION FOR HEAT TREATMENT  
SINCE 1946

70  
Years  Engineered in Germany

EMA  
Induction  
Technology



## Welcome to EMA Indutec

Operating in a fascinating high-tech environment, we are the specialist and the single-source provider of inductive heating systems and frequency converters. Ranging from concept planning, development, design and manufacturing, right up to our comprehensive after sales service, we offer solutions that are tailored to meet your requirements. And you receive everything from one single source. We are passionate about the work we do for innovative companies from sectors like the automotive and wind turbine industry, ensuring their market success.

## Commitment and Passion since 1946

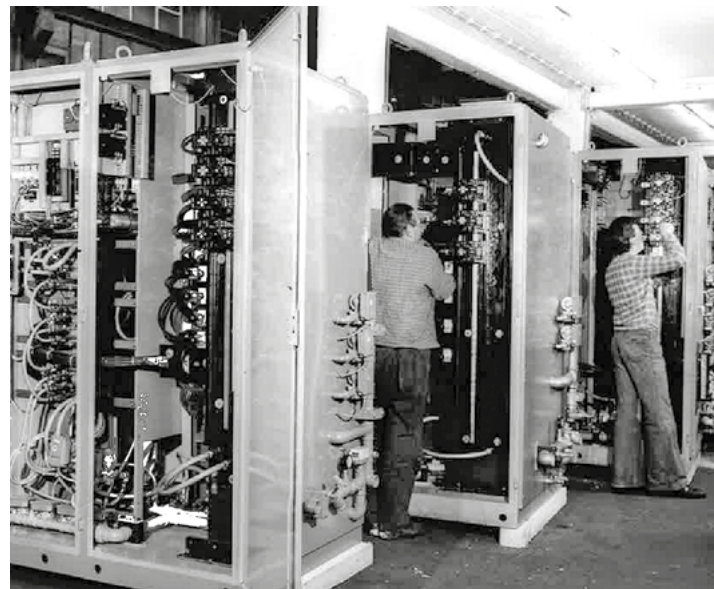
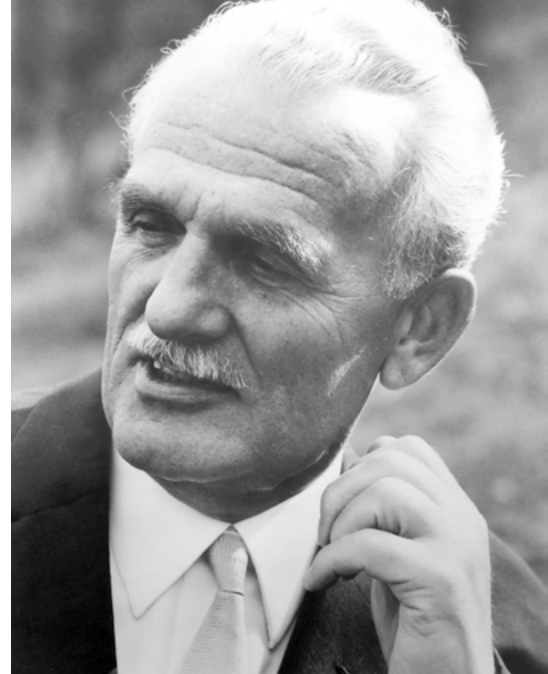
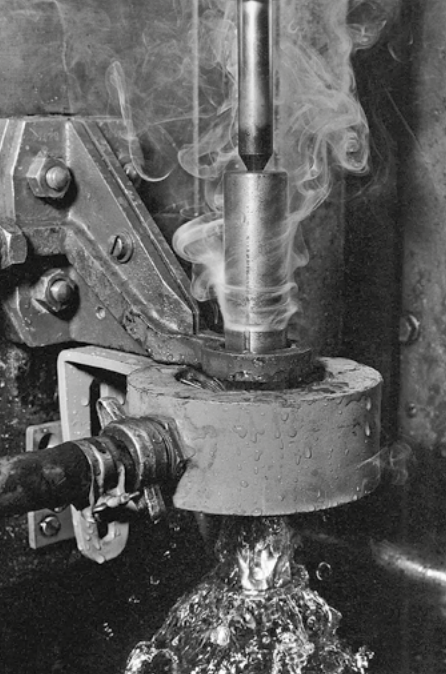
Our company is well known for innovation, strength and cooperation for more than 70 years. What started out as a small repair shop at Hirschhorn near Heidelberg in the Neckar valley has developed into an internationally successful engineering company with more than 150 employees worldwide. Since the year 2000, we are part of the AICHELIN Group, one of the world's largest producers of thermal treatment plants with its HQ in the Austrian town of Mödling, near Vienna.

Our success story started back in 1946, when electrical engineer Walter Schultze founded "EMA Elektromaschinen Schultze GmbH & Co. KG". The company quickly outgrew its original premises, a former army hangar. To facilitate better production procedures and ensure the company's growth, he decided to invest in additional halls. In the region with relatively little industry, Walter Schultze focused on innovative technological processes, while at the same time creating hundreds of jobs.

## Tradition generates Trust

Walter Schultze positioned the company as a manufacturer and service provider in the segment of inductive heating, melting and hardening systems, as well as frequency converters. The company founder placed particular emphasis on high performance standards and the latest technology, as well as training and promoting young talent from within the company ranks. As the business became increasingly successful, demand for our systems also grew outside the German-speaking region. Thus, in the 1960s and 1970s subsidiaries were established in Great Britain and India. Over the decades, EMA Indutec has shifted its geographical focus towards China and the US.

Induction  
Technology  
at its Peak



## Focus on Research and Development

Following the death of the company founder in 1976, his family took over management of the company. By the end of the 1980s, around 20 percent of the workforce was working in the design and development department. This focus on research and development guaranteed further development and expansion of our product and service portfolio. We therefore also act as the centre of expertise for induction heating and hardening systems within the AICHELIN Group. The state-of-the-art EMA Technology Centre in Meckesheim, located between Heidelberg and Sinsheim, is the heart of research and development activities in induction technology within the Holding. Its excellent testing facilities guarantee important process optimisation input.

## Get everything from a Single Source

As a full-range provider, EMA Indutec manufactures machines and custom systems for hardening, quenching and tempering, as well as frequency converters for various applications, such as heating, melting, forging and for furnaces. The portfolio is completed by ancillaries, such as re-cooling systems, measurement and control systems, washing systems, as well as loading and unloading systems. The worldwide installation and maintenance of your systems is in good hands with our well equipped and qualified Service department. Our comprehensive after sales service includes training and technical seminars held locally, an on-call service for spare parts, as well as a 24-hour service with hotline for technical questions. As an affordable alternative to investing in brand new systems, we also provide modernisation services for older systems. With our remote service via a security provider, we are able to offer our customers immediate help to locate and eliminate any fault that may occur in a quick and efficient way.

Ready  
for new  
Challenges

## Looking to the Future

We are represented in Beijing, China since 2010 and remain on a successful expansion course. Under the umbrella of the AICHELIN Group, we have access to extensive structures and valuable expertise, and we can benefit from synergy effects. In 2015, a new subsidiary was added in Detroit, USA. Thanks to our massive pool of experience and the innovative capacity of our employees, we are well prepared to meet the challenges of today and the future. Some 70 years after our company was founded, we are not only able to look back over a highly successful history in Germany, but we can also look forward to a promising global future. This is because we understand the markets, know the processes and have mastered the key technologies that point to the future of our customers.

# An Overview of our End-to-End Solutions

## Induction Heating and Hardening Systems

- Over 70 years of experience in the field of inductive heat treatment
- Over 10,000 induction systems in continuous use worldwide
- Development and manufacturing from one single source
- Cost-efficient and highly reliable systems
- Low energy consumption per work piece
- Precisely reproducible hardening results
- High throughput
- Extremely low-deformation heat treatment processes
- Highly scale-free hardening zones thanks to heat treatment under inert gas
- Easy integration into production lines
- Reduction in manufacturing costs per unit
- User-friendly set-up, conversion and maintenance
- FEM simulations
- **Areas of application**
  - » Surface hardening
  - » Quenching and tempering
  - » Hardening in an inert gas atmosphere
  - » Heat shrinking
  - » Fixture hardening

## IGBT Converters with digital inverter control

IGBT converters in the power range from 20 kW to 20 MW with frequencies from one Hz to 400 kHz

- Heating
- Melting
- Forging and forming
- Hardening, quenching and tempering
- Easy integration into various manufacturing systems
- High energy efficiency and overall efficiency
- Precise and reproducible energy metering
- Fast replacement of old and external appliances
- Customer-specific solutions and special installations

## After Sales Service

- Global 24/7 service with hotline
- Professional and high-performance Service Centre
- Preventive maintenance service
- Smart remote control solutions
- Efficient spare parts concepts
- Customer-specific retrofit
- Inductor development, production and repair service
- Remote Assist
- Training sessions for operators, maintenance personnel and induction experts (also held locally on customers' premises)

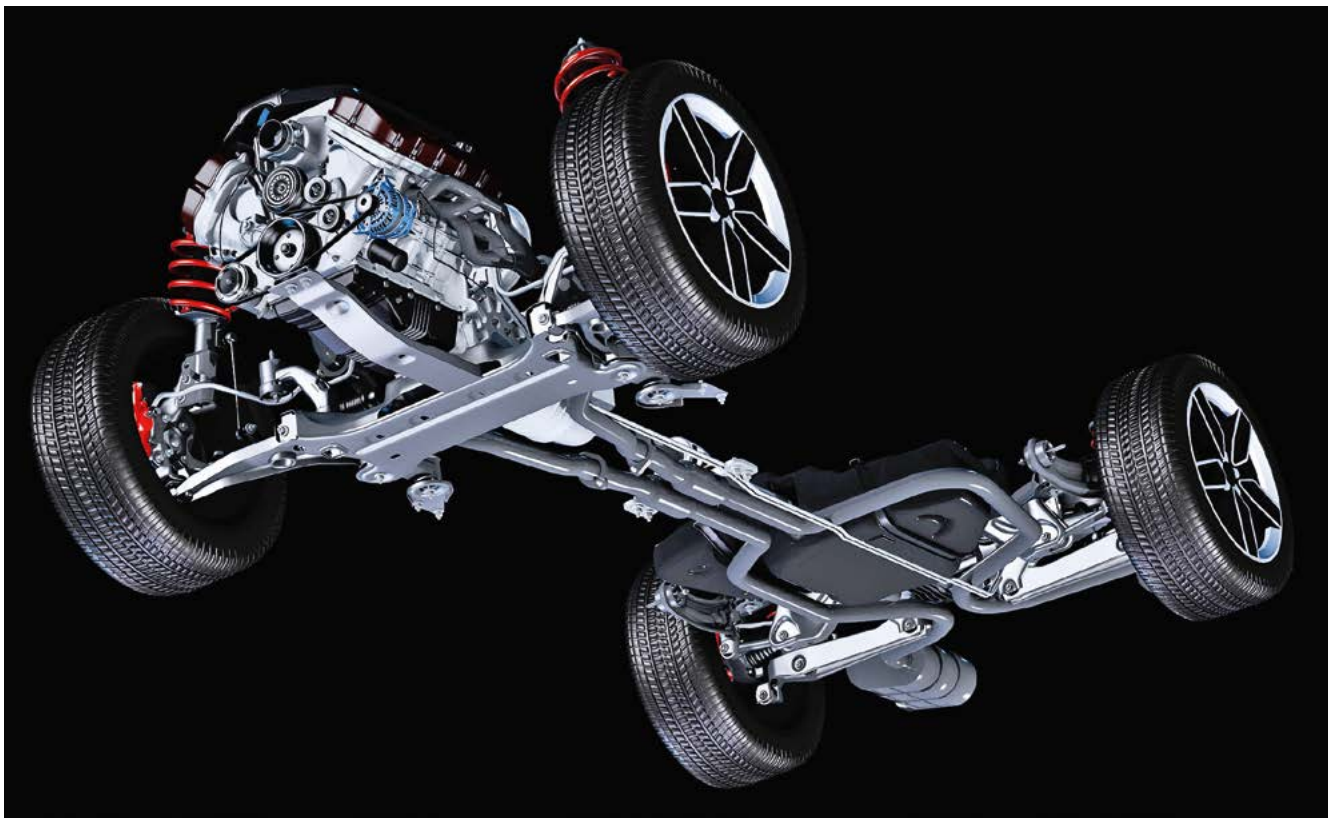




# Hardening Systems – Driveline

In the automotive sector, the term “driveline” stands for the components in the drive train not including the gearbox. The component machining requirements in this segment are particularly demanding. Indeed, customers today not only require high quantities of components to be supplied, but also expect these components to be capable of handling ever greater torque loads, while also delivering fuel savings and weight reductions. The hardening systems produced by EMA Indutec have been specially designed to meet these challenges. Manufacturing of parts in bulk quantities is often performed completely automatically on production lines. To this end, we offer fully linked hardening systems with ultimate reproducibility, minimal downtimes and

network connection for remote service. Machine accessibility has been designed to offer the greatest possible productivity and thereby the shortest downtimes. The set-up processes and service access have been optimised and greatly simplified for both operators and maintenance personnel. To maintain a consistently high output, we also offer service packages and extremely fast response times within 24 hours in the event of malfunctions. Our training packages for your employees complete our overall portfolio and help you achieve the best quality production over the long-term. In other words, we offer you end-to-end complete solutions for inductive processing of important components in the „driveline“ from a single source.



Powertrain, Driveline-Components (Source: Fotolia.com)



## Linkage Hubs – three-track systems available

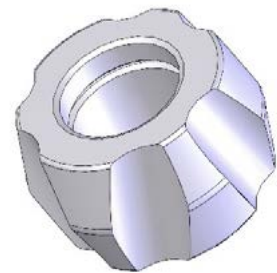
The inner races can be hardened and tempered completely automatically within very short cycle times. As a special feature, the inner race can also be processed in a housing using inert gas. This greatly reduces the amount of scale on the component surface. The unit can also be retrofitted to existing systems at any time. EMA Indutec offers concepts for hardening and tempering between one and three inner races at the same time, tailored to your specific requirements. The three-track hardening system can, for example, be used to process up to three different components at the same time. This guarantees you maximum flexibility, while also securing the best possible yield and usage of floor space. The system is fully integrated, including washing chamber and component drying.

### Common areas of application

- Surface hardening of raceways or gearings
- Tempering
- Working in an inert gas atmosphere

### Your benefits

- Unique flexibility through up to three processing stations
- Optimum accessibility for set-up and service work
- Minimal scale on surfaces due to the use of inert gas
- Remote service via security provider



Inner race



# Hardening Systems – Driveline

## Joint Housing – sophisticated concepts

Together with the joint housing, the inner race forms the basic module for a constant-velocity joint. As is the case with inner races, short cycle times and high productivity are the objectives. The joint housing can also be processed using EMA Indutec hardening systems with inert gas. This is a benefit that really pays off, as it greatly simplifies post-production work on the bell housing. We offer sophisticated concepts for hardening and tempering of joint housings.

The systems are matched to your machining tasks and can execute a very wide range of processes in a reproducible manner. The compact systems can be optimally integrated into your existing production line. They are equipped with a washing chamber and a component dryer, which not only ensure the best possible results, but also guarantee fast subsequent processing.

### Common areas of application

- Surface hardening of raceways or gearings
- Tempering (also as residual heat)
- Working in an inert gas atmosphere

### Your benefits

- Ideal for integration into existing production lines
- Optimum accessibility for set-up and service work
- Minimal scale on surfaces due to the use of inert gas
- Remote service via security provider



Hardness range of a joint housing



## Wheel Bearings – long service life due to inductive processing

The drive shafts with constant-velocity joints transfer the torque from the gearbox to the wheels, where the wheel bearings keep the wheels „on track“. High-grade inductive processing is the basic prerequisite for ensuring a long service life of highly stressed ball bearings, such as those used in wheel bearings. The systems offered by EMA Indutec for hardening and tempering wheel bearing components excel through their high degree of flexibility and excellent yield. This makes it possible to induction-harden wheel bearing flanges and outer races and to additionally induction-temper them using a special process in a single system.

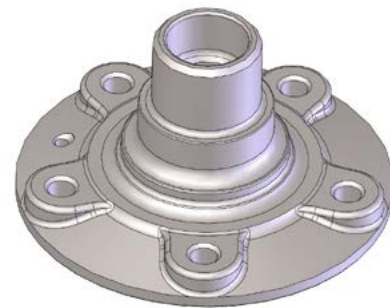
The modular design of the systems enables them to optimally meet the demanding requirements in terms of cycle times. The components can also be preheated as a way of reducing cycle times. The fully automated systems have buffers, component checks and ejector chutes for discharging test parts.

### Common areas of application

- Surface hardening of bearing positions
- Tempering (also as residual heat)

### Your benefits

- Ideal for integration into existing production lines
- Optimum accessibility for set-up and service work
- Special tempering process
- Remote service via security provider



Wheel bearing flange



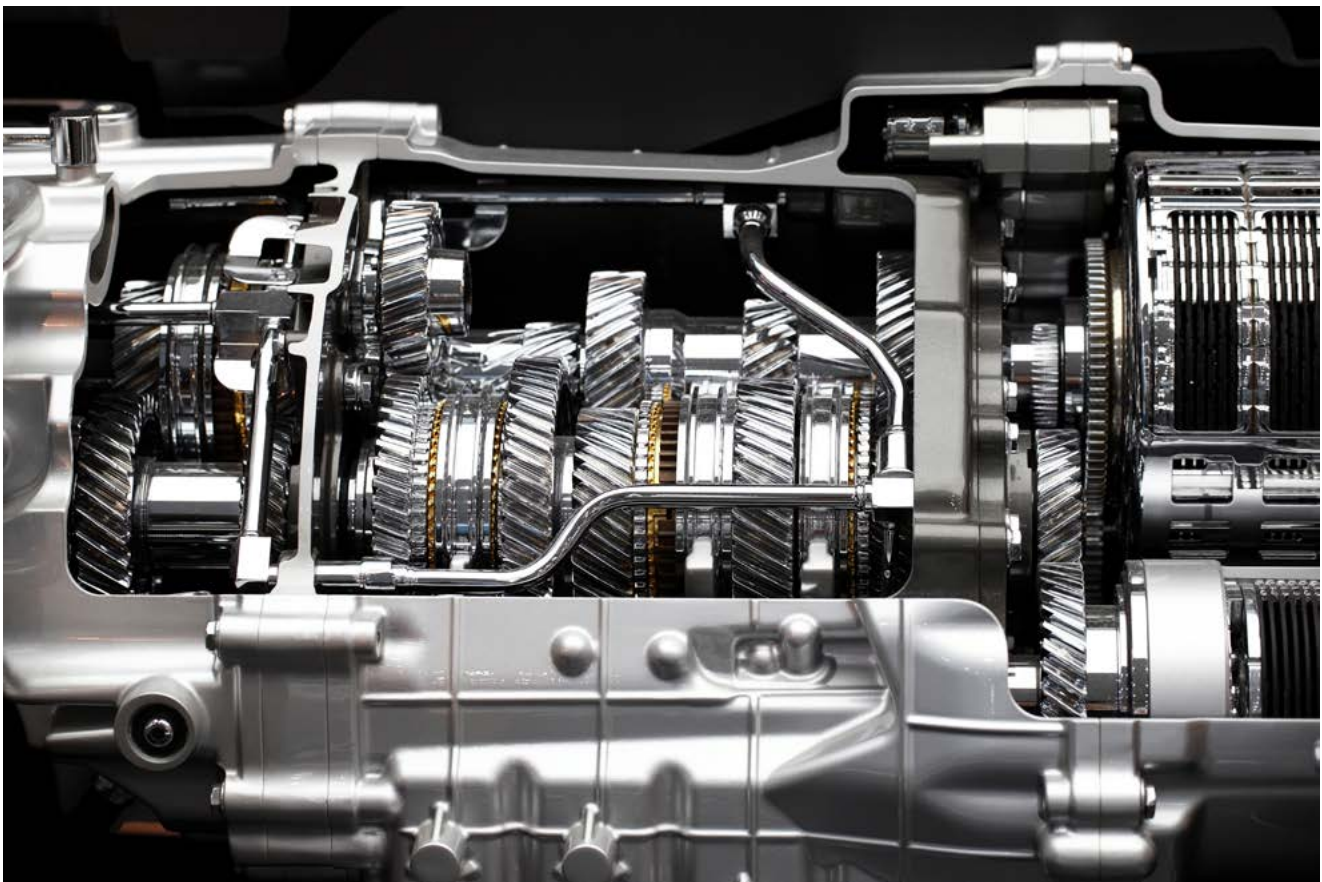
# Hardening and Calibration Systems – Gearbox

The drive train in motor vehicles includes the “drive-line” and “gearbox” sections. Just like the components in the “drive-line”, vehicle gearboxes must meet the same challenging requirements in terms of fuel savings through lightweight construction and also be capable of handling the highest loads. In addition to this, modern gearbox components are expected to meet extremely tight tolerances after being heat treated. Costly post-machining work on the treated components, involving turning or grinding, can be substantially reduced through efficient and ultra-precise inductive calibration technology. During calibration, the rotation-symmetric workpieces are, for example shrunk onto a mandrel and then pressed down from above. This process makes it possible to achieve tolerances of less than

0.05 mm on calibrated surfaces following heat treatment.

In addition to this, the components can be processed in an inert gas atmosphere. Scaling can be reduced to a minimum thanks to the heat treatment, while post-machining work such as abrasive blasting can be significantly reduced or prevented altogether. The fully automated systems have been designed both for interlinked deployments in production lines, as well as manual standalone operation.

EMA Indutec also offers a remote service, extremely fast response times and training programs for your team, therefore you gain the maximum benefit from the systems.



Manual Transmission (Source: istockphoto.com)

## Synchronisation – unique and special process

If the clutch pedal is not depressed properly when changing gears in a manual gearbox, a crunching sound can often be heard coming from the gearbox. This crunching noise comes from the synchronisation, which matches the speed of the desired gear cluster in the gearbox to the speed of the current gear cluster. The tothing of the sliding sleeve is subject to extremely high loads. High-grade heat treatment is absolutely indispensable here, particularly for these highly stressed components. We have developed a special and unique process for precisely this application, whereby synchroniser sleeves are induction-heated and calibrated in an inert gas atmosphere. The tolerances of the components on calibrated surfaces are below 0.05 mm. In many cases, using this process actually means that no further post-machining work is required for the sliding sleeves.

Another major advantage is that complex gear geometries on synchroniser sleeves can also be treated using EMA Indutec's special process. Protruding or missing teeth and teeth with varying external diameters can be easily processed using the *Vela* inductive calibration system. Buffer storage and automation connectivity, as well as process expertise round off our offer. The unique universal press at EMA Indutec is available for process development and prototype parts. Together with our specialists your new process for sliding sleeve calibration can be developed, tested and taken to series production. Naturally, you also have access to our remote service via a network connection and enjoy fast response times.



Single Cone Synchronization (Source: Company Schaeffler)

# Hardening and Calibration Systems – Gearbox

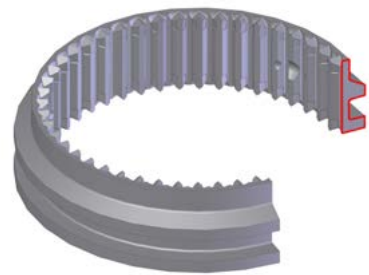
## Synchronisation

### Common areas of application

- Calibration
- Tempering
- Working in an inert gas atmosphere

### Your benefits

- Minimal post-machining requirements due to the calibration process
- Optimum accessibility for set-up and service work
- Minimal scale on surfaces due to the use of inert gas
- Remote service via security provider



Hardness range of a sliding sleeve

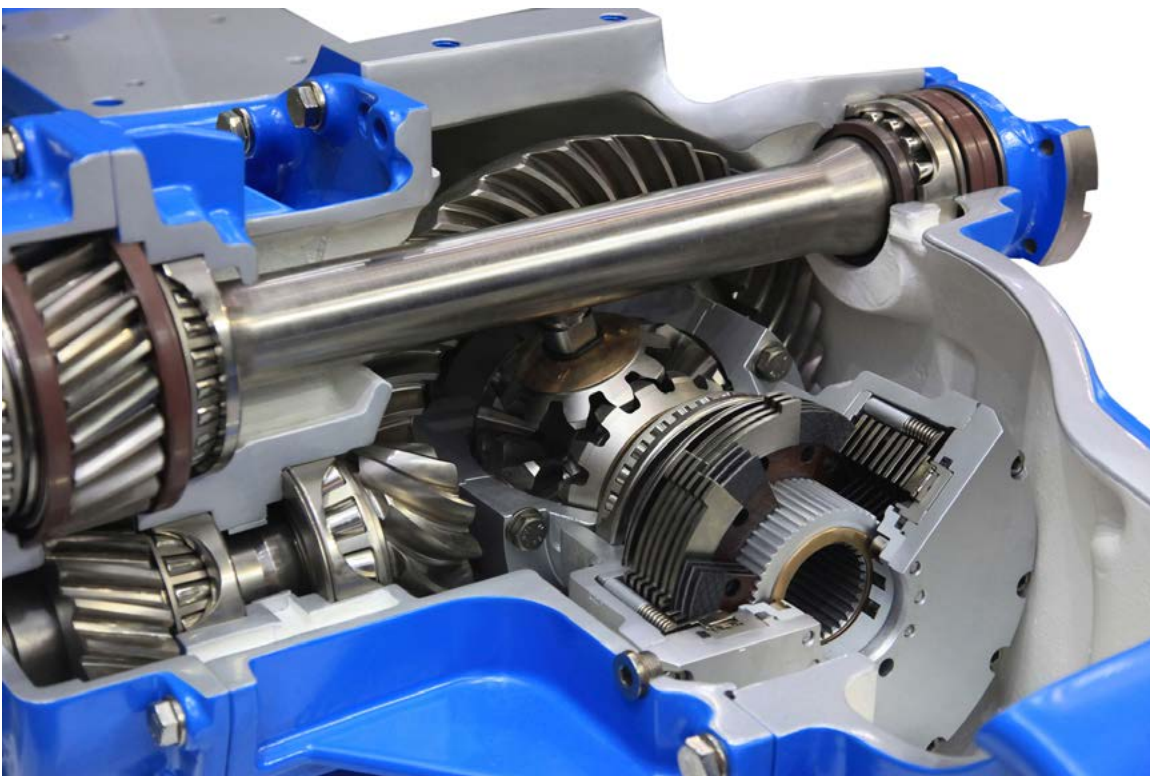


## Differential – tolerance of less than 0.05 mm for gears

The differential distributes the torque from the output shaft to the wheels. To compensate for the different relative speeds of the left and right wheels when cornering, the two drive ends of the differential are connected via gears inside the differential. The torque is transferred to the bevel gear via the pinion on the input side of the differential. This is connected to the differential casing, which transfers the torque via the internal bevel gears to the wheels. The bevel gears inside the differential casing, the so-called compensating gears, also compensate for the different speeds of the wheels, for example when cornering. The gears are highly stressed components, thus high-grade heat treatment is essential to reduce wear. The bevel gears in particular are subjected to severe deformations during conventional hardening processes and therefore often require a great deal of cost-intensive post-machining work.

This is where the calibration systems from EMA Indutec really play to their strengths. To minimise the time and costs associated with post-machining work, the components are calibrated, quenched on a mandrel and pressed following heating. After heat treatment, the concentricity and perpendicularity tolerances are less than 0.05 mm.

The components can also be processed in an inert gas atmosphere, making them virtually scale-free and thereby significantly reducing cleaning costs. Thanks to their very small footprint in comparison with conventional heat treatment systems, the calibration systems for bevel gears are easy to integrate into existing production lines.



Differential (Source: Fotolia.com)

# Hardening and Calibration Systems – Gearbox

## Differential

An universal press is available at EMA Indutec for process development and production of prototype parts. Together with our specialists, your new process for bevel gear calibration can be developed, tested and taken to series production.

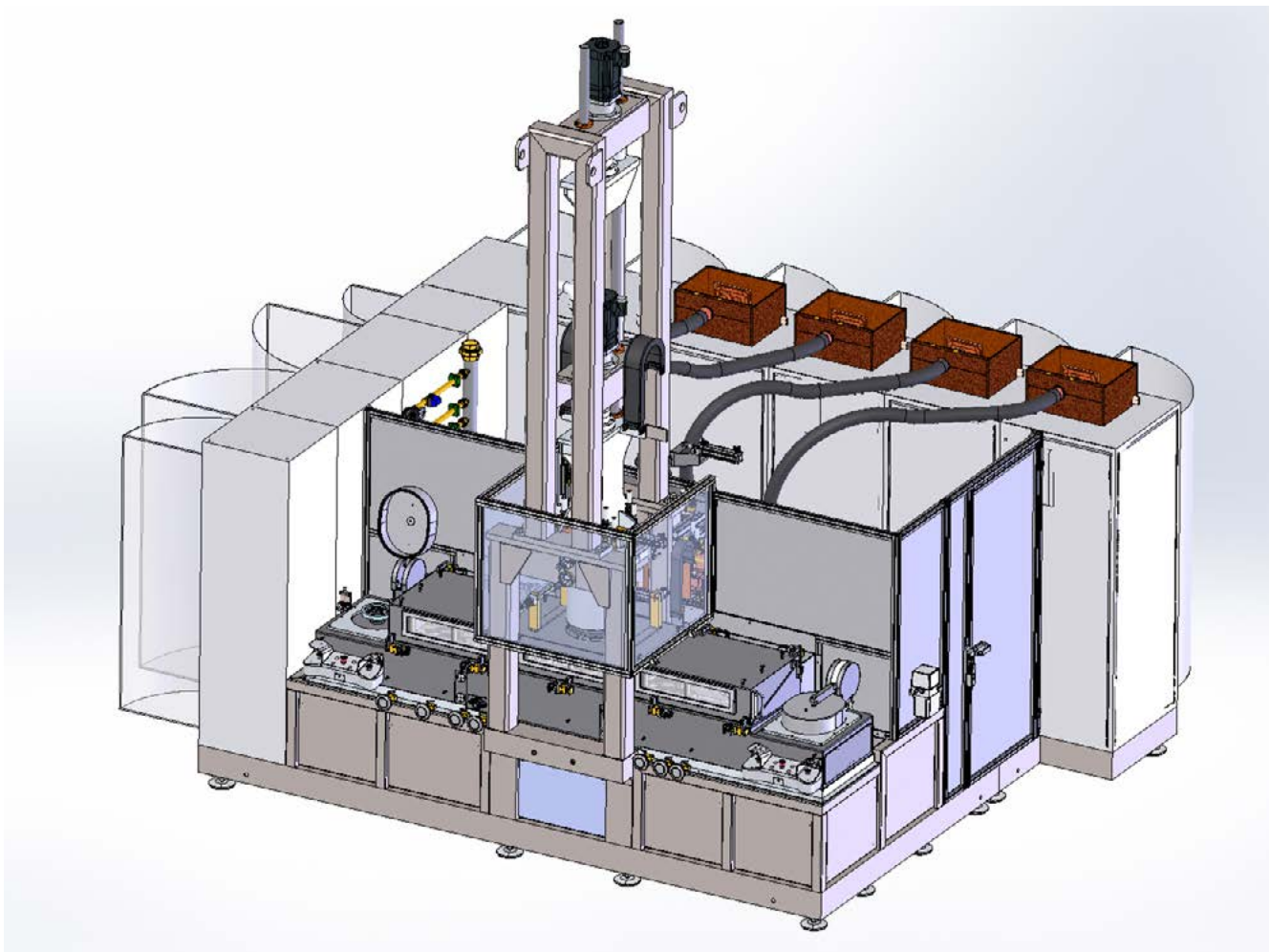
In combination with the converter technology from EMA Indutec, you have access to a system with high component quality, high energy efficiency and low running costs. The service team from EMA Indutec supports you 24 hours a day and can also be on-site quickly if needed.

### Common areas of application

- Calibration
- Tempering
- Working in an inert gas atmosphere

### Your benefits

- Minimal post-machining requirements due to the calibration process
- Optimum accessibility for set-up and service work
- Minimal scale on surfaces due to the use of inert gas
- Remote service via security provider





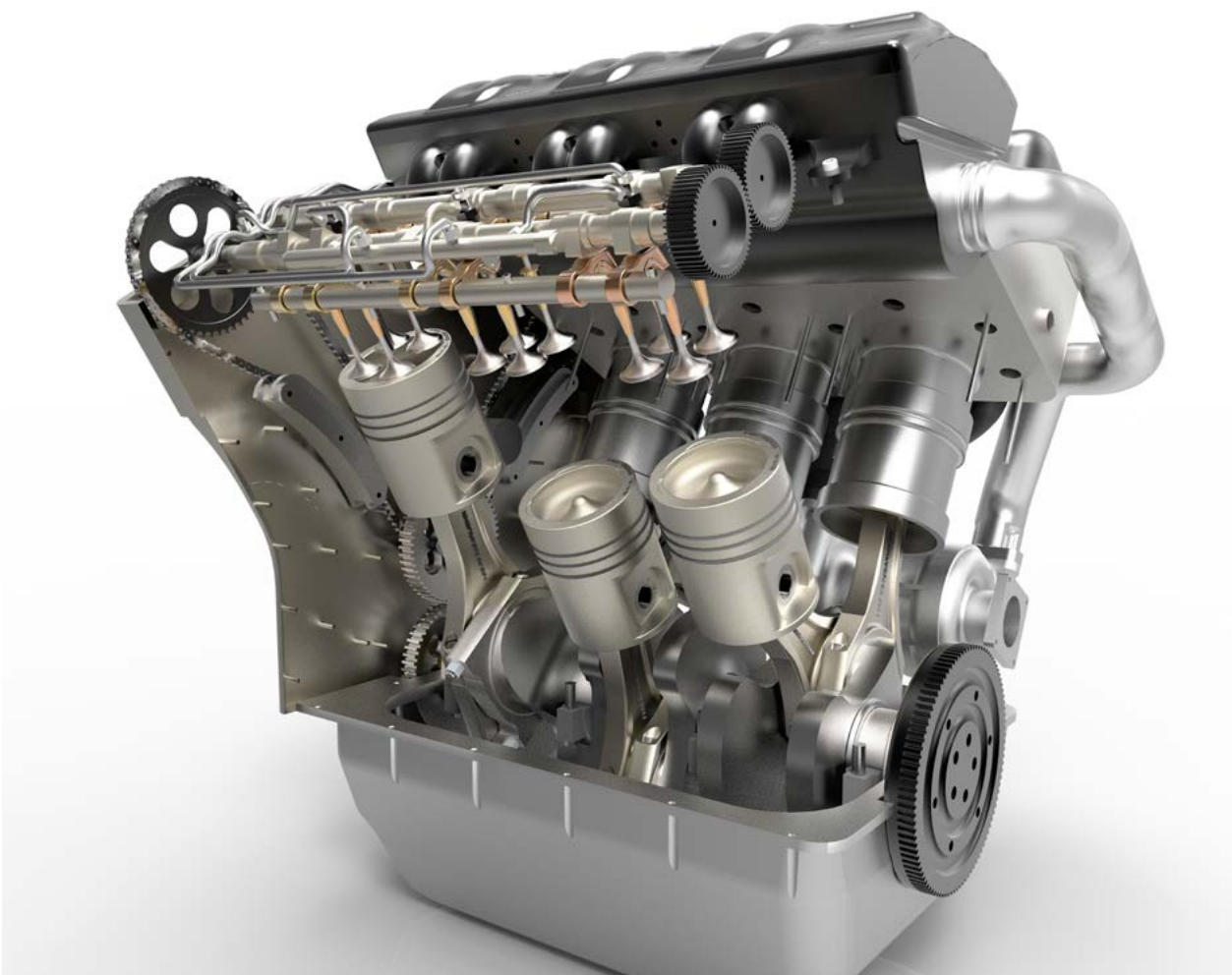
# Hardening Systems – Engine



In the “engine” segment, a large number of components are induction-treated, including camshafts, valves, gears, crankshafts and compensating shafts. The components in combustion engines must meet extremely demanding requirements, including wear resistance and lightweight construction. They must also be able to handle severe stress, such as load changes with jolts and major temperature differences. High-grade heat treatment of the components is absolutely essential here.

Not only must the components used in the „engine“ segment meet strict quality requirements, they must also be produced in large numbers.

This combination presents all manner of challenges. To meet the requirements of the individual components, EMA Indutec offers you solutions tailored specifically to your engine-related needs.



Assembly of the engine without housing (Source: PI / Shutterstock.com)

# Hardening Systems – Engine

## Cam Lobes – a very wide range of cam geometries can be processed

The assembled camshafts fitted in internal combustion engines stand for consistent lightweight construction in this field. For example, they are up to 50 percent lighter, more modular and more versatile than their cast counterparts. With assembled camshafts, cam lobes are attached to a high-precision tube and positioned as needed. Before being attached, the cam lobes are separately heat treated. To cater to the large quantities required, while maintaining the strict quality requirements, EMA Indutec has developed a system with particularly short cycle times and optimised service and maintenance accessibility to series maturity.

Thanks to its integrated automation, the *Aquila* system can be optimally integrated into your existing production line. Process monitors and the robust mechanics guarantee the high quality of the induction-treated workpieces. The *Aquila* also allows you to process a very wide range of cam geometries, such as cams with a collar for cylinder shutoff or pump lobe applications.

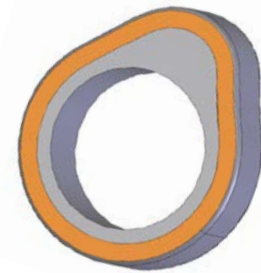
In combination with our After Sales and Remote Service, EMA Indutec supplies optimized systems that guarantee high availability, very short cycle times and maximum flexibility.

### Common areas of application

- Surface hardening
- Tempering

### Your benefits

- Very short cycle times
- Optimum accessibility for set-up and service work
- Optimum integration into production lines
- Remote service via security provider



Hardness range of a cam lobe



## Camshafts – homogeneous hardness profile

The classic manufacturing method for camshafts is casting followed by machining operations. After pre-machining the bearing surfaces and cams, they are induction heat-treated. We offer a special process for hardening camshafts. The cams are rotationally aligned by CNC axis and positioned in line with the inductor before the component is induction-heated. This guarantees a homogeneous hardness profile across the entire cam.

The *Lupus* machine can be operated as a standalone solution or integrated into a production line. The system's plug and play concept brings together all components on a single base frame.

This in turn facilitates fast commissioning and easy set-up of the system on site. The EMA converter with digital controller guarantees cost-effective processing and utmost process monitoring. The aftersales service excels through fast response times and remote service connectivity.

### Common areas of application

- Surface Hardening
- Tempering

### Your benefits

- Very short cycle times
- Optimum accessibility for set-up and service work
- Easy to automate
- Remote service via security provider



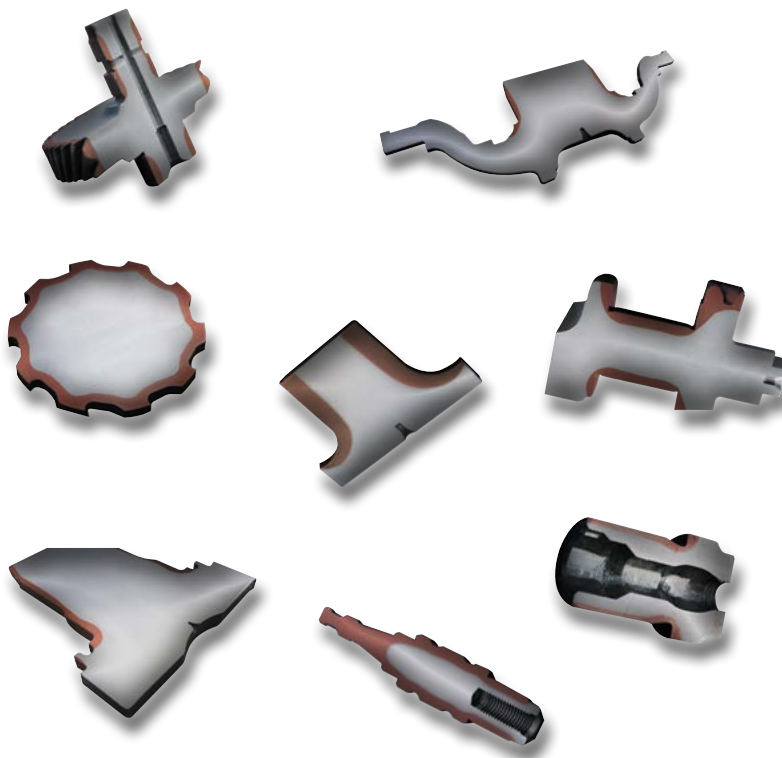
Camshaft

# Vertical Hardening Machine

Standardised feeders must meet a whole host of requirements. They need to be flexible and universal, yet also be tailored to the requirements of the customer, as well as affordable and efficient. All hardening plants are keen to process as wide a range of workpieces as possible using the machines at their disposal. Obviously, the speed at which they can retool their machines to different workpieces therefore also plays a critical role. However, series production of large batches with all safety aspects is also very important. The vertical hardening machines offered by EMA Indutec are in line with market requirements and help your hardening plant move forwards. The wide range of workpieces handled by the progressive hardening machines from EMA Indutec stretches from just a few centimetres in length up to 5 metres - with diameters ranging from 5 mm to 3,000 mm.

The robust machines excel through their high flexibility and easy extendibility. The EMA modular system for vertical hardening machines offers you these advantages at an attractive price. Your specific adaptations can be implemented easily and cost-effectively. In combination with an EMA converter, your vertical hardening machine fulfils the requirements in terms of flexibility, universality and efficiency. The latest IGBT converters with digital controller complement the machine and ensure consistent component quality.

In combination with the 24/7 service, the network connection guarantees high availability and enables our experts to clear any faults online without the need of a service call on-site.



## Tucana Progressive Hardening Machine – flexible with high output

The *Tucana* range of hardening machines impresses through its compact and space-saving design with integrated converter, control cabinet and re-cooling system. This plug-and-play solution can clamp workpieces up to 500 mm in length. Optional equipment, such as various indexing plates, multi-station fixtures or suitable centres, is then used to match the machine optimally to your requirements. The large frequency range that can be covered from just a few Hertz up to 400 kHz, the process support and the online service connection combined with our fast service guarantee a flexible and high-output machine.

### Common areas of application

- Small to medium-sized components in progressive hardening applications
- Stress-relieving, tempering, annealing, quenching
- Possibility to work in an inert gas atmosphere

### Your benefits

- Compact plug-and-play solution
- Robust and durable machine
- Individually configurable
- Remote service via security provider



# Vertical Hardening Machine

## Taurus Vertical Hardening Machine – tried, tested and cost-effective

The *Taurus* progressive hardening machine has been demonstrating excellent performance for many years. The new version is a highly flexible, robust and efficient solution for hardening workpieces up to 1,500 mm in length and 500 mm in diameter. A machine concept proven in dozens of applications that comes with an extended range of configuration options, paired with modern EMA Indutec converter technology, represents a powerful and cost-effective solution for your hardening shop.

Various turntables equipped with a variable number of processing stations, tips, inert gas enclosures, calibration devices or stations for hardening of gears up to three metres in diameter are possible.

The *Taurus* machine can handle a large range of components. The EMA converter guarantees reliable inductive treatment. You obviously also enjoy access to our diverse training programme, the online remote service and the fast response times of our entire service team.

### Common areas of application

- Small to large components in progressive hardening applications
- Stress-relieving, tempering, annealing, quenching
- Possibility to work in an inert gas atmosphere

### Your benefits

- Versatile and flexible due to supplementary package
- Robust and durable machine
- Individually configurable
- Remote service via security provider



# XXL Hardening Systems



Large components and heavy loads – the requirements of your XXL components from areas such as wind energy, shipbuilding, crane building and heavy engineering are extreme. Aggressive environments in the maritime sector, wind and weather, massive weight forces, as well as dust and dirt present major challenges for the components - which are also expected to deliver the longest possible service life. Components subject to extreme loads and stresses can handle these requirements more effectively when they undergo high-grade heat treatment. The systems offered by EMA Indutec boast the necessary flexibility and quality requirements for workpieces up to eight metres in diameter and three

metres in height. The excellent efficiency of the EMA converters helps to reduce the costs of inductive heat treatment. Various concepts are available for treating the components. For example, it is advantageous to induction-treat toothed components. The quenching medium can then drain off downwards. The same applies to bearing raceways, as they can be treated at an angle in order to save space. To compensate for the deformation that occurs during heating of the components and to ensure true-to-tolerance processes, the systems from EMA Indutec are equipped with a sensor-based or mechanical inductor tracking system.



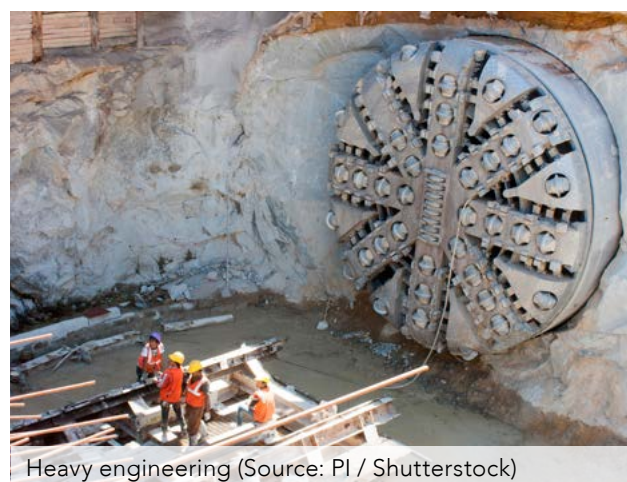
Wind power industry (Source: Istockphoto)



Shipbuilding industry (Source: PI / Shutterstock)



Machine construction (Source: PI / Shutterstock)



Heavy engineering (Source: PI / Shutterstock)

# XXL Hardening Systems – Horizontal

Many XXL components are induction-hardened in particular at highly mechanically stressed points, such as gears/raceways on ball bearings or roller bearings. Since the applications are generally based on special customer specifications and they are often produced in small numbers, the primary focus is on flexibility and the cost effectiveness of the system. The systems in the *Libra* range have been designed specifically to meet these requirements. Their extremely rigid portal also enables them to process a very wide range of workpiece dimensions. To simplify the workpiece definition when setting up the machine, EMA Indutec has developed an easy-to-use parameter input mask for the control system. Only the dimensions of the workpiece and the tool are defined here.

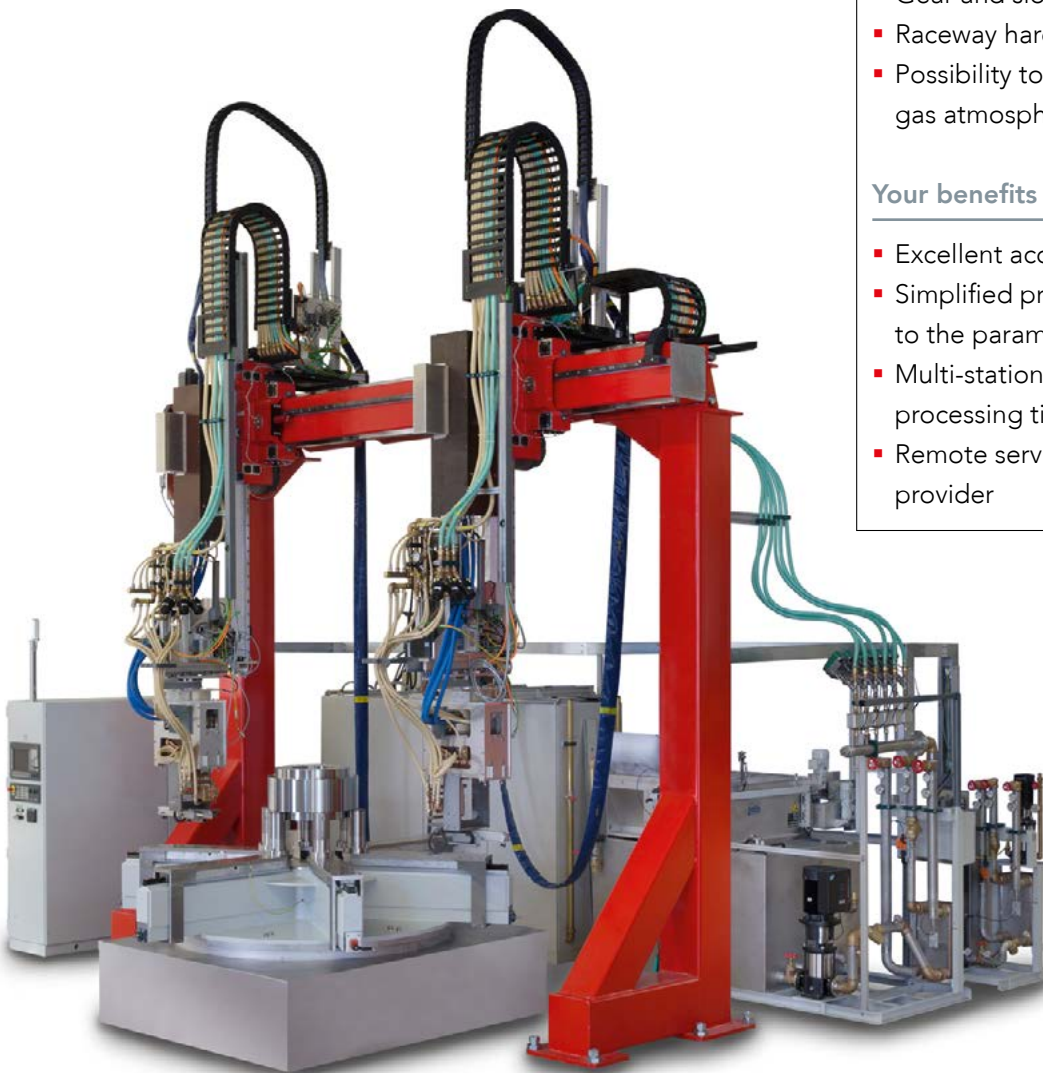
The treatment program is then generated by the control system itself, thus no programming skills are required. Thanks to their high degree of flexibility and efficiency, the EMA converters make an ideal addition to the machine. The systems can be configured through the number of inductors. This has the great advantage that during gear hardening, two teeth can be treated at the same time, which halves the overall processing time. In combination with the tried and tested EMA remote service and general customer support services, we also offer you an XXL system for XXL parts with XXL benefits.

## Common areas of application

- Gear and slot hardening
- Raceway hardening
- Possibility to work in an inert gas atmosphere

## Your benefits

- Excellent accessibility
- Simplified program creation due to the parameter input mask
- Multi-station solution to reduce processing time
- Remote service via security provider





# XXL Hardening Systems – inclined



In terms of hardening of bearing rings inductive treatment at an inclined position has proven itself. The motion of the quenching medium running down the component creates an aftercooling, thus no sprayers are required. The system's footprint can also be reduced by aligning the workpieces upright.

The *Libra* hardening system offers you precisely these advantages, which it combines in a cost-effective and flexible overall concept for hardening bearing tracks or roller raceways. To minimise set-up times, the tried and tested parameter input mask is used to define the component and tool.

## Common areas of application

- Raceway hardening

## Your benefits

- Excellent accessibility
- Simplified program generation due to the parameter input mask
- Multi-station solution to reduce processing time
- Remote service via security provider



# Fixture Hardening and Calibration Processes

To reduce tedious and costly post-production work on surfaces that have already been hardened, we have worked intensively and successfully over the last few years on fixture hardening in connection with induction-heating and subsequent induction-tempering. In close cooperation with many customers all over the world all manner of processes using EMA systems were successfully integrated into their production lines.

## The process for standard, carburized workpieces

The rotation-symmetric workpiece is clamped in a mounting fixture and heated up homogeneously to austenitising temperature using an induction field. The workpiece expands in this process. The calibration mandrel, which is to give the part its final contours, is then introduced into the inner aperture. Quenching or cooling down virtually to room temperature is then performed. During hardening, the

workpiece shrinks onto the calibration mandrel and thereby achieves the requisite dimensional accuracy. This is followed by the tempering process for the component, which has shrunk and now fits tightly on the calibration mandrel. This process provides two key advantages. Firstly, the component expands again slightly. The internal diameter of the part that has been shrunk onto the mandrel then gets slightly larger and the calibrated workpiece can be removed using minimal force. Secondly, the desired final hardness can be adjusted by selecting the appropriate temperature. Once the mandrel has been removed, the part can be cooled to room temperature to prevent any heat-related issues further along the process chain.

### Ihre Vorteile

- The hardening and calibration process can be integrated directly into the production line
- Calibration is performed directly following heating
- Four individually controllable quenching systems
- Energy savings due to short heating times for hardening and tempering
- Workpiece dimensions close to final contours
- 40 percent less carburization depth necessary
- Additional operations that were previously necessary can now be dropped
- Removed while warm – thus no wear to the mandrel
- Possible to work in an inert gas atmosphere
- No scale formation
- Workpiece cleaning operations (washing, sand blasting) no longer needed
- **Up to 30 percent smaller footprint!**
- **Up to 30 percent lower investment costs!**

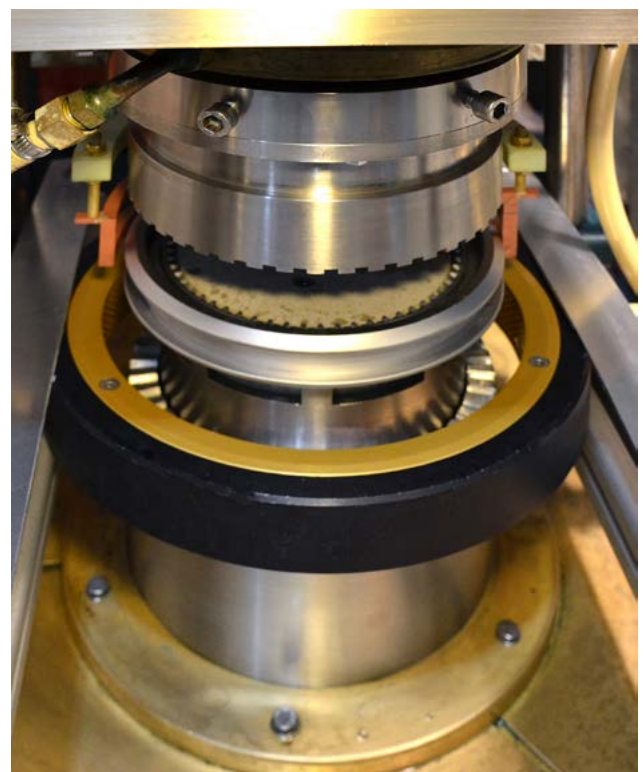


## New Heat Treatment Concept – up to 30 percent lower investment costs

In comparison with conventional fixture hardening, the new machine from EMA Indutec excels thanks to several crucial and unusual criteria. In keeping with the latest technological practices, workpieces are warmed up in a gas-fired ring or rotating furnace, carburised and then transferred to the press while hot. During the transfer, the parts cool down to a varying degree. The time that elapses between the end of the heating phase and the start of quenching is of key importance for the quality. In the new process the inductor in the machine is also capable of compensating the temperature losses. If virtually scale-free heat treatment is required, the workpieces are generally transferred cold.

The new machine can be equipped with a closed inert gas chamber, in which the complete heat treatment process (potentially including reheating) can be performed. Four quenches are used, each of which can be controlled independently of the others. There are outlets in the lower fixture, the upper fixture and the calibration mandrel, as well as in additional outer quenches. These four quenching options offer the greatest possible flexibility and also allow initial shape corrections to be performed simply by adjusting the start times of the quenches.

It goes without saying that flow rates and quench times can be individually adjusted and monitored. After quenching, the workpiece is not removed from the mandrel while cold, but rather induction-heated once again while on the mandrel. As the temperature increases (to annealing temperature), the workpiece expands slightly. A small gap starts to occur between the workpiece and the mandrel at around 200 °C. This allows the workpiece to be removed from the mandrel without the need for any appreciable force. This holds the great advantage that no notable signs of abrasion or score marks are left behind on the dimensionally accurate and precisely machined surface of the calibration mandrel. This significantly increases the service life of the mandrel. Since water soluble polymers are used as the quenching medium in inductive heat treatment, the washing machine required for oil quenching is generally not needed here.



# Fixture Hardening and Calibration Processes

## New concept for Heat Treatment – Step by step

### Hardening

#### Step 1

The workpiece is clamped into the non-conductive brackets and moved into heating position.

#### Step 2

An induction heating or re-heating to hardening temperature follows.

#### Step 3

The workpiece is released. The upper fixture is lowered and the mandrel is extended again.

#### Step 4

Quenching is performed while the workpiece is pressed and the workpiece shrinks onto the mandrel.

### Tempering

#### Step 5

The fixture is opened again.

#### Step 6

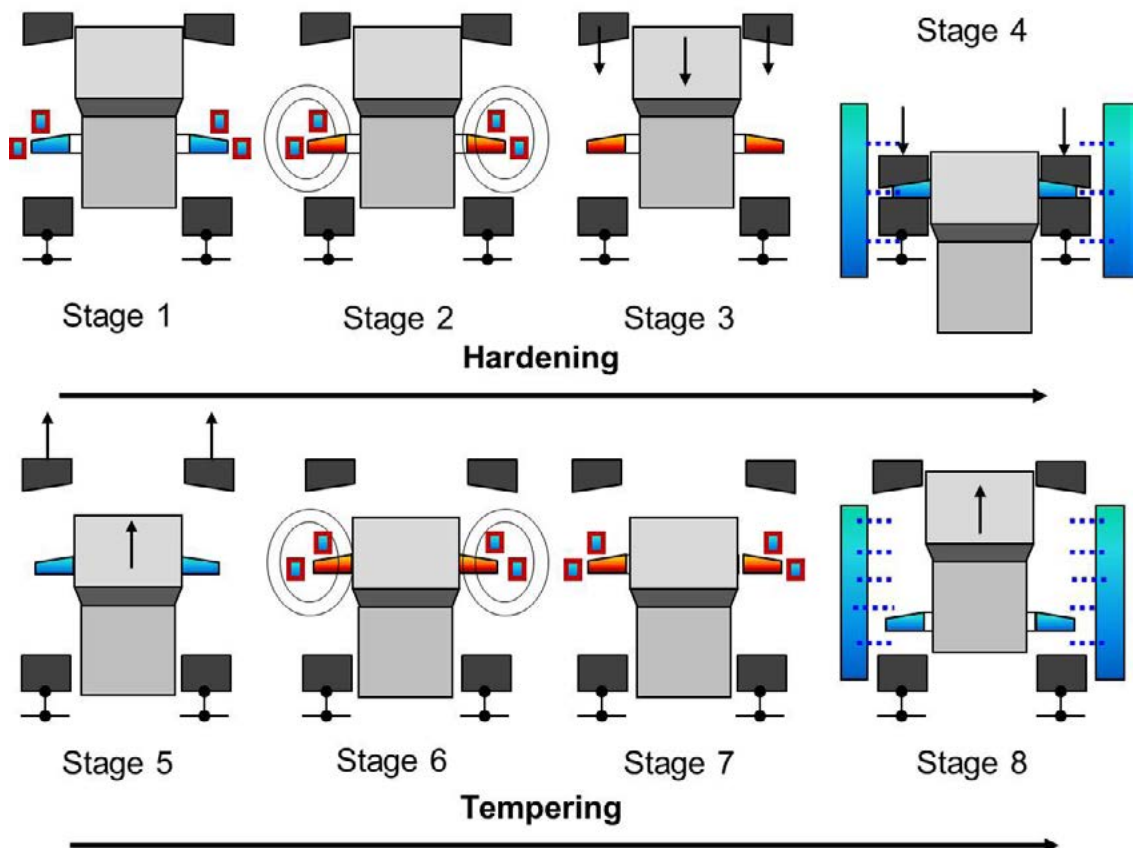
The inductor heats the workpiece back to maximum annealing temperature.

#### Step 7

The workpiece is stripped from the mandrel.

#### Step 8

If necessary, further induction tempering is performed, followed by cooling.

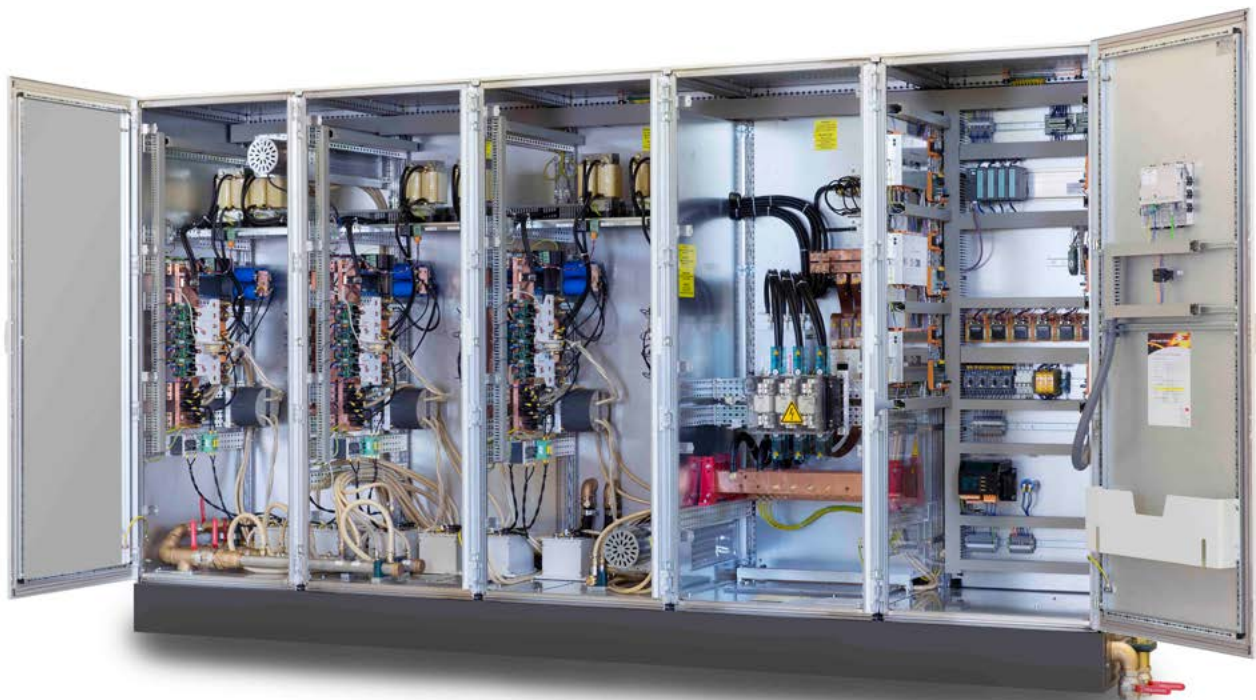


# Tube Tempering



In this anniversary year, EMA Indutec has successfully completed an order whose scope broke records. The system in question is used to heat treat pipeline pieces for natural gas and crude oil transport. Alongside the aforementioned quality and reliability of our products, the system impresses through its high degree of flexibility, which allows processing of pipes

with diameters from 14 to 60 inches, lengths of up to 12.5 metres and weights of up to 15 tonnes. An digital EMA converter with a maximum output of up to 2.5 MW acts as the power supply and facilitates a system throughput of up to 8 tonnes per hour.



# IGBT Converter Technology

The product portfolio offered by EMA Indutec encompasses a wide range of the latest IGBT converters. EMA products are renowned throughout many sectors for their reliability and excellent efficiency. We provide the necessary power source of energy for the most diverse applications.

Each IGBT converter has a dedicated digital control system. The large number of integrated interfaces provided allows the units to be connected to current bus systems, control systems and other components.

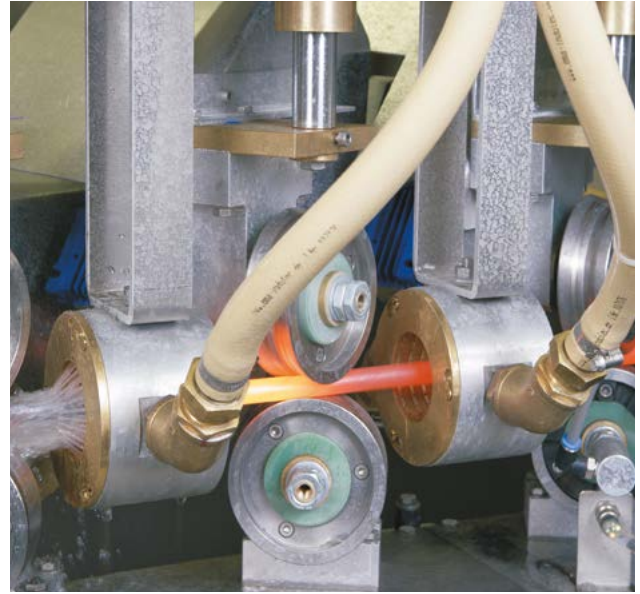
Thanks to their user-friendly commissioning and operating processes, as well as their modular structure, the converters supplied by EMA Indutec can easily be adapted to any requirements.

## Your benefits

- Frequency range from one Hz to 400 kHz
- Power output from 20 kW to 20 MW
- Low reactive power requirements, and thereby cost savings
- High energy efficiency and overall efficiency
- Multiple individually controllable outputs possible
- Constant power factor in every load range
- Precise and reproducible energy metering
- Easy integration into most diverse manufacturing systems

## Heating

- Shrinking
- Bonding and soldering
- Coating and drying
- Strips and wires



## Channel furnaces

- Copper and copper
- Aluminium and aluminium base alloys
- Steel



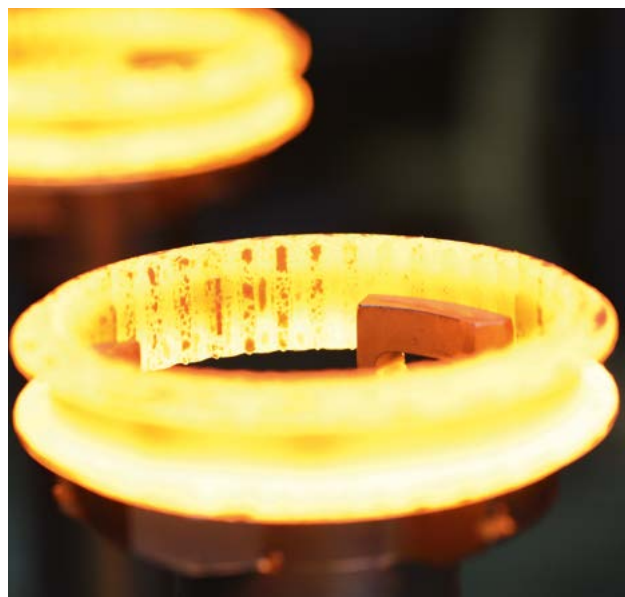
## Melting

- Crucible melting furnaces
- Laboratory furnaces
- Vacuum furnaces



## Hardening, annealing and tempering

- Tooth systems
- Bar Steels
- Axles and shafts



## Forging and forming

- Blocks/ slugs
- Billets
- Rods/ tubes
- Tubes and tube ends
- Rails



# Research and Development

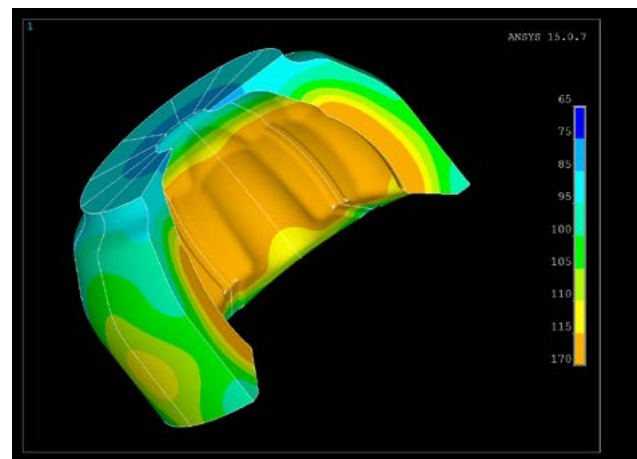
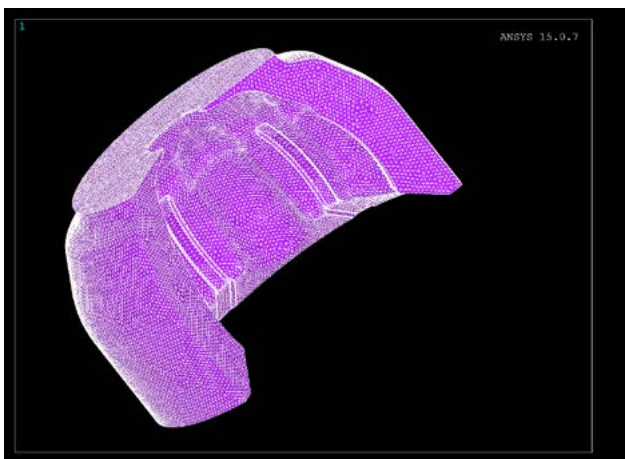
## New opportunities due to simulations on high-performance computers

The ever stricter mechanical requirements of modern components, particularly in the aviation and automotive construction industries, require high precision and quality when it comes to heat treatment. Inductive heating processes, and induction hardening in particular, must strike a balance in terms of the strong dynamic interactions between the electromagnetic field, the temperature profile and the material parameters. As the geometric complexity of modern components is on the rise, conventional analytical or empirical processes used for induction heating can no longer deliver the requisite results. EMA Indutec has therefore been using numerical simulations for several years as an important tool when planning new systems. This computer-based approach allows complex procedures to be depicted, analysed and optimised more effectively. It also allows data to be captured that would otherwise be virtually impossible or extremely complex to measure. With numeric simulations, all relevant geometric and physical parameters are transferred to a virtual yet 100 percent accurate and realistic model. Due to the varied degrees of freedom optimum physical process parameters can be derived from countless calculation processes.

### Your benefits

- Realistic modelling, analysis and optimisation of complex procedures
- Capturing important data in positions that cannot be recorded by measurement
- Time and cost savings, since far less time spent on testing

Depending on the level of computer performance available, this method can take a certain amount of time. However, the processing time can be significantly reduced by using the latest high-performance computers. These machines also make it possible to simulate processes which would otherwise overpower conventional computer hardware due to their geometric dimensions or complexity. This means that we can now develop solutions that are optimally geared to our customers' requirements.



Numerical grid and temperature distribution in a workpiece



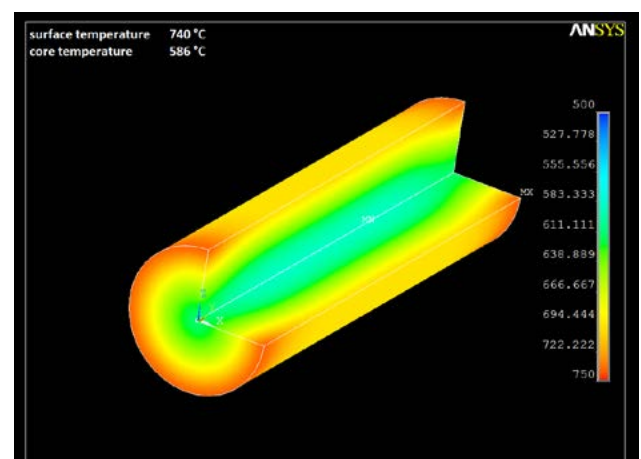
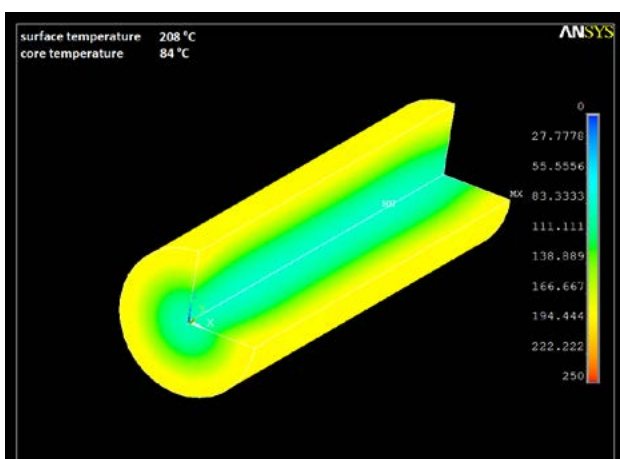
## Our Innovative Concept for Inductive Billet Heating

In comparison with conventional heating processes, induction pre-heating of billets made from non-ferrous metals offers many advantages for extrusion processes. These include process reliability and high throughput, although the ability to set an even temperature profile is perhaps the most important. To reduce power losses in the inductor and achieve high electrical efficiency, conventional billet heating systems operate at low frequencies (generally 50 Hz to 200 Hz). Power is typically supplied via oscillating circuit converters. Combined with the multi-layer coil design, however, the low operating frequencies lead to comparably high reactive powers. These need to be balanced out by a correspondingly dimensioned compensation unit, which in turn leads to increased investment costs and space requirements. A cooperation between EMA Indutec and Russ Elektroofen led to a modern and highly efficient process in the field of induction melting which has since then proven its value at numerous customers. It has now been possible to transfer this innovative concept successfully to inductive billet heating systems. Earlier research had already shown that a higher degree of electrical efficiency can be achieved below mains frequency.

### Your benefits

- Reduction in investment costs and space requirement
- High efficiency of up to 65 percent with non-ferrous metals
- High degree of process reliability
- Optimum combination of quality and improved price-performance

The operating frequency was therefore reduced to a level below mains frequency. The use of a single-layer tunnel profile with high wall thickness offers a sufficient cross section for the current and reduces electrical losses in the coil. This coil design not only reduces the reactive power, but also increases the performance factor. In connection with the modern inverter controller, this means that an oscillating circuit system is not needed. This in turn allows operation at a fixed, predefined frequency and renders an expensive compensation unit superfluous.



Temperature distribution in a brass block at two different temperatures

# After Sales Service

## Perfectly well advised

In anticipation of our customers' wishes, we have significantly extended our portfolio of services. Contactless analyses and system inspections with the thermal imaging camera or a machine data analysis via the remote service allow creeping faults and changes in the system to be detected early on and preventively eliminated. We also offer an on-call service for spare parts and precision tools which guarantees a high degree of flexibility and fast delivery. Through proactive maintenance, we significantly increase the service life and operational reliability of our system range. On request, we can also work on products from other manufacturers.

The experienced and highly qualified service sales team regularly visits production and maintenance managers to present the portfolio of products and services to highlight the benefits for our customers.

Our goal is to determine the best possible service for the requirements of our customers through personal talks as a way of securing the necessary machine availability. Whether you are looking for help with technical questions or your machine is at standstill, our service hotline is available 24/7, all year round. Our ticket system ensures that you receive the help you need quickly. If induction systems are to be partially or completely modernised, EMA Retrofit is the right choice.

With qualified specialist personnel from all departments, we are responsible for overhauling or modernising EMA induction systems. In addition to this, we offer a remote service and very fast response times, as well as training programmes to ensure that our customers can get the very best from the systems. We provide you with an individual solution that is best suited for your many varied tasks.



## Remote Assist

EMA Remote Assist is an efficient approach for fast service and optimisation of availability and investments.

### Expert Network

No matter where your system is located, our service engineer is never far away. Depending on what you need, you will be supported immediately by one of our Remote Assist specialists, who can get your system back up and running without being directly on site. In addition to this, the Remote Assist specialist can bring in other specialists from a pool of experts at any time to help find the optimum solution. If on-site work is necessary, the service engineer then has the right tools and spare parts to hand on arrival at your company.

### Managed Security

The latest security technology with a remote platform allows you to benefit from a wide range of new services. All activities are logged to guarantee complete transparency.

### Operating Assist

Our Remote Assist experts support you in adjusting configuration parameters or identifying spare parts and localising machine and system faults.

### Set Up Assist

The set-up service ensures that security standards are met and configuration data is secured.

### Reports

Remote service reports provide you with full transparency. All documents can be viewed on the remote service platform.

#### Your benefits

- Reduction in running costs
- Increase in productivity
- Increase in availability



# Subsidiaries

Our subsidiaries in China and the US support the EMA HQ as well as the production site in Germany, and guarantee global support for our customers.



Production in Meckesheim, Germany



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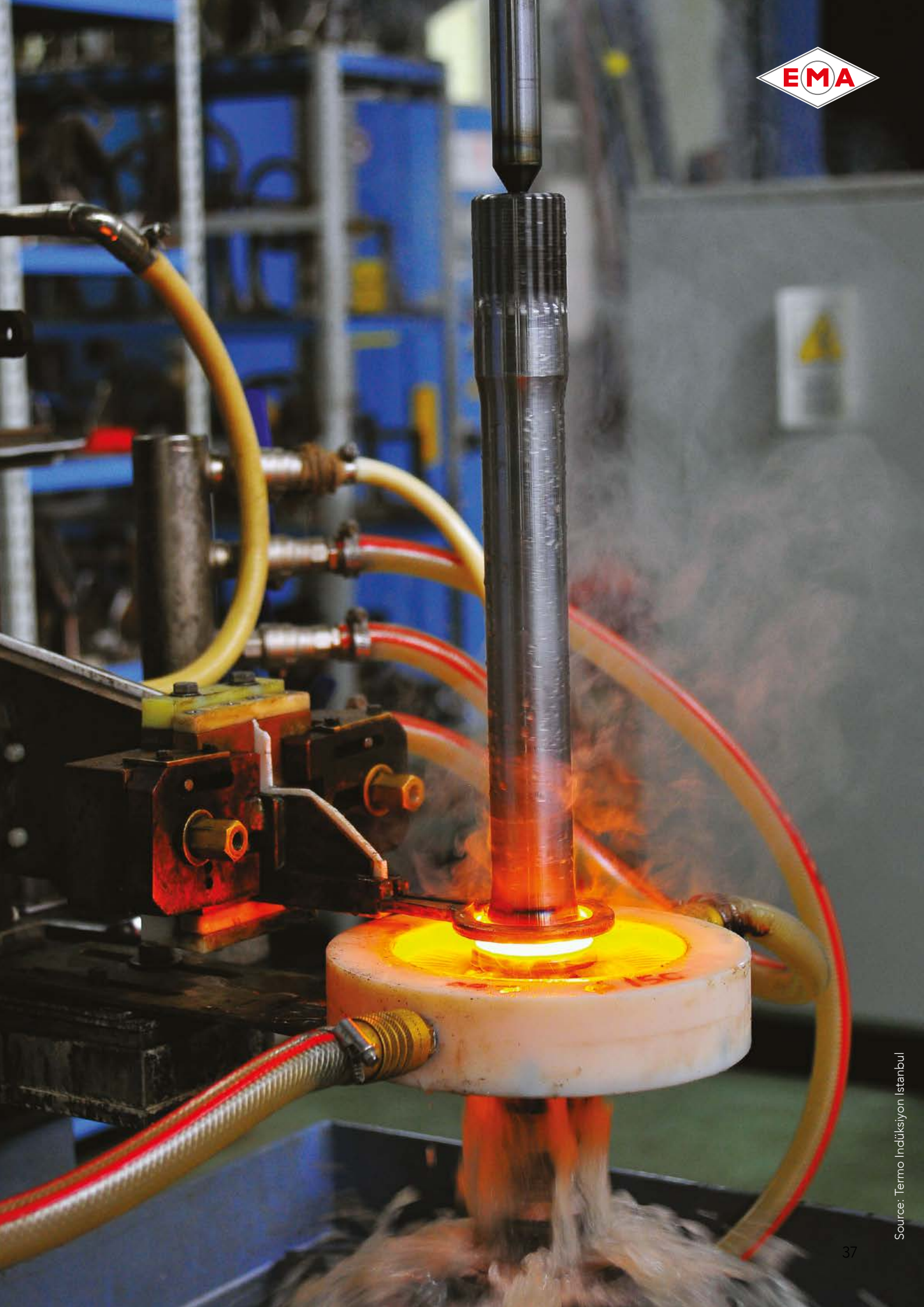


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Exhibition stand by EMA Indutec in Beijing





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