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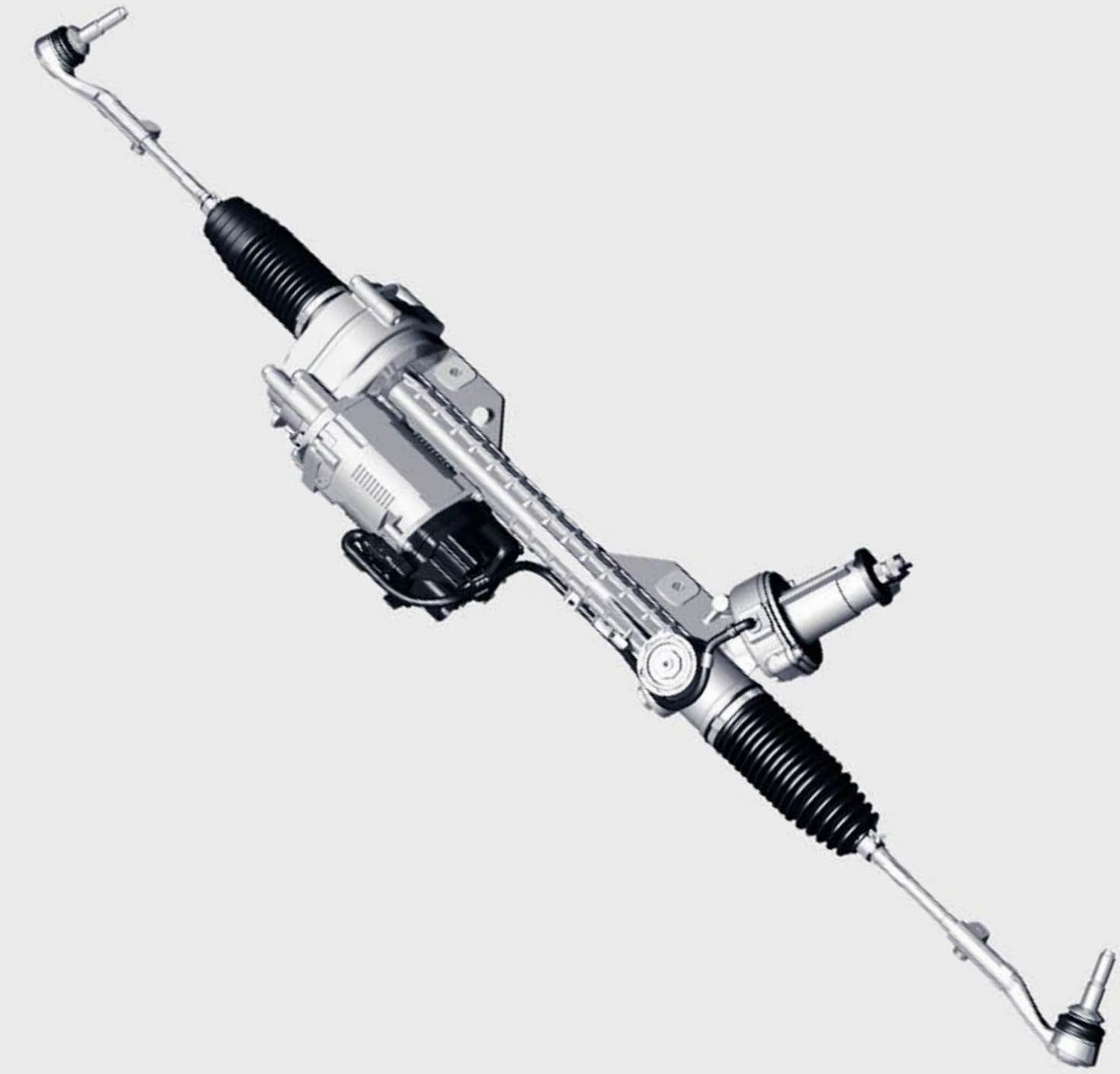
EFD Induction Heating News No 1, 2011



EFD Induction lands major automotive hardening orders from ZF

The strong recovery in the global automotive market and a major technology shift towards electric motor steering systems are key factors behind a series of major orders from ZF.

EFD Induction recently won a significant series of orders for induction hardening systems from ZF, one of the world's leading driveline and chassis technology companies. The first batch of equipment for the orders—which involves systems for hardening automotive steering components—is currently being built at EFD Induction's facility in Freiburg, Germany.

For EFD Induction CEO Eivin Jørgensen, the order underlines ZF's confidence in EFD Induction's technical and manufacturing capabilities. "Only companies that can satisfy the most stringent quality standards are selected as partners by ZF. After all, ZF is a renowned innovator whose products appear in everything from the new Alfa Romeo Giulietta to Audi's flagship models, from Hyundai earth movers to BMWs and Range Rovers."

The orders also include hardening systems destined for ZF's North American manufacturing centers. These systems will be built at EFD Induction's factory in Madison Heights, Michigan. "Customers such as ZF value our worldwide network of factories, workshops and after-sales backup," comments Jørgensen. "We have the resources to support these customers—wherever they are operating."

The past year has seen a marked upswing in orders from the automotive industry for EFD Induction equipment and services. "Fortunately, with our manufacturing capacity in North America, Europe and Asia, we're able to help our automotive partners meet the demand that built up over the past couple of years."

Another factor behind the ZF order is a technology shift from hydraulic to electric motor steering technology. "The move to electric motor steering poses new hardening challenges," says Jørgensen. "However, as we are the world's leading induction hardening company, we have the skills and experience to meet them."

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Power firms opt for Minac

Two of Europe's leading power generation technology companies recently placed repeat orders for EFD Induction's mobile Minac Twin systems. The first, from Austria-headquartered ANDRITZ HYDRO, involves a Minac 25/40 Twin. The system will be used for copper brazing at ANDRITZ HYDRO's facility in Linz, Austria.

Read more on next page ►

A mobile Minac being used to braze windings. The 'Twin' version boasts two independent outputs.

Talkline

The benefits of agility

Welcome to the first Hot Topics of 2011.

The globalized economy has created many challenges for manufacturing companies in recent years. One such challenge is the need for agility—being able to respond swiftly and effectively to customers' needs around the world. At EFD Induction we have succeeded in building just such a flexible, responsive organization. This—together with our worldwide network of factories, workshops and offices—lets us act quickly to help our customers meet new market demands.

An example of this agility in action is our cooperation with ZF, one of the world's leading steering system manufacturers. Working closely with ZF, we were able to devise hardening solutions to meet the growing demand for electric power steering systems. What's more, we are able to work with ZF on a truly international basis, with our German and US facilities building hardening machines for ZF factories in these respective countries.

Agility also means having the technical skill and creativity to find new cost-saving solutions to old problems. In this issue of Hot Topics you can read how we adapted our Terac deck and bulkhead straightening technology to straighten ships' doors. Of course, such creativity is a hallmark of EFD Induction. It is the same spirit of invention that drove us to launch the mobile Minac induction heating system. And that lets us find ways to expand the frequency range for reliable IGBT transistors, leading to the development of our latest generation of high-uptime Weldac welders.

Our ability to combine agility with a worldwide presence has been particularly useful during the past 18 months. As the global economy recovers from the downturn, manufacturers have been under pressure to meet the sudden spike in demand. The recovery has in turn led to strong interest for EFD Induction equipment and services, especially from the automotive, electro-technical, offshore and tube and pipe industries. This Hot Topics reports on just a few of these recent projects. If you'd like to know more about our solutions and how they might help increase productivity at your company, just contact your nearest EFD Induction office.

All the best
Eivin Jørgensen

PS: This Hot Topics reports on Kristian Berggren's contribution to a major heat treatment publication issued in Sweden. Kristian, who is managing director of EFD Induction Sweden, also found time to write the 'Induction Instruction' article for this Hot Topics. A recognized expert on the induction heat treatment of metals, Kristian will be at the SHTE conference in Gothenberg, Sweden in September this year. If you plan on visiting the conference—and are curious about the benefits of induction heating—Kristian will be delighted to answer any queries you may have.

EFD® INDUCTION

Hardening system for valve specialist Basso

Argentina-based automotive valve manufacturer Basso A.S. has ordered a vertical hardening system from EFD Induction. The system—designed to harden valve stem ends—is currently being constructed at EFD Induction's facility in Freiburg, Germany.

"As we all know, engine valves are subjected to extreme conditions," says Stefan Rechtacek of EFD Induction Germany. "The hardening process for this critical component must satisfy stringent quality standards. So we're delighted that Basso, a world-leading manufacturer of valves, chose us to devise a solution. It's a major vote of confidence in our technical capabilities."

The hardening system includes a 25 kW Sinac power source, a hardening machine with four rotating fixtures, a quenching system, customized inductors, loading and unloading mechanisms, a CNC/PLC control system. "The system is a complete induction hardening solution that will be integrated into the production line," says Rechtacek. "Such in-line integration is a key advantage of induction hardening, allowing high throughput and productivity."

Based in the northeast of Argentina, Basso S.A. is a part of the Basso Group, which also includes Basso Motor Parts. Basso S.A. focuses on manufacturing valves for mass-produced models. While Basso Motor Parts specializes in valves for racing and high-performance marques such as Maserati and Ferrari. The two companies produce more than 18 million components annually.

A selection of some of the valves produced by Basso of Argentina.

► *Power firms opt for Minac, continued from page 1*

"This latest order means ANDRITZ companies have now purchased about 25 Minac systems from us over the past two decades," says Matthias Gruber, managing director of EFD Induction Austria. "And that number does not include five Minac systems delivered to ANDRITZ HYDRO in India during the past two years, or the four Minacs delivered to the same customer in Brazil last autumn."

The Minac is a versatile, mobile induction heating system available with various output powers up to a maximum of 220 kW at intermittent operation. Automatic output matching—which ensures optimal power output for different heating operations, coils and materials—is standard for all Minac models. 'Twin' models feature two independent power outputs from a single converter, in effect offering two heating systems in one.

"When a company such as ANDRITZ HYDRO, with its stringent standards in a demanding industry, places repeat orders for an equipment item, then you know you've passed a tough quality control test," says Gruber. "It proves just how much value the Minac can add to a company's operations."

Positive experience

The other repeat order involves a Minac 18/25 Twin, and came from Jeumont Electric, the France-based specialist in power generation and conversion technologies. The Minac is being employed to wind large two- and four- pole rotors. Two teams use the Minac to simultaneously braze conductors that are up to eight meters apart from one another.

"The order," says Olivier Feraud of EFD Induction France, "came about because of Jeumont Electric's previous positive experience with our Minac systems. So when it came to acquiring another mobile induction heating solution, Jeumont Electric knew who to turn to."

According to Feraud, the Minac Twin's independent power outputs mean "a single mobile heater weighing less than 80 kilos can perform two completely separate heating operations simultaneously."

Another factor that makes the Minac popular with companies such as Jeumont Electric is the system's versatility. "The Minac," explains Feraud, "can handle a wide range of applications on practically any electrically conductive material. So the same system can be used to braze, shrink fit, straighten, cure and heat treat."

Minac delivers fast, localized heat.

A member of the Altawest Group, Jeumont Electric builds and maintains a wide range of generators and motors (synchronous and asynchronous), control systems and converters. The company is mainly active in the electric power plant, marine and process industries.

Two handheld power outputs connected to one Minac 'Twin' power source. The outputs, which are fully independent, can also be fixed.

Safe heating for ‘Safe Concordia’

Mobile heating equipment from EFD Induction was recently used to help repair a steel bulkhead on the ‘Safe Concordia’ accommodation and support platform, currently being towed to Brazil to start a contract for Petrobras.

The equipment—an EFD Induction mobile Minac 25/40—was used to pre-heat the weld area before and during the welding of a 40mm-thick steel patch onto one of the platform’s crane towers. To ensure optimal weld results, the weld area needed to be pre-heated to 80-100 °C, then maintained at that temperature throughout the entire welding process.

Such weld pre-heating is often carried out using resistance heating pads or mats. But as Jon Philpott, the EFD Induction engineer who performed the pre-heating explains, the presence of high-voltage cables near the weld area ruled out resistance heating. “Induction is not only flameless, it is also extremely fast and localized. This means induction heating results in minimal stray heating and heat soak, especially when compared to resistance heating.”

The contractor chosen to weld the patch, Whittaker Engineering, tested the EFD Induction equipment at its base outside Aberdeen, Scotland. “The offshore industry has tough safety and quality standards,” says Ken Whittaker, Whittaker Engineering’s co-founder. “EFD Induction had to first prove their solution could do the job while satisfying these requirements. Once that was achieved, the equipment, together with an EFD Induction offshore engineer, set off for Curaçao where the platform was then located. I’m more than happy with the result, and with the cooperation between us and EFD Induction.”

Built by Keppel Fels in 2005, the ‘Safe Concordia’ is a six-column, semi-submersible accommodation platform with capacity for up to 455 persons. The platform is owned by Prosafe, the world’s leading owner and operator of accommodation/service rigs. The company owns eleven semi-submersibles and one jack-up.

Prosafe’s ‘Safe Concordia’ accommodation and service platform. Flameless induction heating was used to pre-heat a section of crane tower that also serves as a control room bulkhead. “© Prosafe”

Induction opens doors for Libra-Plast

EFD Induction has developed an innovative door straightening solution for Libra-Plast, one of the world’s leading manufacturers of bulkhead doors, hatches and containers for the maritime industry. The solution is based on EFD Induction’s well known Terac deck and bulkhead induction straightening system.

The traditional method for removing weld-induced distortions in metal doors is mechanical ‘cold bending’. The method is however costly and time consuming. Cold bending requires a highly skilled operator, and the results achieved are not always permanent. The process is also potentially damaging to the doors’ structural integrity.

According to Mark Wells of EFD Induction, the new straightening solution exploits the same thermo-mechanical principles as the Terac deck straightening system. “The basic approach is the same: using induction to heat selected areas that subsequently cool and contract into the desired shapes. The technical challenge for us was to ‘miniaturize’ the Terac, as a ship’s door is a rela-tively small scale assembly with narrow tolerances.”

After consulting closely with Libra-Plast technicians, Wells and his EFD Induction team found that using pre-programmed energy/time cycles easily straightened weld-induced bumps in the doors. Similar heating cycles were then used to straighten the door stiffeners, and to correct distortions introduced by welding hinges to the doors.

The power source for the new straightening solution is an EFD Induction mobile Minac 18/25 Twin. “It’s called ‘Twin’ because it features two independent power outputs,” explains Wells. “This means two operators can work independently from one power source— which is a major boost to productivity.”

A marine door from Libra-Plast. The EFD Induction solution used to straighten weld-induced distortion is based on proven Terac technology.

The induction straightening system is now in everyday use at Libra-Plast, and has slashed the time needed to remove weld-induced distortions. The solution has also eliminated an entire straightening procedure from the doors’ manufacturing process. “That’s correct,” says Wells. “With the previous cold bending method, an extra round of straightening was required after welding on latchings and other customer-specific fittings. That is no longer needed with the induction straightening system.”

EFD Induction contributes to new heat treatment book

Leading Swedish research institute Swerea IVF recently published “Stål och Värmebehandling” (“Steel and Heat Treatment”). A key writer on the project has been Kristian Berggren, managing director of EFD Induction in Sweden, who contributed to the 800-page book’s section on induction heating.

“The book,” says Berggren, “brings together the knowledge of 24 writers and 40 specialist advisors from Sweden’s steel and heat treatment industries. I’m particularly proud that the book has a strong pedagogical and practical focus—it’s designed to help manufacturers, teachers and students overcome real-world challenges.”

The book is currently only available in Swedish, but there are plans to produce an English translation. Copies can be ordered from Swerea IVF at +46 (0)31 706 60 00 or info@ swerea.se, or from EFD Induction Sweden (+46 (0)21 300 010 or sales@se.efdgroup.net).

The book’s cover features a picture of a gear heated by EFD Induction equipment.

Induction Instruction

'Induction Instruction' is a series of articles written by recognized experts on various aspects of induction heating. In this second article in the series, Kristian Berggren, managing director of EFD Induction Sweden, explains the differences between scanning and single-shot induction hardening.

There are two alternative methods of induction hardening: conventional 'scanning hardening', and the less common 'single-shot hardening'. It is sometimes the case that workpiece characteristics determine which method must be used . A long, large-diameter shaft, for instance, requires scanning, as the power needed for single-shot hardening would simply be excessive. Then there are workpieces whose irregular shapes or complex geometries makes single-shot hardening the only viable alternative.

Scanning hardening involves movement between the workpiece and the the induction coil. Scanning is divided into two processes: vertical and horizontal hardening. In the former, the workpiece is held in a vertical position between two centers. An induction coil then moves upwards across the length of the workpiece. The speed at which the coil moves can vary, but is typically in the range of 5 - 25mm/sec.

A major advantage with vertical scanning is that the induction coil is relatively easy to make, as it is normally a single-turn round ring. Another advantage with vertical scanning is that the quench assembly is placed below the induction coil. This means the quench medium flows downwards without interfering with the heating. It is possible to control the depth of hardening in different zones of the workpiece by adjusting the coil's speed and the power fed into it.

Less deformation

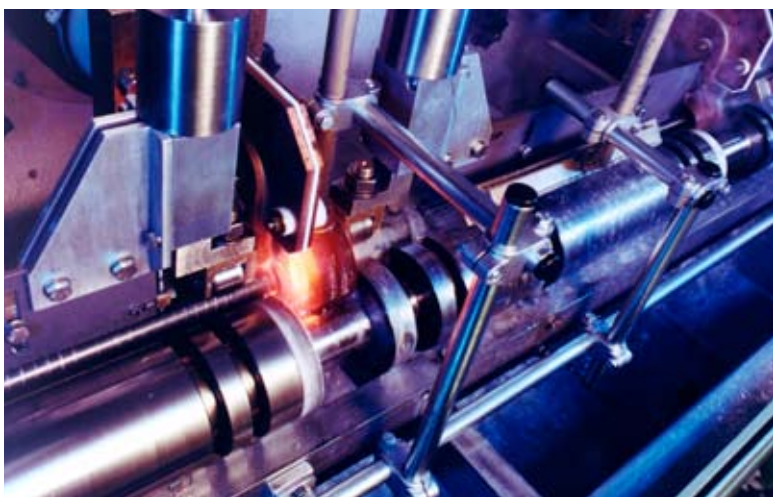
With horizontal scanning hardening, a horizontally held workpiece is fed through a coil and quench. One benefit of horizontal scanning is that it can reduce deformation. Minimal deformation is achieved by having the workpiece in a concentric position in the coil and quench. This results in symmetrical heating and quenching, which minimizes deformation. Another benefit is the possibility of hardening large workpieces. It is, for example, possible to harden 6m long tubes with this method.

Single-shot hardening means the complete hardening zone is first heated and then quenched. Such hardening can be achieved with a multi-turn coil that encircles the entire hardening zone. But for workpieces with rotational symmetry it is more usual to use a coil that follows the workpiece's contour, combined with rotation. Coils can be designed to 'push extra heat' into areas such as fillets on flanged shafts, where it is often difficult to obtain sufficient hardening depth.

The benefits of single-shot hardening include minimized deformation, and optimal results for workpieces with complex geometries and/or large diameter changes. The method also reduces deformation. And the method's relatively long heating times (compared to scanning) benefit the workpieces' microstructure and residual stresses. But even if single-shot's heating time for each grain is longer compared to scanning, the total heating time is shorter since the entire heating zone is heated at the same time.

Kristian Berggren of EFD Induction Sweden is an acknowledged expert in the field of induction hardening .

Single-shot hardening typically requires more power than scanning. This extra power is needed to achieve the required temperature increase in the complete hardening zone. Moreover, the coils used in single-shot hardening are more complicated and expensive than those used in scanning. And if the power demand changes somewhere on the workpiece, it will be necessary to physically modify the single-shot coil. With scanning, such changes can usually be handled by adjusting the control program.

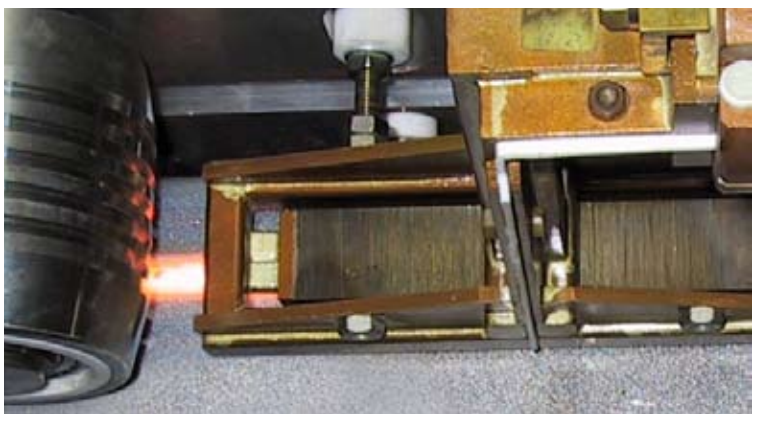


Horizontal centerless scanning hardening. The first coil hardens to a depth of 1.5mm. The second, visible on the right, performs in-line tempering. A hardened and tempered 400mm-long shaft exits the machine every 40 seconds.

Inline T-beam straightening

ESAB, the world-renowned welding and cutting specialist, has ordered an EFD Induction Minac 50/80 Twin for one of its ESAB IT-100 automatic T-beam welding machines. The machine, to be installed at a shipyard in the Ukraine, is a fully automated solution with a welding speed of more than 1m/min. The EFD Induction Minac will be used to provide inline straightening of the welded beams.

"We're always delighted to work with ESAB," says Patrik Olsson, technical manager at EFD Induction Sweden, "and we're particularly excited to contribute to the T-beam welding machine. It's a solution that really exploits the characteristics of in-line induction heating to cut costs and lead times for customers. For example, the Minac straightens the beams during the welding phase, thereby eliminating the need for a separate post-weld straightening stage."



A coil heats one side of the T-beam web. A second coil simultaneously heats the other side, introducing shrinkage to compensate for weld-induced distortion.

Straightening of T-beams is necessary because of cambers (bow-shaped bending distortion) caused by longitudinal upwards shrinkage following heat inputs from the welding process. A typical camber for a 16m long T-beam that has been welded without in-line straightening would be between 60 and 100mm.

"Induction heating is ideal for this sort of automated application," comments Olsson. "Alternative methods such as mechanical and manual flame straightening are slow, inaccurate and demand hours of work by skilled operators. There is an in-line alternative that uses propane burners mounted on the welder. But even this method has drawbacks. Heat input is difficult to predict, repeatability is poor, and distortion can be corrected in one dimension only."

The Minac ordered by ESAB is a 'Twin' model. That means the induction heating system has two independent power outputs and coils. The two coils simultaneously heat each side of the 'web', the part of the beam represented by the vertical stroke in the letter T (the horizontal stroke is known as the 'flange'). The heat induced in the beam by the induction coils causes shrinkage that compensates for that caused by the welding heat. "The use of induction straightening in automated T-beam welding leads to significant financial savings," says Olsson. "The process not only eliminates an entire production phase, it is also virtually impossible to overheat the beam. And since induction is so controllable, it is possible to achieve extremely accurate repeatability."

AUSTRIA
Tel.: +43-1-914 23 16 Fax: +43-1-914 33 04
E-mail: sales@at.efdgroup.net

CHINA
Tel.: +86-21-5442 0227 Fax: +86-21-5442 0242
E-mail: sales@cn.efdgroup.net

DENMARK
Tel.: +45 8622 8435 Fax: +45 8622 8465
E-mail: sales@efd-induction.dk

FRANCE
Tel.: +33-4-7649 3250 Fax: +33-4-7696 2090
E-mail: sales@fr.efdgroup.net

GERMANY
Tel.: +49-761-8851 0 Fax: +49-761-8851 139
E-mail: sales@de.efdgroup.net

INDIA
Tel.: +91-80-7820 404 Fax. +91-80-7820 405
E-mail: sales@in.efdgroup.net

ITALY
Tel.: +39-039-32-3320 Fax: +39-039-32-2697
E-mail: sales@it.efdgroup.net

JAPAN
Tel.:+81-(0)45-670-7129 Fax:+81-(0)45-670-7001
E-mail: sales@jp.efdgroup.net

NORWAY
Tel.: +47-35 50 60 00 Fax: +47-35 50 60 10
E-mail: sales@no.efdgroup.net

POLAND
Phone: +48-32-237-62-26 Fax: +48-32-797-14-74
E-mail: sales@pl.efdgroup.net

ROMANIA
Tel.: +40-21 332 3140 Fax: +40-21 332 3140
E-mail: sales@ro.efdgroup.net

RUSSIA
Mob.: +7-921-947-6431
E-mail: sales@ru.efdgroup.net

SPAIN
Tel.: +34-944-72 09 36 Fax: +34-944-72 09 88
E-mail: sales@es.efdgroup.net

SWEDEN
Tel.: +46-21-300010 Fax: +46-21-353656
E-mail: sales@se.efdgroup.net

THAILAND
Tel: +66-2757-4128 Fax: +66-2757-4127
E-mail: sales@th.efdgroup.net

UK
Tel.: +44-1902 308800 Fax: +44-1902 739222
E-mail: sales@efdinduction.co.uk

USA
Tel.: +1-248-658-0700 Fax: +1-248-658-0701
E-mail: sales@us.efdgroup.net

www.efd-induction.com