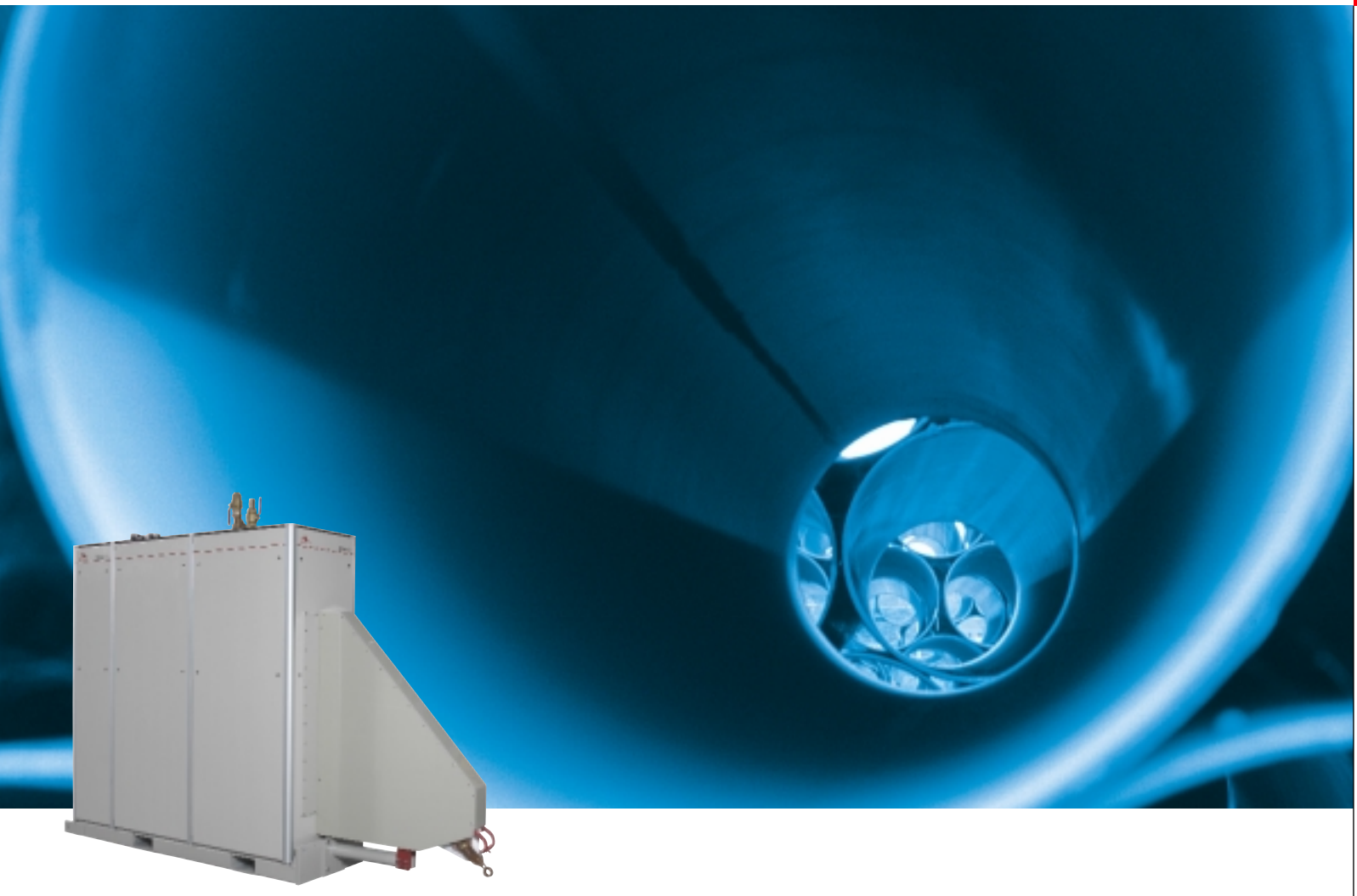
hottopics

EFD Induction Heating News No 1, 2004



Revolutionary high-uptime Weldac G2 series launched

In a major development for the tube and pipe welding industry, rugged IGBT transistors can now be used in high-frequency welding for small tubes with frequencies up to 350 kHz. The durable transistors translate into more uptime, more throughput and less energy consumption than traditional MOSFET transistors or vacuum tube welders.

Visitors to EFD Induction's stand at last November's FABTECH exhibition in Chicago were in for a surprise: a single-cabinet, high-frequency (up to 350 kHz), EFD Induction Weldac G2 featuring IGBT transistors.

The new Weldac G2 series means Tube and Pipe manufacturers can now get all the familiar advantages of MOSFET welders (high power efficiency, low operating costs) together with the unrivaled reliability and uptime of IGBT transistors.

Short circuit-proof

Comments Inggard Torvik, head of R&D at EFD Induction: "IGBT transistors have been around for years. But their properties have limited their use to lower-frequency induction heat applications (typically up to 150 kHz), such as welding larger pipes. Small tubes usually require higher frequencies—an area dominated by MOSFET transistors, despite them being more costly and less reliable."

The secret behind the new high-uptime Weldac G2 is a patented internal switching pattern that boosts the frequency of IGBTs to as much as 350 kHz—making them ideal for small tube welding.

A major advantage of the IGBT transistors is that they are virtually immune to coil short-circuits, caused, for example, by metal slivers getting caught between the coil and the tube.

While this can destroy a MOSFET transistor, the IGBT is not affected.

Read more on next page ▶

Staying on track

Alessandro Mariani of EFD Induction Italy explains how induction technology keeps the trains running.

All of us remember as children gazing in wonder as trains thundered by. But what very few of us then realized—few still do—is that trains need to regularly change their metal wheels.

It sounds like hard work, but EFD Induction equipment makes the procedure clean and easy. A standard EFD Induction converter, the Minac 150, is fitted with a specially designed coil that heats wheel rings for quick disassembly. The same converter and coil is also used to shrink-fit new rings.

Of course, train wheels come in different sizes. But the EFD Induction coil can be easily adjusted to fit different diameters. This is made possible by moving the segments that make up the coil. A centering device ensures that the wheel ring is securely and accurately held in the center of the induction coil.

Software built into the Minac lets the operator pre-set the desired ramp-up times, power delivery and dwell times. This ensures that the correct surface temperature and heat pattern for the rings are achieved.

When it comes to trains, EFD Induction equipment is used for more than removing and assembling wheels. Another standard EFD Induction converter, the Minac 18, is perfect for disassembling and shrink-fitting bearing and lock rings. There are, of course, plenty of other applications in train construction and maintenance where EFD Induction equipment can be used. To find out more about them just contact your nearest EFD Induction representative.

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And the winner is …

EFD Induction would like to congratulate Anders Erik Karlsson, a process development engineer at rock-drilling specialists Atlas Copco Secoroc, on winning the draw announced in the previous issue of *hottopics*. Anders' prize is an induction heating hotplate for the home. And thanks to everyone else who entered the draw … better luck next time!

FABTECH feedback

This past November, Chicago was host to the 2003 FABTECH International trade show. FABTECH is North America's largest annual metal fabricating and forming event. For EFD Induction, it meant the promotion of the Minac product line and the introduction of a new Weldac induction welder design.

Read more on page 3 ▶

Induction for faucets

Manufacturers of high-quality faucets face three tough challenges: how to achieve robust joints; how to achieve virtually invisible joints; how to achieve robust, invisible joints as quickly and cost-effectively as possible. Little wonder then, that more and more faucet makers are turning to EFD Induction for answers.

Read more on page 4 ▶

Chief Executive Talkline

EFD Induction has since its foundation been driven by innovation, and is passionate about introducing more customers to the benefits of induction technology. In fact, it was EFD who in the early 1980s pioneered transistorized generators. The result was the Minac, a small, powerful, mobile converter that revolutionized the induction industry. Our solutions to tough heat treatment and hardening problems are well-known, and our technical skills have been successfully transferred to our operations in the US and China.

Innovation continues to characterize EFD Induction. During 2004 we will launch new, even more compact products. For example, our newly designed medium-power Minac generators make the induction process more cost-effective. And our new Weldac G2 300 welder—recently launched at FABTECH in the US—features reliable IGBT transistors at high frequencies up to 350 kHz. Then there is our patented dual-frequency generator that can supply the same coil with two frequencies—something that promises to benefit many customers. We have also successfully supplied heating solutions that operate under protective atmospheres. This is an exciting development, as protective gas prevents scaling and subsequent costly brushing. Lead times and costs go down as a result.

Making a business climate of innovation is itself an innovation. EFD Induction is more than a marriage of companies. It is a partnership of people who believe in the benefits of induction technology—and who are dedicated to finding new applications for that technology. The EFD Induction group includes a diversity of talents and nationalities. But we are all united by our common culture of innovation.

Roger Hjerth, Chief Executive.

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Easy to operate

The new Weldac G2 underlines EFD Induction's focus on safe and easy operation. As Torvik puts it:

"The Weldac G2 is seriously complex on the inside, but we've made it a breeze to operate, with a minimum of manual settings and other operator interference. For example, coil changes are done in seconds, with the frequency adjusting automatically to each tube dimension."

The new system is housed in a single compact cabinet with a much smaller total footprint than its predecessor. No separate power or rectifier unit means no cables linking them to the welding station. Valuable space is saved. Installation is simplified. And because the single-cabinet design costs less to make, the new Weldac series costs less to buy.

Simple arithmetic

Inggard Torvik expects that many existing welders using ancient vacuum-tube technology will be replaced with new Weldacs:

"The arithmetic is simple. Vacuum tubes are increasingly expensive as the worldwide supply dries up. Besides, they are energy-inefficient and short-lived. Vacuum-tube systems require higher maintenance and are more costly to use."

The new Weldac should also be of interest to those who have already switched to solid state, but are dissatisfied with MOSFET-related downtime. Also, the absence of reactive power in the Weldac G2 makes it more efficient in terms of total energy consumption than all other welders on the market.

Solid-state pioneer

For EFD Induction's Olav Waerstad, Department Manager Power Systems and Sales, the latest Weldac G2 series confirms his company's reputation as a solid-state pioneer.

"Everyone in the business knows we've been at the forefront of solid-state induction technology since the early 1980s, when we developed and commercialized some of the world's first transistorized systems. In fact, our Weldac welders—also known as ELVA welders—became a big hit. Nearly 100 of them have to date been installed in the US alone.

The new Weldac continues this pioneering heritage. By using more rugged and less costly standard transistor components—which until now have been unsuited for high-frequency tube welding—we're creating a whole new level of reliability and cost efficiency in Tube and Pipe manufacturing."

Some features …

- The single cabinet Weldac G2 system consists of the frequency converter, a busbar and an external control system.
- Can be delivered with four different output power levels: 150, 200, 250 or 300 kW with a frequency range of 200 to 350 kHz.
- Can handle tube dimensions from OD 3/8" up to OD 5", all with a two-turn coil design.

… and benefits

- Patented IGBT design gives high uptime and production output.
- Diode rectifier with high-power factor at all power levels.
- Wide electronic automatic matching range and automatic frequency adaptation.
- Short circuit-proof operation.
- Compact design, all in one single cabinet.
- Small footprint, fast installation, easy to retrofit.
- Divided control system, can be incorporated into any line control system.
- Low cooling water consumption due to high efficiency.

Induction magnet bonding in motor manufacturing

Every time you use a hand tool, domestic appliance or a car's power windows, air conditioning or wipers, chances are you are using a permanent magnet type motor. Which also means you are probably benefiting from induction heating applications developed by EFD Induction engineers.

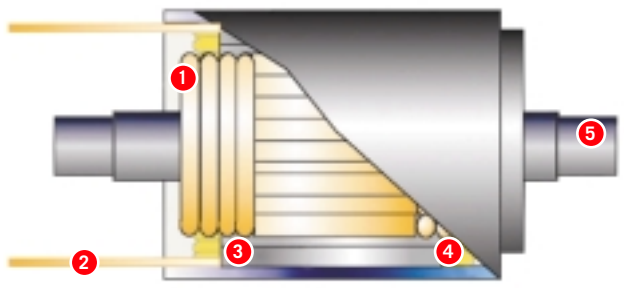
Over the past few years, more and more motor manufacturers have turned to EFD Induction to help them improve productivity and quality. One area where induction has had a major positive impact is the replacement of conventional assembly methods (mechanical clips) by induction bonding.

With induction bonding, single-component epoxy adhesives are cured by heating the motor housings. Magnet properties remain unaffected during the process. The benefits of induction bonding are varied and significant. To start with, the vibration noise experienced with mechanical assembly is virtually eliminated. Also, epoxy single-component adhesive does not require extra preparation work. Finally, the precise repeatability of induction bonding ensures uniform quality.

EFD Induction designs, builds and customizes automated equipment for magnet bonding. Our resources include complete testing facilities to assess magnet position and overall strength. These testing facilities are valid for production lines with a capacity of up to 600 motors per hour.

Of course, magnet bonding is far from being the sole application developed by EFD Induction for motor manufacturers. Our engineers also design equipment for hardening rotor shafts, for curing stator isolating varnish, for burning wire ends varnish—all for full in-line production.

So next time you drive a car, use an electric drill, or switch on a hair dryer, spare a thought for EFD Induction's hard-working engineers—and for the hard-working induction technology they have perfected.



1. Rotor 2. Connection wires 3. Magnet 4. Stator 5. Axle shaft
A typical electrical motor used in the automotive industry for engines (alternators), windshield wipers, power windows, etc.

Continued from page 1

Mark Prasek (left) and Bill Anderson on duty at the EFD Induction stand at FABTECH. Note that Bill is holding a metal bar heated "cherry" red by induction heating.

FABTECH feedback

As with any trade show, there is always concern for how it will be attended. The previous 2002 show reflected the North American economy at the time and was, therefore, poorly attended by both attendees and exhibitors. With this past show in mind, the grim possibility of a repeat was felt.

Fortunately, it appears that there are signs of life in the North American economy once again. Attendance was somewhat better than expected, and the overall quality of the attendees was very promising. They came with purpose and almost two years of equipment needs.

The timing could not be better for EFD Induction. The new Weldac welder is truly revolutionary. Not only is it the only welder to offer more robust IGBT inverter technology up to 350 kHz, it is the only single-cabinet design on the market. And as if that were not enough, EFD Induction has been able to reduce costs significantly on this new design. All these facts add up to improved performance and reliability at a lower cost for the customer.

It was fun to see the visitors'expressions as the changes were explained. But it was even more fun to see their reactions when told that they were looking at the entire welder—there is only one cabinet.

The EFD Induction booth included a Minac induction heating demonstration unit. The unique ability of the induction process to heat a steel bar "cherry" red on one end while still allowing it to be held with a bare hand on the other end is rather amazing to see. The demonstration proved to be a great tool to attract people to the booth—many of whom had never seen an induction heating process before. Once at the booth, visitors could also see how induction could be used for both brazing and shrink-fit applications.

All in all, the show proved to be very successful. New contacts were made and existing contacts were renewed. We are confident that our efforts at this show will carry over into the new year.

Brazing aluminum for air conditioners —a brief introduction

Sverre Masterød, Section Manager for Standardized Systems at EFD Induction, explains why induction heating is the superior technology when brazing aluminum for air conditioning systems.

Aluminum-brazing operations are essential when making air conditioning systems. Here are some examples: brazing of tubes on condenser assemblies, brazing of tubes on evaporators, brazing of tubes to block fittings, brazing of tube assemblies.

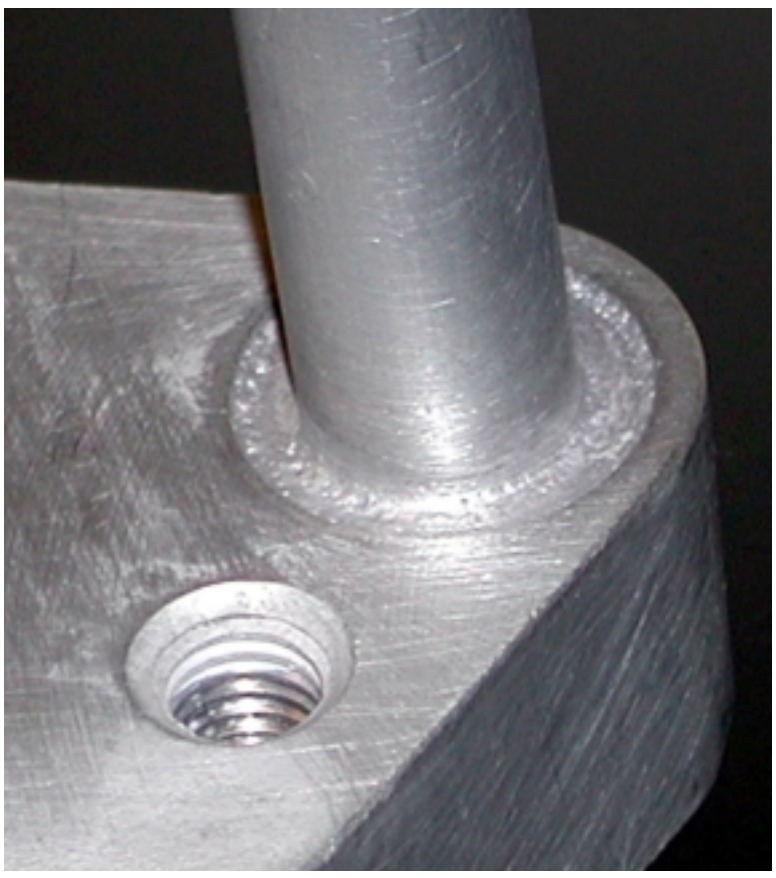
Aluminum brazing is, however, a difficult application that places high demands on parts and induction equipment. This is especially true when high-temperature aluminum alloy is used, as the tolerance window for the process is extremely narrow. That's because the high liquidus temperature of the alloy is very close to the melting temperature of the base material. In fact, the difference can be as low as 40°C.

Flux is a crucial factor when brazing aluminum which has a thick oxidation layer. To maintain the desired process results in repeat operations—and to ensure consistent first-time-through quality—the same amount of flux and alloy must be applied. To achieve this, pre-shaped alloy rings are normally used.

There are new alloys on the market that allow brazing at lower temperatures, thus making the process easier. But the type of alloy used invariably depends on the strength requirements for the part to be brazed.

Here are some of the benefits of induction brazing of aluminum parts for air conditioning systems:

- Better first-time-through quality levels than with alternative methods. This also results in less scrap and less re-working.
- Fast cycle times mean more parts produced per hour.
- Safe, clean and environmentally friendly—no gas, no open flames.
- Less energy consumption—with induction, heat is generated only when and where it is needed.
- Maximum uptime—the process is operator independent—reduces the risk of human errors.
- Quality assurance feedback—computer in the induction converter keeps a log of key process parameters.



A perfect job every time with induction brazing.

Minac Twin for major European automotive sub-supplier

How EFD Induction solved a tricky technical challenge—and still met the tough quality demands of a German automotive sub-supplier.

EFD Induction Germany recently delivered a half-automatic induction brazing machine for brazing tubes and bushes under protective atmosphere. The customer is one of Europe's leading sub-suppliers to automobile makers.

The task appeared straightforward: braze bushes to tubes using copper brazing material. However, a process temperature of 1,100°C, work piece wall thickness of less than 3 mm, and a maximum cycle time of only 32 seconds per piece turned the task into a technical challenge. Added to this was the need for high throughput and excellent repeatability.

After reviewing the customer's needs, EFD Induction Germany proposed a Minac Twin solution. This solution—which involves one converter with two independent work stations—met all the technical, quality and productivity specifications. Set-up time was reduced to a minimum by designing the work piece fixture with integrated gas pipe-work and a quick-release clamping system.

The system has worked without a hitch since its installation in the autumn of 2003. Indeed, the customer is so pleased with the system's performance and benefits that plans are underway to purchase two more EFD Induction installations.

Unique hardening solutions for unique hardening demands

Karl Hirsch, General Manager of Heat Treatment Services at EFD Induction Germany, is no stranger to tough challenges. But two particular demands—and the special solutions devised by EFD Induction—stand out.

"Well, our work team here in Freiburg was presented with a tough problem: how to lessen distortion when hardening complete steering racks, shafts and gear parts. And, of course, how to lessen it in a way that was cost-effective and met stringent quality levels."

The problem is that when hardening by scanning, the coupling needs to be adjusted because of distortion in the workpiece. Moreover, non-uniform hardening patterns create a risk of cracking. Traditional remedies such as forced fixing or empirical methods are unsuitable, as they reduce process reliability. They also result in non-uniform hardening.

To solve the problem, Hirsch and his team began intensive lab testing. Says Hirsch: "Coming up with a purely technical solution is only one part of the job. The really hard part is to devise a cost-effective solution that fits the customer's existing line configuration."

The team's solution was a standard HGL-type machine with a double spindle augmented with lateral axes and a specially developed sensing device. "The solution," comments Hirsch, "gave excellent results. The combination of the sensing device and our control concept lets us measure distortion during the heating cycle, and, by controlling the axis in real time, we ensure a constant coupling distance. Distortion is significantly reduced because the induction coil follows the workpiece."

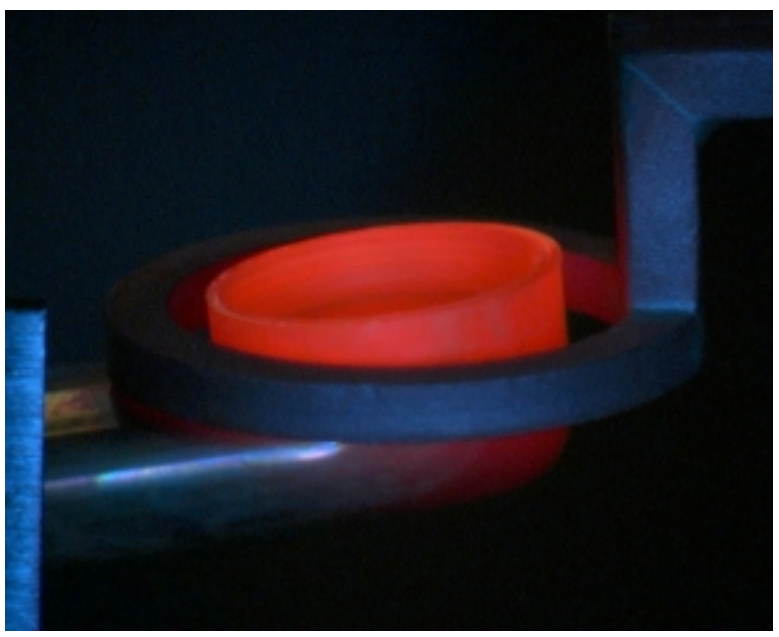
The second development was a drum-hardening machine. "Here," says Hirsch, "we had to achieve a constant tension force on the work piece via the centers with simultaneous adjustment of the coupling distance between workpiece and coil."

Using standard components, Hirsch's team came up with a concept that features automatic length compensation provided by an electronic measurement system and CNC-axis. The machine is also easy to maintain, and boasts short setting times. Changing and aligning of the coil is performed outside the working area.

The solution also eliminated all mechanical moving components from the quench tank, while a fast portal loading unit and chain-linking assured flexibility. Precise process control was made possible by an advanced CNC-control system.

Although developed as one-off customized solutions, both developments have since been adopted by several customers. Says Hirsch. "We modify the machines for each customer. To date, the feedback has been excellent. Both developments work without a hitch, and the customers are more than happy."

Development #1: A standard HGL machine with robot for the hardening of complete steering racks, shafts and gear parts.



No mess, no fuss, no waste—EFD Induction at work brazing faucets.

Induction for faucets

Over the past couple of years, EFD Induction has devised solutions for brazing faucet tubes to sockets, and for brazing thread inserts. These solutions are now in use with some of the world's leading faucet makers.

Fast heating times and precise repeatability make induction perfect for faucet brazing. Induction heating is, for example, much faster and more accurate than conventional methods. The fast, consistent heat obtained by induction heating produces full-penetration joints. Induction also reduces the time needed for brazing, while at the same time ensuring perfect-looking individual joints.

Variable thermal conductivity means it is essential to balance the heat when brazing thread inserts. Customized induction coils, plus a limitless range of coil positions, achieve the optimal balance.

The EFD Induction equipment most commonly used for faucet brazing—the Minac line of mobile converters—features a micro-controller that allows precise output energy control and energy supervision. This micro-controller makes it possible to pre-set programs for faucets of different shapes and sizes. These predefined programs, together with coil changes that take only seconds, ensure speedy adjustment times when changing between faucet models.

Induction brazing is cost-effective, too. It consumes less energy than alternative technologies; primarily because with induction, heat is produced only when needed, and is accurately delivered.

¡Cien installaciones!

(100 reasons to celebrate in Spain and Portugal)

EFD Induction in Spain and Portugal marks its tenth anniversary in style—by delivering its one hundredth installation.

Although it was only started ten years ago, EFD Induction s.l. is firmly established as a key supplier of induction heating solutions throughout the Iberian Peninsula.

The company has already celebrated its tenth anniversary. But now it has an extra reason to hold a fiesta—the sale and delivery last December of the company's one hundreth induction heating installation.

The delivery was for two Minac 12/18 induction heating systems to Fagor Electrodomesticos s. Coop., Spain's leading maker of domestic appliances.

Application	No. of delivered installations	Total power
Hardening	25	3,045 Kw
Hardening & tempering	6	425 Kw
Welding	5	2,535 Kw
Brazing	22	675 Kw
Bonding	16	685 Kw
Pre-heating	23	1,950 Kw
Post-heating	3	250 Kw

Above: Engineering Manager Iñaki García (left) of Fagor Electrodomesticos S. Coop. with EFD Induction Area Manager Juan Miguel Escolar Gonzalez.

Left: Since its launch ten years ago, EFD Induction has delivered 9,565 Kw in installations for a wide range of industrial applications.

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@ech-efdgroup.com.cn

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 591 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

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

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