hottopics

EFD Induction Heating News No 2, 2004

The Technip Offshore vessel "Apache" winding steel pipes at Orkanger.

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On course for offshore

It takes a special kind of company to work for the offshore oil and gas industry. People have to be tough, adaptable and mobile. As for equipment, it has to be compact enough to be mobile, yet rugged enough to perform under demanding conditions. EFD Induction is therefore extremely proud to report on its growing involvement with offshore customers.

To outsiders, Orkanger doesn't look important. But in fact, this quiet village near the Norwegian city of Trondheim is the site of an important pipe assembly workshop for oil and gas pipes to and from North Sea oil fields.

One of the companies working at Orkanger is Thermotite Bredero Shaw Norway. Part of their job is to coat the pipes with a special epoxy prior to further coating with Polypropylene. This helps prevent leakage and corrosion in the pipes —enabling them to remain submerged in salt water for decades.

In order to successfully apply the epoxy, the outside of the pipes must first be heated. The heat has to be uniform across the application area, and the temperature must not deviate outside a very narrow band. If these conditions are not met, the epoxy will not adhere correctly to the pipes.

One Friday several weeks ago, EFD Induction Norway received an urgent call at its HQ in Skien, southeast Norway. It was Thermotite Bredero Shaw. There was a problem with their pipe heating, could we help them get back into production on Monday? We said we'd try, and bundled an engineer and an EFD Induction MINAC 18/25 demo unit into a van for the 700 km drive to Orkanger.

The engineer reported for duty on Monday and started trial heating with his MINAC 18/25. The job was complicated by having to hold a consistent temperature across areas consisting of weld seams to steel brackets of varying thicknesses. However, the engineer quickly found a way to scan the application area with a low temperature for 2-3 minutes, enabling the epoxy to be applied without any problems.

The customer was of course delighted to get back into production by Monday afternoon. But even we were somewhat taken aback when they wanted to keep the MINAC 18/25 mobile induction converter. Although it was a "demo" unit, the machine had performed so well, they insisted on keeping it on site!

Rescue at sea

Another example of how EFD Induction staff and equipment helped maintain production for an offshore customer involves the "Sleipner A" gas and condensate (light oil) platform, 240 km off the Norwegian coast.

The urgent problem this time was a pump bearing. It was defective and had to be replaced. But the risk of an explosion ruled out the use of gas torches and other open flame heating. Bringing the pump ashore for repairs was ruled out as too expensive. Instead, EFD Induction was called in, and within hours of the

Read more on next page ▶

Steel bars and induction —a brief guide

Joachim Plust of EFD Induction Germany discusses how integrated induction heating leads to better, faster and cheaper heat treatment of steel bars.

Treating steel bars in order to enhance torsion characteristics, reduce alloy components, etc. has long been a well-known process. One traditional treatment process involves using continuous furnaces. However, the use of continuous furnaces makes it extremely difficult to control and monitor the heat treatment process.

But there is a better way: inline heat treatment. This alternative, which hardens and tempers at high temperatures without interruption, is reliably achieved by processing the bars individually with integrated induction heating.

Over the years EFD Induction has worked closely with numerous customers in the steel

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Crank up the volume!

EFD Induction France has long been a leader in the design and manufacture of crankshaft hardening machines for auto makers. That leadership is now being extended to extra-large crankshafts for the truck, power generating, ship and railway industries.

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In gear for shrink fitting

Sub-contractors to the automotive industry must constantly strive to trim costs, waste and lead times—while simultaneously meeting tough quality demands. Little wonder then that more and more sub-contractors are opting for induction heating to shrink-fit gear wheels. This is particularly true for gearbox assembly lines, but it also applies to a range of processes involving the assembly of gear wheels onto shafts.

Induction heating provides several cost and quality benefits. Heat delivery

Read more on next page ▶

EFD Talkline

One of the beauties of induction heating is the range of applications and industries where it can be used. Another is the induction process itself —flame-free and without direct contact with the work-piece. Induction is truly an 'untouchable' heat. Finding new, exciting uses for induction heating is a passion at EFD Induction. You can read about some of them in this issue of *hottopics.*

We call upon diverse in-house skills when devising your induction solution. We have to know your process, application and quality demands. In particular, we have to know how to boost your productivity. These challenges have always attracted, and continue to attract, engineers to our company. Our experience with induction lets us identify potential productivity and cost improvements in your operation—whether by in-line integration, better space/energy utilization, maximizing uptime, computer simulation or professional coil services.

Our experience with many applications from many industries has strengthened our R&D efforts. It allows us to transfer breakthroughs from one area to another. Consider our new breakthrough Weldac G2 (incidentally, two of the engineers involved in this project recently received a prestigious award at TUBE 2004). Or our new, patented Dual/Multi Frequency Generator. This universal generator, which has already won orders, can simultaneously supply the same coil with two frequencies.

The range of profitable uses for induction is exceptional—as are its savings and improvements potential in your process. Together we can make it happen.

EFD®

▶ *On course for offshore,continued from page 1*

alert being raised, one of our engineers and a MINAC 18/25 converter were rushed by chopper to the platform.

Once on the 210-meter-high platform, the engineer used the MINAC to heat the pump's bearing ring prior to disassembly. He then treated the new bearing before re-assembly. The job went without a hitch, and the pump was back at work within hours.

Safe, quick, effective. A MINAC 18/25 saves the day on the Sleipner A platform in the North Sea.

EFD Induction has been helping offshore service companies since the mid 90s. Not only does induction heating mean no open flames on ships and rigs, our "fork type" open induction coils do not enclose the work piece.

Typical offshore applications:

- Post Weld Heat Treatment
- Pre Weld Heat Treatment
- Pre heating before coating
- Tube bending
- Soldering
- Shrink fitting
- Removal of rubber coatings
- Removal of glued parts
- Hardening of spray coatings

▶ *In gear for shrink fitting, continued from page 1*

is accurate—you only heat the part you want to heat. Temperature control is accurate, too; with precise control of ramp-up times and holding temperatures. Moreover, induction heating reduces the risk of ovality, as heat delivery is accurate.

The benefits of induction are easily available, as an induction heating system can be easily fitted into existing production lines. So if the prospect of better quality, more throughput and lower costs sounds attractive, contact us today. Together we can devise a solution to improve the productivity of your shrink-fitting operation.

▶ *Bar steel and induction, continued from page 1*

bar industry. The results of this cooperation are sophisticated induction installations that deliver stable, flexible and amazingly reproducible heating processes to customers worldwide.

Inline heat treatment with EFD Induction equipment typically processes steel bars with a diameter of 20–140 mm. The length of the bars ranges from 5–18 meters. The hardening temperature is approximately 900°C and the tempering temperature is in the region of 700°C.

Although conditions vary from customer to customer, a number of key benefits are common to users of inline induction heat treatment:

- Enhancement of material properties, such as toughness, reduction of area, etc.
- Optimized consumption values
- No starting phases
- Quick batch changes – small batches
- Improved results in terms of homogeneity
- Clean processes; oils and fumes are extracted and cleaned

Examples of installations for bar steel:

- For an output of 1 ton per hour the induction power used is 250 kW, 10 kHz for hardening and 200 kW, 6 kHz for tempering. The layout of this installation, including inlet- and outlet magazine and cooling units, is approx. 26 x 7 meters.
- For an output of 3.5 tons per hour the induction power used is 600 kW + 250 kW, 10 kHz for hardening and 600 kW + 100 kW, 6 kHz for tempering. The layout of this installation, including inlet- and outlet magazine and cooling units, is approx. 44 x 10 meters.

Higher outputs are possible.

Temperature supervision by pyrometer ensures controlled heating.

A specially designed quench ring.

A typical installation for induction heat-treatment of steel bars.

Hardening market heats up in India

EFD Induction India has grown steadily since its launch in Bangalore in 1992. But the first half of this year has seen spectacular growth—much of it due to a surge in demand for hardening solutions. India-based automotive suppliers are particularly keen buyers, but orders have also been received from customers in Korea, Australia, Malaysia and Thailand.

One recent order, for example, was to design, manufacture and deliver a solution for brake shoe hardening for Brakes India, part of the TVS Group. The delivered solution hardens the brake shoes at two stations, using pneumatic cylinders to vertically move the inductors. Brakes India is extremely satisfied with the solution, and has placed a repeat order.

Another recent order for the automotive industry came from Delphi Automotive Systems Ltd. The order involved the design and delivery of a BVH 1000mm Vertical Hardening Machine. The finished machine features twin hardening stations equipped with hydraulically operated grippers, and pneumatically operated rotation chucks with job support. The steady rest arrangement is exceptionally sturdy and rugged.

With India emerging as an attractive source of components for international automakers, EFD Induction India stands poised to consolidate its position as a leading provider of hardening solutions in Asia.

A planning meeting at EFD Induction India. From left: Balakrishna Paisari, Arun Kumar, Narendra Prabhu, Hubert Reilard, N. Balakrishna and Mahesh Gupta.

Induction take-off for A380

A giant is born. The Airbus A380 incorporates the very latest technology—including engine axle shafts from EFD Induction.

When it enters passenger service in 2006 the Airbus A380 will be the world's only twin-deck, four-aisle airliner. EFD Induction France is proud to play a key role in getting—and keeping—this new flagship of the Airbus family airborne.

Whichever way you look at it, the new Airbus A380 aircraft is an engineering marvel. A double-decker giant that can carry 555 passengers in non-stop comfort for 15,000km (8,000 nautical miles), the A380 checks in with a length of 73m (239ft 3in), a geometric wing span of 79.8m (261ft 8in) and a maximum take-off weight of 560 tonnes (1,235,000lbs).

Lifting all this off the ground are four double flex jet engines with a thrust range of 70,000lbs slst. Obviously, each and every engine component must be of the highest possible quality. But the main engine shaft has to be especially well made, as it must withstand high torques, high rotation speeds and unusually high temperatures

The responsibility for making the shafts lies with Aubert et Duval, a company recognized as one of the world's leading specialists in the 'refractory' alloys used in the aerospace and other high-tech industries. Aubert et Duval will deliver forged preforms to the engine manufacturers, who in turn will machine them into the main engine axle shafts.

Forging these 250mm diameter bars of special alloyed steel calls for a rapid pre-heating to 1250°C, with a narrow tolerance of +/– 10°C. Which is why Aubert et Duval turned to EFD Induction to design and supply an induction solution that can pre-heat with such accuracy.

The result is a complete induction system that includes handling equipment. Also included is control equipment capable of controlling all parameters. Each of the system's three induction converters delivers 100 kW at 1,000 Hz, thus allowing fine adjustments of temperature. Also featured is a feedback signal from the 8,000 tonne press that lets the system supply a part ready to forge at exactly the right moment. This accuracy avoids overheating and excessive soaking time, both of which are detrimental to quality because they lead to increased grain size and oxidation.

The induction system has been designed and built by Soldago, EFD Induction's French subsidiary specializing in induction heating solutions for forging and melting.

Write stuff scoop award at Tube 2004

This spring's Tube Düsseldorf was a memorable experience for everyone involved. But for Bjørnar Grande and John Inge Asperheim, two young engineers at EFD Induction Norway, the event was made extra special when they were awarded the prestigious Hugh Sansome President's Award.

The award is presented to the author(s) of the best paper presented at an International Tube Association (ITA) conference during the previous two years. The choice of best paper is made by the ITA's Papers Award Committee.

The award committee considered 70 papers presented at the three ITA conferences held since Tube Düsseldorf 2002. After narrowing the finalists to 8 papers, the committee picked as the winner Grande's and Asperheim's paper "Temperature Evaluation of Weld Vee Geometry and Performance", which was presented in India last year at ITA's Tube Hyderabad.

For the management of the EFD Induction Group, the award confirms the company's position as technical innovators. "That two of our younger engineers should win such a highly-regarded award underscores our company's technical excellence. EFD is immensely proud of Bjørnar and John Inge."

Grande's and Asperheim's winning paper can be downloaded for free from the ITA Secretariat. For more details, go to www.itatube.org/confpap.asp

A justifiably proud Bjørnar Grande (left) and John Inge Asperheim (with trophy) flank Mrs Pam Sansome and ITA Chairman Albert Sedlmaier at the award ceremony. Mrs Sansome is the widow of Prof. Hugh Sansome, a key figure in the development of the ITA.

The screen star

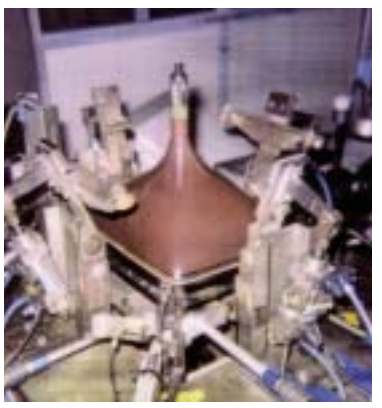
When manufacturing a television or computer monitor, it is essential that the cathode ray tube be correctly mounted. To achieve this, a so-called 'shrinking frame' is attached to the cathode tube and shrunk to fit its outer dimensions. Once properly positioned, this frame allows the correct mounting of the tube within the monitor. Muffing material is inserted between the frame and the tube to protect the latter from cracks and other damage. The frame itself is a closed construction made from normal magnetic iron. Zinc-plated versions are also available.

To obtain the required shrinking, it is first necessary to heat the frame to at least 450–500°C. The heat source for this operation has traditionally been open gas flames. However, the use of gas has major drawbacks: heat distribution is uneven, and it is not possible to dismount an already shrunk frame from the monitor.

But there is a better way, one that removes the disadvantages of gas—induction heating systems. The power rating of the induction system to be used depends on the size of the frame and the monitor. But normally, a rating of 5-20 kW is needed. A low frequency system such as the EFD Induction MINAC 18 is necessary in order to achieve uniform temperature distribution.

When using induction heating for this particular application, it is crucial that the coupling distance on all four sides of the frame be identical. Following successful pre-heating, the tube is automatically immersed and the frame cooled with compressed air. The heating time is 5–25 seconds, depending on the size of the frame and the installed power of the induction system.

Induction heating can also be used for disassembling cathode ray tubes. Moreover, disassembly with induction heating leaves the frames undamaged, meaning they can be re-used. Traditionally, the frames of faulty tubes were mechanically detached and scrapped—a costly problem that induction heating has now solved.



Pre heating shrinking frames: heating time is only 5–25 secs., and disassembly does not destroy the frames.

Hitting our stride in China

In 2002 EFD Induction China began delivering equipment manufactured at our plant in Shangai. Since then we have supplied more than ten made-in Shangai EFD Induction machines. The results so far have exceeded our highest expectations. Customers are delighted, not only with the equipment, but also with the quality of our after-sales service. Indeed, we have already received repeat orders. The strong position gained by EFD Induction China is confirmed by recent orders from automotive sub-suppliers such as GKN, the Waxiang Group and FAW-Koyo.

Chinese demand for EFD Induction MINACs continues to grow. As does demand for our equipment for tube welding. A particularly interesting development is the strong demand for WELDAC welders. This growth has been helped by our ability to make our own supporting units for WELDACs and annealers. This reduces prices for complete units, making us even more competitive.

Our most important order to date—for a 1200 kW WELDAC and three 800 kW annealers—was recently received from the Tianjin Shuangjie Pipe Company. The customer is currently establishing a 24-inch mill in Tianjin province, about 200 km from Beijing. When completed the mill will be the largest of its kind in China—a perfect way for us to prove the suitability of our welders for large mills in China's booming tube industry.

A lifeline for varnished wires

Coils made of varnished copper windings are essential to a vast range of electrical components and appliances, automobile starters and generators being only two examples. What's more, making coils can be a tricky job, as the wires must be perfectly insulated from their housing or magnetic blocks. The costs of less-than-perfect insulation are large. Should current leakage be detected at the final control stage, the entire finished product has to be rejected.

Recently, a French manufacturer decided to install automated, fully insulated control procedures before final assembly. However, to achieve this it is first necessary to ensure that all the varnish on the terminals is burned and easy to brush out—something that only induction heating can guarantee. Today, this customer uses EFD Induction equipment to heat wire ends. This burns the varnish, which is then brushed out. The EFD Induction solution is integrated into a fully automatic line that includes a 100% insulated control system. Scrap and re-working costs have gone down considerably, as faulty parts are now detected well before final assembly.

Above: Heating station for coil terminals, with double solenoid inductor. Below: Coil terminals after heating and brushing; copper wires can be used for insulation tests.

▶ *Crank up the volume!, continued from page 1*

The "Robot Flexible Machine" concept introduced by EFD Induction France has for years been a big hit with automakers. By allowing various types of components (from three cylinder to six cylinder crankshafts) to be processed almost at random, these hardening machines ensure extremely short changeover times. The concept is a major boost for car-makers—particularly those manufacturing "tailor-made" autos with short delivery times—and machines have been delivered in Germany, France, Spain and China.

EFD Induction France is now using its crankshaft hardening know-how for large-component processing. An example is the recent delivery of two hardening machines to TIANRUN Crankshafts Co., a Chinese manufacturer of crankshafts for trucks and heavy-duty vehicles. Each machine has a 250 kW, 3-10 kHz power system and processes 12 crankshafts per hour. The handling system is a "drum" type machine that holds four components. A single hardening head ensures individual hardening of crank pins and main bearings, as well as hardening of "fillets", the radius between pins or bearings and the main crankshaft body.

The TIANRUN contract was won against stiff opposition from international competitors. A key customer demand was compliance with hardness pattern and microstructure specifications—challenges so tough that some competitors gave up at the test stage. The expertise gained in winning the TIANRUN contract is already being put to good use. In fact, EFD Induction France recently won another contract to deliver hardening machines for truly giant crankshafts, all the way up to 4.5 meters long. It is further confirmation, if any were needed, that EFD Induction France is the world leader in developing, making and delivering robot-type hardening equipment for crankshafts.

A helping hand for car manufacturers. A "Robot Flexible Machine" swings into action.

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