hottopics

EFD Induction Heating News No 1, 2006

Heating up the winds of change

Oil crisis… energy crunch… global warming. All of us are aware of the need to find sustainable alternatives to fossil fuels. One of the most promising alternatives is wind. It's clean, it's free, and supplies are unlimited. There's just one problem. How can we harvest it? Fabien Marquies of EFD Induction Germany explains how modern technology extracts energy from the skies—and what EFD Induction is doing to help it.

There's nothing new about wind energy. For millennia mankind has harnessed it to move ships. And, of course, windmills have been grinding grains, pumping water and irrigating fields for centuries. What is new is the prospect of using wind to supply entire cities with electricity—something that's not as far-fetched as it sounds.

For example, according to new figures from the Global Wind Energy Council (an international wind power advocacy organization), 2005 was a record year for the global wind power market. The year saw the installation of 11,769 MW, a 43.4 percent increase over 2004. Worldwide, the total installed wind power capacity now stands at 59,322 MW.

The figures are impressive. But what role, if any, has induction technology played in the promotion of green wind power? To answer that, we first have to examine the structure of a typical modern wind turbine. Basically, a wind turbine consists of tower-mounted rotors which, when turned by the wind, rotate a low-speed shaft that is connected via a gearbox to a high-speed shaft that supports the generator.

To start with, a large bearing is needed in order for the rotors to turn. But not just any bearing will do. Due to heavy loads and punishing torque, the rotor bearing must be custom hardened—something for which our multi-axis hardening solutions are ideal. EFD Induction vertical hardening systems are also perfect for treating the shaft connecting the rotors to the gearbox.

In gear with multi-frequency

The heart of any wind turbine is the gearbox. Here the leisurely turns of the rotor blades are transformed into the approximately 1500 revolutions per minute required by the generator. Traditional hardening technologies cannot deliver uniform hardness patterns to the complex

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Transformer manufacturing comes clean

Have you ever heard of cleaning with induction heating? The transformer manufacturing industry has, and is using EFD Induction equipment to remove electrical insulation varnish from copper lead bundles. EFD Induction's Tom Brown reports from the USA.

Commonly called 'cleaning' in the transformer industry, the removal of insulation varnish has traditionally been done with gas torches or brushes. But transformer manufacturers are now discovering the cost and quality benefits of induction heating, especially the benefits of EFD Induction Minac units equipped with hand-held induction coils.

Minac's hand-held transformers and coils let operators easily heat copper leads at the transformer assembly point. In other words, Minac brings the heat to the transformer windings—a much more practical (and cost-effective) solution than bringing the winding to a stationary induction system.

Minac is superior to traditional cleaning methods in two key areas: heat delivery accuracy and process times. Let's consider heat delivery precision. As is well known, induction is a contact-free and extremely accurate heating method.

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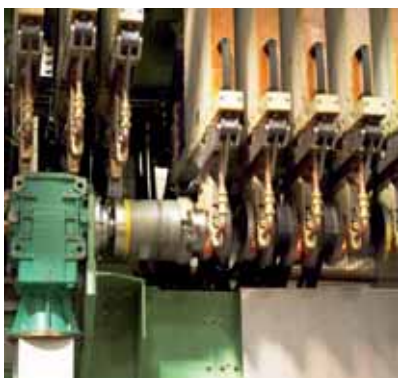
Cranking up productivity at John Deere

When the world's largest manufacturer of agricultural equipment decides to invest in production upgrades, you can be sure it chooses the best solutions on offer. Jean-Pierre del Gobbo has the details on why John Deere selected a crankshaft hardening system from EFD Induction France.



Crankshafts look pretty straightforward. In reality they are complex components, essential in all combustion engines (after all, they translate reciprocating linear piston motion into rotation). And as part of the engine's lubrication circuit, crankshafts play the role of 'heart', spraying oil onto piston pins at a very precisely defined moment in the four-stroke cycle. That's why lubrication holes are drilled through the solid mass of bearings and crank pins.

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Talkline

The smarter heating solution

Induction offers numerous advantages over alternative heating methods. It is more efficient, cleaner and easier to control. And if all that were not enough, induction also improves quality, enhances productivity and makes all the difference to the working environment. Put simply, induction is the smarter way to heat.

At EFD Induction we have decades of experience in practically every industrial heating process. In fact, our induction know-how has been improving quality and boosting competitiveness for customers around the world for the past half century. The key to our success? Treating each customer—and each customer's needs—as unique, and developing unique solutions.

This issue of Hottopics presents a small sample of these solutions. You can read about installations as diverse as large tube welders, crankshaft-hardening machines and manually operated multi-application mobile heaters. You'll also read about exciting technical innovations such as our patented multi frequency concept. And the many ways we can contribute to environmentally sound wind power.

Of course, delivering an induction heating solution means much more than merely delivering machines. Feasibility studies, commissioning, training services and coil and maintenance programs are part and parcel of customized solutions. This is especially true in today's competitive business environment, where such services are essential to maximizing equipment uptime and throughput.

Fortunately, EFD Induction is present around the world. Which means customers, regardless of their location, have easy access to our solutions—something that helps explain the wide geographic spread of the articles in this issue. So, whatever your process, and wherever you are, there's a good chance that EFD Induction can help improve your productivity. Give us a call today, together we can help you put the smarter heat to smarter use.

Elvin Jørgensen, Chief Executive Officer.

EFD® INDUCTION

▶ *Heating up the winds of change, continued from page 1*

geometries of the gears. But EFD Induction's multi frequency hardening solutions can.

Our patented multi frequency technology delivers high and medium frequency power simultaneously to a single induction coil. The proportion, or 'mix' of frequencies can be adjusted at will to match the specific requirements of each workpiece. The result is perfect—and reproducible—contour hardening. (Learn more about our multi-frequency technology on the next page)

EFD Induction hardening systems can also be used for the tooth-by-tooth hardening of the yaw motor. Crucial to the turbine, the yaw motor keeps the rotors turned into the wind. The yaw motor swivels the rotors into the correct position by means of a cam wheel that engages a large yaw bearing mounted on the turbine tower. An electronic controller that is constantly fed data by an anemometer mounted on the nacelle tells the yaw motor when to turn the rotors.

Beyond hardening

EFD Induction's contribution to wind turbines is not limited to component hardening. The generator, for instance, requires brazing, an operation easily performed by our range of mobile Minac induction power systems. Featuring long flexible connector cables and push-trigger hand-held transformers, Minac systems let operators braze even the most difficult-to-reach generator parts.

Moreover, Minac comes in 'twin' versions. These models feature two independent power outputs that can function simultaneously under identical or different operating parameters. And Minac's mobility makes it ideal for on-site repairs and maintenance at wind farms.

Much has been made of the 'green' or 'environmentally friendly' nature of wind turbines. But induction technology has the potential to make this energy source even greener. That's because induction is itself an inherently clean process. It eliminates naked flames (and the resulting smoke and fumes), reduces the need for fuel transports, and promotes safer, healthier work places.

Induction is also energy-efficient. There is none of the massive heat loss associated with ovens and furnaces. In fact, induction and wind power form a 'virtuous circle'—clean electricity from the wind powers induction heating systems that make turbines that generate clean electricity … It's a beautiful partnership, one that EFD Induction is proud to be a part of.

▶ *Cranking up productivity at John Deere, continued from page 1*

Of course, nothing can be left to chance when hardening a component as important as a crankshaft. At the same time, engine manufacturers must control costs and maintain throughput levels. All of these considerations help explain why John Deere has selected an EFD Induction crankshaft hardening system for its production plant near Orleans, France.

The system features a host of exciting technical innovations. To start with, a robot-operated buffer of about 40 parts means non-stop production, even during inductor changeovers. And in a single station, eight hardening heads harden the crank pins and bearings for three, four and six cylinder crankshafts.

Quality control

Another highlight is the robot's role in non-destructive testing. In addition to its 'hands' for gripping crankshafts and positioning them throughout the treatment cycle, the robot features special tooling for checking lubrication holes.

After indexing the component, the robot introduces a needle through the hole to check for any drilling abnormalities. Another tool then controls the chamfers machined at each end of the lubrication holes. The robot identifies any faulty parts and places them on a special exit belt.

The hardening system can treat and quality control up to 32 parts an hour when processing 3 cylinder shafts; 18 parts an hour for 6 cylinders. And the reaction of the world's largest maker of agricultural equipment to its new EFD Induction crankshaft hardening system? To date, John Deere has been delighted with the system—with the quality of the hardened shafts, with our ability to meet customer specifications, and with our lead times.

▶ *Transformer manufacturing comes clean, continued from page 1*

Ramp up times, precise temperatures and hold times can be set in advance. The heat is generated within the material itself in very specific areas. This, of course, minimizes the risk of unwanted heat transfer to adjacent areas and materials.

Then there is induction's superior process speed. Conventional mechanical cleaning such as brushing typically cleans only one lead at a time. Moreover, brushing is abrasive, leading to loss of base material. Induction on the other hand easily cleans entire bundles of leads in one go—and without damaging base materials. With induction, considerably less time and labor is needed to ready copper leads for brazing and/or lug crimping.

The benefits of induction heating don't end with cleaning. Minac, for instance, is incredibly versatile. Simply swap coils, and Minac is ready to take on most brazing jobs. For example, Minac can braze the previously cleaned leads to copper bus work. Induction heating is of course flameless, making it safe and comfortable to work with. Neither does induction need additional consumables—apart from the quenching solution—whereas torch heating requires a gas supply.

In short, induction heating is unrivaled as a means to cost-effectively achieve high quality cleaned and brazed copper components for large electrical transformers. But don't take our word for it. Contact EFD Induction today and let us show you how our systems can boost your productivity.

Airborne air conditioning

What have Augusta of Italy, Stork Fokker of the Netherlands and Eurocopter of France and Germany in common? NHIndustries, the joint venture that makes the revolutionary NH90 helicopter. And guess which heating technology they insist upon for the helicopter's air conditioning assembly?

An NH90 takes to the skies—with a little help from EFD Induction.

There's never been anything like the NH90 helicopter project. The largest initiative of its kind in European history, the project brought together four national governments in an effort to design, make and sell one of the world's most advanced flying machines. The results have been dramatic. Since production was greenlighted in 2000, NHIndustries has received firm orders for 357 machines, and options for a further 86.

Obviously, the NH90 is a prestigious project for any sub-contractor, even one as experienced as David Hart Aerospace Pipes (DHAP), of Salisbury, in southern England. An approved supplier for customers such as BAE, Airbus and Raytheon, DHAP is responsible for the air-conditioning unit assembly for the NH90—a process for which they use an EFD Induction Minac induction heater.

Comments DHAP Managing Director Simon Dootson: "This is actually the first time we've performed induction brazing. But we're extremely pleased with the results. More importantly, so is our customer. Induction delivers the controllability and process repeatability demanded for this project."

Since its foundation in 1999, DHAP has won a reputation for its specialist welding, brazing, soldering and fabrication capabilities. The

customer list has grown too, and now includes Formula One racing teams as well as aircraft manufacturers. Continues Dootson: "Obviously, having the kind of customers we do, product safety is top of the agenda. That's why we have rigorous quality control and testing; something our induction brazing has passed successfully."

Certified to ISO 9001:2000, DHAP boasts pressure testing to 18,000 psi, and level-two NDT penetrant flaw detection. Leak testing on the Minac-brazed air conditioning units is carried out in nitrogen gas at 45 bar. Says Dootson in conclusion: "Induction has certainly speeded up the brazing process, but without compromising quality and safety standards. It's enabled us to contribute to the NH90 project, something all of us here are proud of."

The largest just got cleaner

A cleaner, safer, more comfortable working environment is a more productive, more profitable working environment. Everyone knows this. But not everyone realizes the contribution made by induction technology to better working conditions. Thorleif Steinmoen of EFD Induction Norway reports on how induction heating helped improve operations at Europe's largest aluminum plant.

The past couple of decades have witnessed a revolution in manufacturing industry. Lawmakers, often backed by wide public support, have tightened up worker safety and environmental impact legislation. Corporate leaders too have learned that 'green' manufacturing makes commercial, and not just environmental, sense. Cleaner workplaces boost worker morale, which, in turn, contributes to a healthy bottom line.

A perfect example is the use of induction heaters for heating the stubs on anode rods. Heating of this crucial component is necessary for straightening, heat treatment, and for drying graphite coatings.

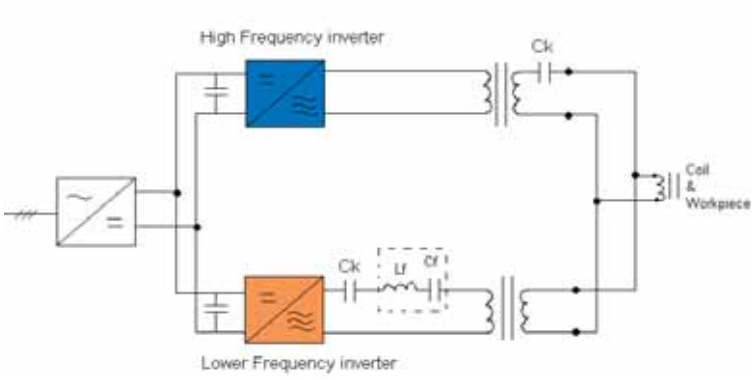
Traditionally, gas heaters have been the heat source, which for many rodding shops has meant noisy, dusty and smoky conditions. Gas heating also requires lots of floor space.

EFD Induction recently helped the Norsk Hydro aluminum plant at Sundal, Norway—Europe's largest—convert to induction heating in the rodding shop. The benefits have been dramatic. Dust, previously a major nuisance due to air turbulence caused by gas, has been eradicated. The risk of damage to the workpiece has been lowered, thanks in part to the low voltage of the induction coil, partly to the precise heat delivery possible with induction. Also, the high overall efficiency of induction saves energy.

The EFD Induction solution, which consists of a high-frequency converter and advanced solid-state technology, delivers 600 kW. It takes less than two minutes to heat a 170 mm stub—all accomplished safely, cleanly and quietly.

No dust, no fumes, no noise. An EFD Induction heater gets to grips with a 170 mm anode stub.

Why tune in to multi frequency?



The history of simultaneous frequencies on a single coil goes back to the late forties. But the full potential of the technology remained untapped until EFD Induction patented its 'Multi Frequency Concept' (MFC). The breakthrough made it possible to use solid-state power supplies equipped with rugged IGBT transistors in full bridge circuits. Such serial compensated power supply ensures automatic matching during the simultaneous delivery of two different frequency ranges to the same induction coil. This then means that the system always operates at optimum output power.

EFD Induction's MFC is particularly suitable for the contour hardening of complex pieces such as gears. An exact mix of high- and medium-frequency power results in perfect heating profiles for even the most complex geometries. The frequency 'blend' is adjusted locally through a microprocessor control system, or remotely through the machine's PLC/CNC system. MFC technology can also be profitably used for quality brazing jobs requiring speedy ramp-up times and variable heating patterns. MFC is available with EFD Induction Sinac heat generators. These generators offer constant mains cos φ and high efficiency, thus minimizing power and water consumption.

Hot fashion

Flexyform manufactures components for women's lingerie and delivers to famous brands such as Playtex, Lou and Sarah Lee. A Minac 6 Twin from EFD Induction helps Flexyform maintain its quality and cost levels.

Another beautiful end result from EFD Induction.

Many bras and corsets are underwired with flexible steel wire that serves two purposes: it shapes the bra to match prevailing fashions; and it makes the bra comfortable to wear. To prevent the wire from damaging the fabrics, both ends are coated with plastic or rilsan.

Flexyform has chosen an EFD Induction Minac 6 Twin to preheat the wire ends prior to coating. The ends are preheated at about 350°C by scanning through two approximately one-meter-long hairpin shaped coils, and then crossing a container of fluidized rilsan powder. The induction coils allow a production rate of thousands of parts per hour. Batches are quite small, 2000 to 5000 parts, as each bra size requires a specific wire length.

Flexyform had previously used infrared technology for preheating. But the Minac 6 Twin solution offers much easier and cheaper maintenance. Also, induction heats the wire first, resulting in much better curing of the rilsan. Infrared is still used for postheating, to smooth the rilsan surface coating.

Big machine, big success

Shanghai-based Baoshan Iron & Steel Company Ltd. is China's largest iron and steel manufacturer. The recent installation of an IGBT-based Weldac and two seam annealing machines enables them to produce a complete range of tubes.

EFD Induction has again proven its market leadership in high-powered solid-state welding equipment. This time it is Baoshan who has chosen to go for an 1800 kW Weldac, the world's largest solid-state welder.

Baoshan has also purchased two 2400 kW seam annealing systems. Each system anneals, quenches and normalizes, and quenches and tempers. The complete system includes six units—all equipped with fully automated orbital tracking to follow the weld seam. It is now up and running successfully at Baoshan, producing tubes up to 24" with wall thicknesses of more than 20 mm.

EFD Induction's Weldac and annealing systems now cover the complete range of tube production, from the smallest to the largest.

Official handing-over ceremony in Baoshan's factory.

On the job for offshore

Welding pipe sections together sounds easy enough. But when the pipe is destined for the tough conditions of North Sea oil and gas fields, post-weld heat treatment is essential. For the past nine years, EFD Induction has been helping pipelines survive in one of the world's harshest environments.

EFD Induction first became involved in the post-weld heat treatment of offshore pipelines in 1997 with a delivery to the Technip Coflexip spool base in Orkanger, Norway. This initial project was followed by a contract for the same customer in the Mexican Gulf. Since then EFD Induction has partnered with Statoil, BP and Exxon on various projects in the North Sea.

Current offshore projects include Statoil's multi-million dollar linking by pipeline of the Skinfaks and Rimfaks satellite oilfields to the large concrete Gullfaks C production platform located 190 km west/north west of Bergen, Norway. The project includes the engineering, fabrication and installation of two parallel 12 km, 10" flowlines and a 4.5 km 8" flowline in water depths of around 140 m. This part of the work has been awarded by Statoil to Subsea 7, one of the world's leading subsea engineering contractors.

EFD Induction's role is to assist with the heat treating of the approximately 2,600 welds involved in the pipelines. Post-weld treatment is needed to relieve stress in the metal caused by the welding, and also to prevent hydrogen cracking in the metal, a common cause of metal failure in subsea environments. The induction system used is a Minac 50 with a closed-loop chiller and a temperature control unit. EFD Induction custom-designed split induction coils for the pipelines, and worked together with the customer on specifying heating cycles.

Avanti!

They say that Rome wasn't built in a day, but of course, it was worth the wait! Well, a similar story can be told about the efforts of Stefano Migliavacca and his colleagues at EFD Induction's Monza office to bring EFD Induction state-of-the-art induction curing systems into the Italian automotive market.

EFD Induction is celebrating. And for good reason: FIAT recently commissioned its first Flex-Coil bonding systems for the closures on the new "Grande Punto" being built in its picturesquely situated plant of Melfi in southern Italy.

Says Mark Wells, EFD Induction's Product Manager for Bonding Systems: "We are so pleased to add the name of FIAT to our list of bonding system customers. FIAT has a proud heritage and as one of the prominent names in the automotive world has been a target client of ours for some time. It's testament to Stefano's hard work to spread the EFD Induction message amongst FIAT and its Tier 1 suppliers that we have arrived at this milestone.

"Induction curing is not new to FIAT but in an age when automotive OEMs are continually striving for better quality and value it's the first time they have specified equipment not manufactured locally. I firmly believe that they chose EFD Induction not only because of our superior technology and process know-how, but because our local support is so strong."

Wells continues, "We know that we haven't 'built Rome' yet, but now we have the foundations to build upon. And based on the results so far of hard work and customer support, I'm more than hopeful that this is the beginning of a very productive relationship."

Perfect Match

As part of a multi-million dollar expansion program, Tubecon of South Africa has purchased a couple of EFD Induction Weldac high-frequency welders. The expansion program will reinforce Tubecon's market position as one of the fastest and most reliable suppliers of hot and cold rolled steel tubing in Southern Africa.

Opting for solid state technology is a result of Tubecon's policy to operate at state-of-the art level, a move that had been postponed until it was evident there was a machine on the market that could guarantee reliable operation under the demanding conditions of frequent product change—and yet maintain high utilization grades.

EFD Induction's Weldac has so far lived up to expectations; while installing and commissioning the machine has been easy and free of problems. In short, the Weldac has delivered the kind of performance Tubecon demands from itself and its suppliers.

The EFD Induction Weldacs supplied to Tubecon feature CAN-bus connections. This means the machines can be easily integrated into the automatic setup systems that Tubecon has developed in-house and installed at its production facility. Here again EFD Induction reflects the flexibility and customer-oriented mode of operation that characterizes Tubecon operations.

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

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

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