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EFD Induction Heating News No 1, 2005

Contents

Earthmoving experience

Caterpillar, Komatsu, JCB, John Deere, Poclain, Clark—they all have two things in common. One, they make large, heavy machines whose case depth, part dimensions and production rates differ radically from those in the automotive industry. Two, they are all customers of EFD Induction, and use the most innovative machines and production solutions available.

Moving mountains is not something one normally associates with induction heating. But for years EFD Induction has been supplying many of the world's leading earthmoving equipment manufacturers with solutions based on induction technology. Along the way we have become experts in this specialized area—particularly in meeting manufacturers' demands for flexible induction machines that combine large power outputs with low frequencies.

The range of earthmoving equipment components treated by EFD Induction is vast. However, the parts generally fall into three groups: components for undercarriages, engines and lifting units. The first group includes track components such as bushings, pins, track shoes, track links and rollers. Other undercarriage parts that we harden with induction solutions include large track shoes (sprockets) that can weigh hundreds of kilos. We also harden final drives.

Hardening components for the second group—the lifting unit—is particularly challenging. That's because of the dimensions involved. Hydraulic cylinders, for example, are often several meters long. EFD Induction also hardens the hundreds of linkage pins commonly needed in one lifting unit.

The third group is made up of engine components. Most of our activity in this area involves the hardening of crankshafts and camshafts, but we also provide hardening solutions for engine blocks, valves, starter rings and cylinder liners. Also, EFD Induction machines have produced millions of injectors.

Tough demands—smart solutions

EFD Induction has pioneered several technical breakthroughs to meet the stringent cost and quality demands set by makers of earthmoving equipment. For example, it was EFD Induction who introduced—and popularized—automatic coil changing for induction machines. We also devised a way to eliminate manual part handling by including induction machines in an automatic Flexible Machining System, and by integrating the common machine tool manufacturing pallet into our solution.

EFD Induction created the first cell ever to use a gantry robot that not only loads and unloads parts onto a vertical scanner, but also changes coils, measures parts and loads the next machine. Moreover, EFD Induction designed

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Complete control —how to get it, how to keep it

Kristian Berggren of EFD Induction Sweden discusses some of the factors that make in-line heat treatment an attractive option.

One of the most powerful arguments in favor of in-line heat treatment is that it gives you complete control over all stages of production. In fact, this is one of the key reasons why in-line induction solutions are well established in high-volume production lines, such as the surface hardening of shafts for the automotive industry.

When the hardening process is fully integrated in-line you and your staff have a full overview of the various processes through which the components have passed. Only then can you keep track of the parameters that shape the final results.

In-line heat treatment also lets you control

Read more on next page ▶

Precision heating

Werner Herbst of EFD Induction Austria explains how precise induction heating is helping a customer part-heat special roofing pliers.

Roofing pliers are an essential tool when handling and shaping sheet metal for roofs, spouts, gutters, etc. At first glance they look deceptively "low-tech." But producing the pliers is a complex process. For example, some parts of the pliers have to be heated no less than six times.

What makes the heating process challenging is the need for accuracy—only specific areas of the workpiece should be heated to forging temperature. Traditional gas heating fails to deliver the necessary precision. But induction is ideal for the job due to its precise heat delivery.

Induction heating is also controllable. The EFD Induction Minac system used by our pliers customers features a microprocessor control. This assures a steady, stable heating process and the desired heat penetration and distribution. Moreover, with Minac the heating

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Talkline

News and views from EFD Induction

The purchase of induction heating equipment is an important decision for any company. After all, it is a strategic investment with long-term implications. Despite this, many companies focus on the price tag when choosing their induction equipment vendor. But making price the sole, or main, criterion when choosing a seller can have serious consequences over time.

For example, does the 'lower' price include preventive and corrective maintenance? What about commissioning? Is training included? What about excessive water, energy and parts consumption? Will you receive after-sales support—and will it be based on in-depth knowledge of your particular processes and applications? All too often an attractive price tag disguises unforeseen and substantial long-term costs.

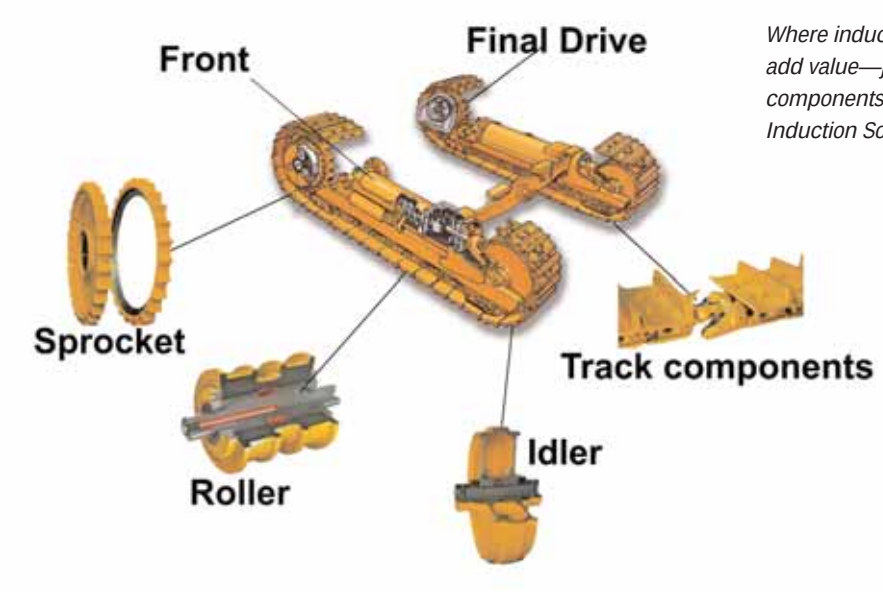
A truly effective purchasing process does not focus solely on price. Instead, it evaluates the total cost and return on investment over an extended period of time. By total cost is meant all the direct and indirect costs (purchase price, maintenance, utilities, labor, etc.) during the equipment's lifecycle.

A sound buying process also examines the value-generating potential of the planned equipment purchase. The questions to be asked here include: Will the equipment boost my overall efficiency? Will it improve throughput? Can it enhance product quality? Is the equipment flexible, can I adapt it to new and/or different processes? Will it lower labor costs? Will it make me money?

Answering the questions above not only helps ensure you choose the right equipment, it helps ensure you choose the right vendor—a partner who understands your business and technical realities. Unfortunately, answering the questions also takes time, and sometimes, specialist financial expertise. So it's understandable if some companies—particularly smaller firms—shy away from the task. But there is an easier way. At EFD Induction we can work closely together with you to develop a cost-benefit analysis for your planned equipment purchase. It's really not much more complicated than that. We look forward to hearing from you.

EFD® INDUCTION

▶ *Earthmoving experience, continued from page 1*



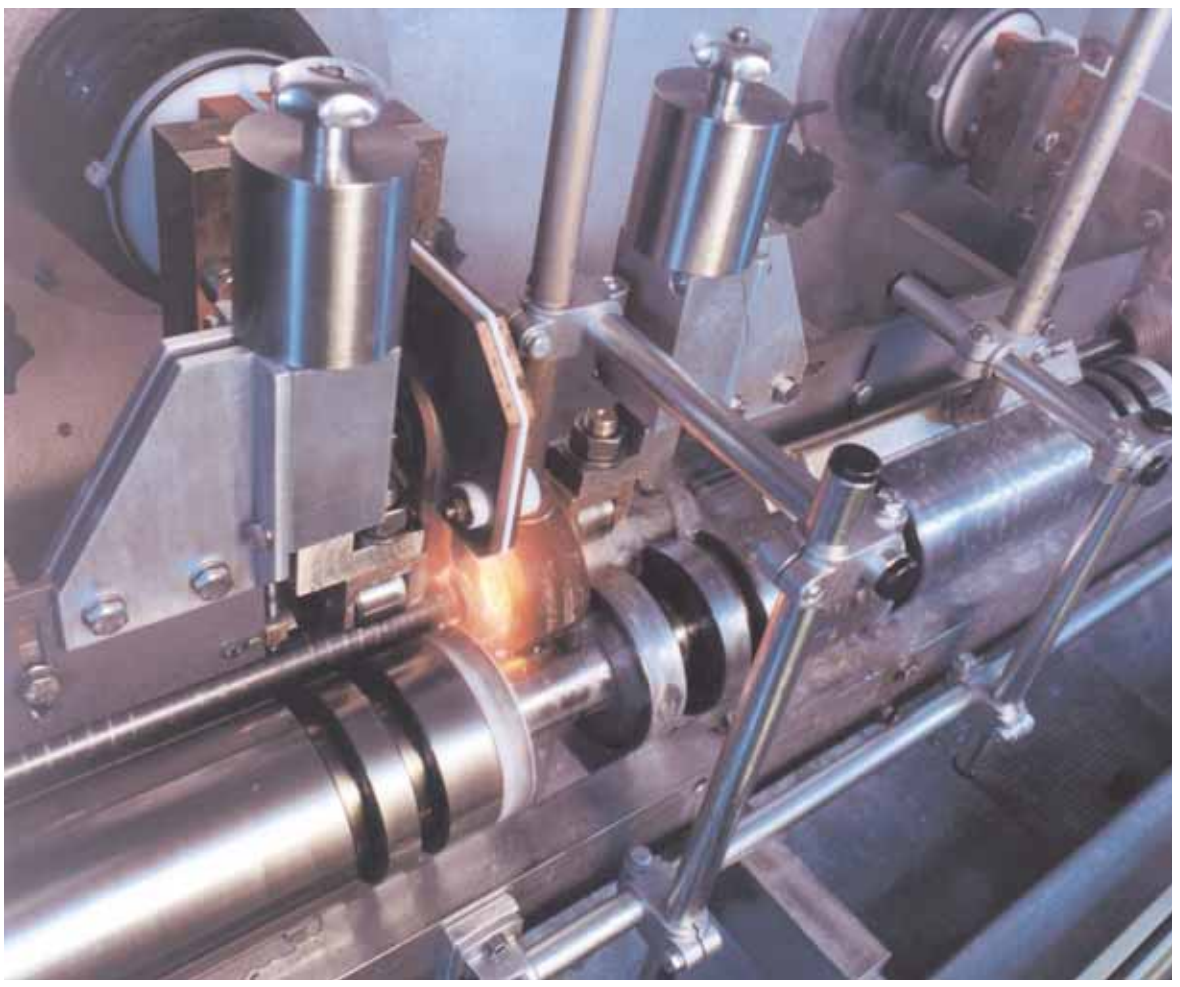
Where induction heating can add value—just some of the components treated by EFD Induction Solutions.

large production cells for sprockets. Our other technical innovations include multiple axis machines for large piston rods (quality demands when heat treating piston rods for heavy equipment are extremely tough due to the high cost of the component).

A common demand from heavy equipment makers is for solutions that provide operational flexibility. EFD Induction has responded with innovations that help manufacturers achieve desired quality at low costs. Take our large induction machines for sprockets, for example. The same machine can perform single-shot hardening at high power. But its multiple-axis coil positioning capability means it can also perform tooth-by-tooth hardening.

So the next time you see an earthmover in action, chances are that many of its components have been heat treated by EFD Induction machines. And it doesn't matter where in the world you are. Because as Europe's number one—and the world's number two—provider of induction heating solutions, we have staff, representatives and facilities dotted around the globe. If making earthmoving equipment is your business, contact us today to learn more about us. You make the machines that move mountains. We move heaven and earth to help you.

▶ *Complete control—how to get it, how to keep it, continued from page 1*



In-line heat treatment in action: integrated hardening and tempering of piston rods in a horizontal centerless machine.

costs. An in-line solution simplifies business processes and administration. Logistics become smoother. Moreover, lead times are reduced, often spectacularly. In addition, in-line heat treatment helps reduce the environmental impact of your operation. Heavy transports are reduced. The environmental benefits are even greater should the treatment process be changed from energy-intensive carburizing.

The benefits of in-line heat treatment are impressive, but how exactly do you go about achieving them? A good place to start is your nearest EFD Induction representative. Give him a call or drop him a line—together you can devise your very own in-line heat treatment solution.

▶ *Precision control, continued from page 1*

process is repeatable. Ramp-up and dwell times, temperatures, penetration, etc. can be repeated over and over again.

The precision, control and repeatability of induction not only assure quality, they also boost productivity. Throughput rates and treatment times are known in advance. Also, induction heating leads to a comfortable, productive working environment. Radiant heat, unlike that produced by gas furnaces, is negligible.

Finally, induction heating can be customized to specific needs and conditions. A good example is the customized induction coils we—together with the customer—developed for treating the pliers. Extensive testing resulted in a coil specially designed for this customer's application. It also resulted in a coil that delivers the best possible quality at the lowest cost.

Straight to water

Most landlubbers don't know it, but the straightening of welded deck and bulkhead plates is a crucial task in modern shipbuilding. It's also a task that EFD Induction has been making easier and more cost-efficient for the past quarter of a century.

In 1981, EFD Induction delivered its first induction-based straightening system to the shipbuilding industry. Things have changed a lot since then. For a start, straightening systems based on induction heating have become smaller, lighter, easier to use, more mobile and more efficient. Second, EFD Induction has supplied its straightening systems to shipbuilders around the world.

One such shipbuilder that recently took delivery of EFD Induction straightening equipment is Fincantieri. With eight shipyards in Italy, Fincantieri is one of the world's major shipbuilders, and as a builder of vessels for the Italian Navy, one that has to meet extremely tough cost and quality demands.

In fact, it is Fincantieri's yard at Riva Trigoso in northwest Italy—a yard that mainly builds naval vessels—that recently acquired an EFD Induction TERAC 30 straightening system. The company had already used TERAC 30 at its largest yard in Monfalcone, northeast Italy. A 750,000 sq. meter facility, Monfalcone specializes in building cruise vessels (Fincantieri builds ships for some of the world's most prestigious cruise operators: Cunard, P&O, Holland America Line, Disney Cruise Line, Carnival Corporation, etc.).

EFD Induction is not, however, limited to just cruise vessel and naval shipyards. Consider the yacht-making industry. Here, the widespread use of aluminum plates for superstructure and hulls rules out traditional gas-flame straightening. But EFD Induction's TERAC 20 system is specially designed for aluminum, meaning yacht makers too can benefit from induction straightening.

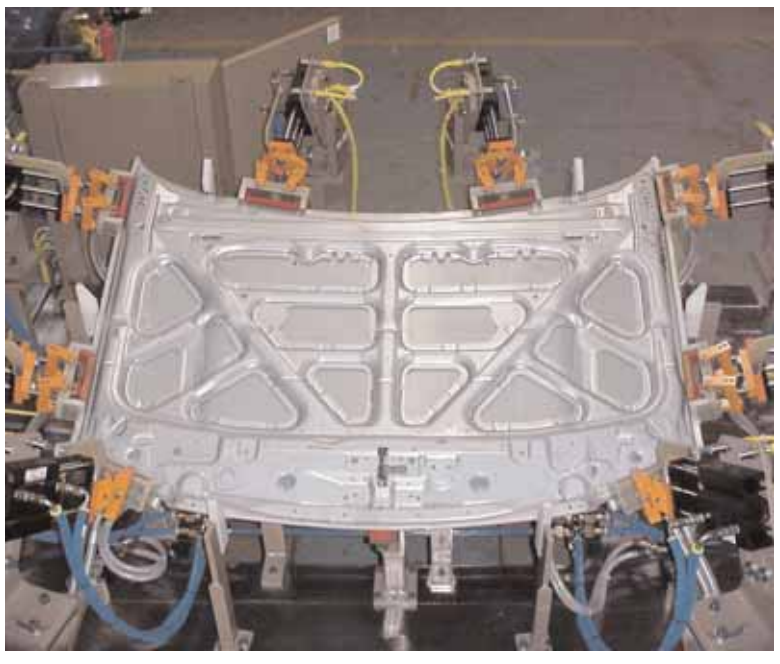
A star is born—the magnificent Carnival Valor under construction in Fincantieri's yard in Monfalcone.

Building bonds with Jaguar

As one of the world's most quality-conscious carmakers, few are as choosy about their partners as Jaguar. So EFD Induction UK is particularly proud to report on their ongoing collaboration with the legendary auto marque.

Staff at EFD Induction UK have enjoyed a long working relationship with Jaguar cars. In fact, since providing an award-winning solution for the XJ saloon of the nineties, our L-Coil®, and latterly, U-Coil® systems have been chosen by Jaguar engineers for every subsequent new model.

Like many automakers, Jaguar has long used structural in-hem adhesives, which are pre-cured by induction heating equipment immediately after hemming. This provides handling strength and dimensional stability prior to the adhesive reaching full strength during the paint process.



A reliable, high-strength, zero-distortion solution for demanding customers: Spot-bonding a hood with U-coils.

Where Jaguar differs from some European manufacturers is its preference for Spot-Bonding® as opposed to full-ring systems. The spot-bonding principle is to provide sufficient strength to maintain geometry, but with a lower energy input to the component to reduce the potential for distortion. The lower energy input also allows faster cooling of the heated areas.

Spot-bonding has, however, proven problematical in the past. This was due to the potential for temperature variations caused by panel condition changes and panel deformation during heating (particularly with aluminum). These temperature variations resulted in reduced strength and increased distortion—the degree of which depended on the temperature change.

Considerable savings

The introduction in 1999 of the U–Coil addressed the limitations of spot-bonding by ensuring that inner and outer panels are heated simultaneously. Also, the self-aligning coil 'head' allows the coil/panel relationship to be maintained, even in the event of panel differences or movement while heating. The extra cost of moving the coils into position was somewhat offset by the cost of the clamps that were no longer needed to maintain panel/shape position. Tooling costs, too, were much reduced. Actual savings in the form of less downtime and re-working far outweigh the initial increase.

The Jaguar X400 (X Type) body shop in Halewood, England, has U-Coil spot-bonding systems for curing closure panels. The systems have delivered a reliable, high-strength, zero distortion process since commissioning and setup of pre-production panels in the summer of 2000.

But it was the move of Jaguar's Castle Bromwich facility towards aluminum body and closure construction that really highlighted the benefits of U-Coil. Aluminum hoods and truck lids are now heated on table type tools, and the aluminum doors of the X350 (XJ) are heated while on the cell output conveyors—with considerable savings in tooling costs and floor space requirements.

Open minds

Mark Wells, EFD Induction UK Product Manager for Bonding Systems, comments: "The growing use of adhesives in the automotive industry, plus ever-decreasing cycle times, underscores the need for robust, flexible curing processes. Our product improvements are the direct result of working with customers such as Jaguar. Their innovative hem-bonding processes are the successful result of a team built by Jaguar engineers who had the open-mindedness to encourage freethinking input from their selected partners. They also had confidence in the team's ability to provide solutions that have taken a once troublesome pre-curing process to new levels of performance."

Die hard!

It's a well-known fact that all dies used in the automotive industry have to be hardened. It's also well known that traditional gas heating is slow, difficult and inefficient. But there is another way. Alessandro Mariani of EFD Induction Italy discusses the technology—and the benefits—of induction hardening.

Surface hardening of dies is essential, not only when producing new dies, but also following repair welding. However, traditional hardening methods—which use gas flames as the heat source—are notoriously slow, costly and difficult.

The drawbacks of gas flames affect virtually every aspect of the hardening process. Controllability, for example, is limited. It is difficult to maintain the correct temperatures, and to deliver the heat to just those parts that require heating. And, of course, it is practically impossible to repeat the heating process accurately.

With gas heating, the flames obscure the heating zones, making it impossible for operators to get a clear view. Also, gas flames produce toxic gases, and by raising the ambient temperature, make the working environment uncomfortable—and less productive.

So what can be done? One solution is to modify an EFD Induction Minac 18 converter, and harden the dies with induction heating. This method provides all the benefits associated with induction: quick heating, precise heat delivery, accurate repeatability, minimal deformation, comfortable working environment, visible heating zones, fast pre-heating for repair welding, etc.

But using a Minac 18 brings other benefits. Mobility is one of them. Using a special carriage, the Minac, together with its chiller and external control unit (ECU), can be moved within, and between, workshops and factories. This allows in-situ repairs, and means an end to the costly and difficult problem of moving large dies. The Minac is easy to use, too. The operator need only glance at an LED display to ensure the heat in the workpiece is correct.

To maximize efficiency, the coils—the component that actually delivers the heat to the workpiece—can be customized for specific dies. And since coils always remain cold, they can easily and quickly be changed, thus allowing the operator to treat different dies with minimal disruption.

Quick, precise, repeatable. An EFD Induction solution ensures minimal deformation and a more comfortable working environment when hardening dies.

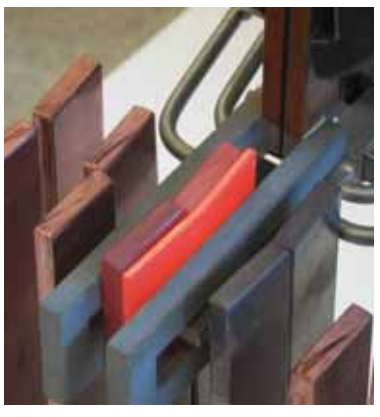
Winds of change

EFD Induction Spain already supplies induction solutions to many of the Iberian Peninsula's leading automotive, electrical and engineering companies. But it recently opened a new chapter with the delivery of three EFD Induction Minac induction converters to Spain's two main manufacturers of wind-power turbines.

Cantarey Reinosa S.A., a member of the Gamesa Eólica Group, one of the world's leading wind turbine makers, took delivery of a Minac 18/25 and a Minac 25/40. The converters, which were successfully installed at Cantarey Reinosa's facility earlier this year, are being used to braze rotor windings and stators for turbines capable of producing 1.5 to 2 MW.

The other delivery, of a Minac 50/80, was to M. Torres Diseños Industriales S.A., a major specialist engineering company based in Navarre, northeast Spain. The Minac 50/80 was installed in October, and is used to braze components for 3-MW wind turbines.

Says Juan-Miguel Escolar of EFD Induction Spain: "We're always proud to deliver our solutions. But we're extra proud to be partners for these two major companies, both of which have outstanding international reputations for quality and innovation."



Adding a fresh wind to clean, green energy—EFD Induction at work treating wind-power turbines.

New presence in Mexico

EFD Induction Incorporated, based in Madison Heights, Michigan, has appointed Rodolfo Alanis Applebaum and his company, Rofaco S.A. de C.V., as their representative in Mexico. Applebaum will focus on the sale and support of EFD Induction's new high-output Weldac G2 welders and Seamac seam annealers for the tube and pipe industry. Applebaum has more than 17 years' experience, and is already prominent in this market through his associations with other leading OEMs.

To further improve response times and support for our Mexican customers, EFD Induction plans to warehouse critical spares in Rofaco's Monterrey facility in northeast Mexico. There are also plans to offer equipment service from the same location. EFD Induction is confident that Rofaco, working closely together with technical and service support personnel from Madison Heights, will prove a major boost to our customers throughout Mexico.

Peak performance from Minac

EFD Induction prides itself on being a pioneer in finding new, exciting applications for induction heating. A textbook example is the recent delivery by EFD Induction France of a Minac 6 Twin to SNR (Société Nouvelle de Roulements), one of the world's leading bearing manufacturers.

The delivery itself isn't special, EFD Induction has been delivering equipment to SNR for years. What is special, is that the Minac 6 is being used to simulate the heat stresses on automobile wheels caused by descending Mont Ventoux, a 1910-meter high peak in the French Alps.

Jean-Pierre del Gobbo of EFD Induction France explains: "Mont Ventoux is more than a spectacular mountain—its grueling slopes make it one of the toughest stages in the Tour de France. They also make it a favorite testing ground for automakers, who use the peak to test the effects of severe braking on car wheels and braking systems."

The Minac 6 Twin is being used by SNR as part of a major initiative to find ways of improving the safety and quality of automobile wheel hubs. Adds del Gobbo: "SNR is a valued customer who for years has used our equipment for forging, tempering and hardening. We're delighted to help SNR with this unusual, but crucial, application."

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