METAL

A MAGAZINE ABOUT METAL FABRICATION FROM **ABB** MAY 2006

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ROBOTICS

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ABB Robotics

721 68 Västerås, Sweden
Tel. +46 21 325 000
e-mail: abb.robotics@se.abb.com
www.abb.com/robotics
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Editorial

On quality and simplicity

> For those of us working in the metal fabrication industry, it isn't news that our world is rapidly changing. New markets are opening up, and new technologies are expanding what is possible for companies whose products require applications such as arc-welding and forming of metal.

For the past four months, I've been taking a whirlwind tour of the world – Europe, Asia and America – to see first-hand how things are shaping up when it comes to metal fabrication. What has surprised me is what I have seen in China – and India, which may get attention for its IT development but is also focused on metal fabrication industry. In these countries, rather than using robots to improve the process and efficiency as we have seen in Europe, America and Japan, robots are being used to ensure quality in a way that hand manufacturing cannot compete with, even where labor costs are extremely low.

Meanwhile, in countries with more established markets, what I've seen is the slow disappearance of highly skilled labor – there are few workers left who are truly experts when it comes to arc-welding done manually, for example. What is needed here are plug-and-play robotic systems with easy-to-use software that can be operated without extensive training. And companies that provide the robots need to fill the knowledge gap left by the disappearance of skilled metal workers. Which is exactly what ABB is doing, working with partners and system integrators to provide user-friendly cutting-edge solutions and innovative programs such as our arc-welding centers and regular partner days devoted to specific applications within the metal fabrication industry.

With this first issue of *Metal Fab* magazine, we aim to show you not just trends affecting the industry, but a range of companies applying real-life robotics solution to metal fabrication. You may just find something that will inspire you to completely change how you do your job.

Dominique Liuzzo
Segment Manager, Metal Fabrication
ABB Robotics

Calendar

Lamiera
May 10 – 13 2006
Bologna, Italy

Weldex 2006
May 16 – 18, 2006
Birmingham, U.K.

Automatica
May 16 – 19, 2006
Munich, Germany

Eastech
May 23 – 25, 2006
W Springfield, MA USA

Beijing Essen Welding & Cutting 2006
May 16 – 19, 2006
Beijing, China

IMTS
September 6 – 13, 2006
Chicago, USA

Weldexpo
September 26 – 28, 2006
Toronto, Canada

Euroblech
October 24 – 28
Hannover 24-28, 2006

Fab Tech AWS
October 31 – November 2nd, 2006
Chicago, IL USA

EMAF
November 14 – 18, 2006
Porto, Portugal

New center
specializing in arc welding

In the autumn, ABB will open its doors to a highly anticipated new feature when the European Welding Technology Center in Friedberg outside Frankfurt, Germany, is inaugurated. The strength of ABB's entire offering will be enhanced even further for employees and customers.

> During the preliminary stage, the European Welding Technology Center, WTC, will mainly serve as a training and demonstration center for ABB's employees, such as sellers, support staff, application experts and customer service. Rainer Uhlig, Head of the Arc Welding Task Force, emphasizes that it will be a win-win situation where all employees who have customer contact will obtain additional knowledge of the total technological solutions and knowledge offered by ABB.

"The opportunity to see and test our products contributes to enhancing our employees' sense of pride in our offering and to our solutions being a natural focus for all discussions with our customers. We have adopted the motto of 'we must be proud of our products and solutions', and I believe that the WTC will play a decisive role in our efforts to follow this motto."

Several countries contributed to financing the project and the WTC is now housed in ABB's existing premises in Friedberg. The center will initially comprise two robot cells, and the focus will be on arc welding.

"By using standardized cells at the center, we will link together our robots and offline-products. We are now able to show customer solutions in, for example, virtual format. We call this overall perspective Cycle of Automation Success, that is the combination of RobotStudio, production solutions and WebWare."

"WTC will be officially opened in October but well-developed plans are already in place for training sessions and demonstrations, for employees as well as customers and partners" explains Rainer Uhlig.

Behind the planning of the new center is ABB's Global Task Force, which during the winter and spring has worked extensively with preparations for both the WTC and a new manufacturing center in the Czech Republic.

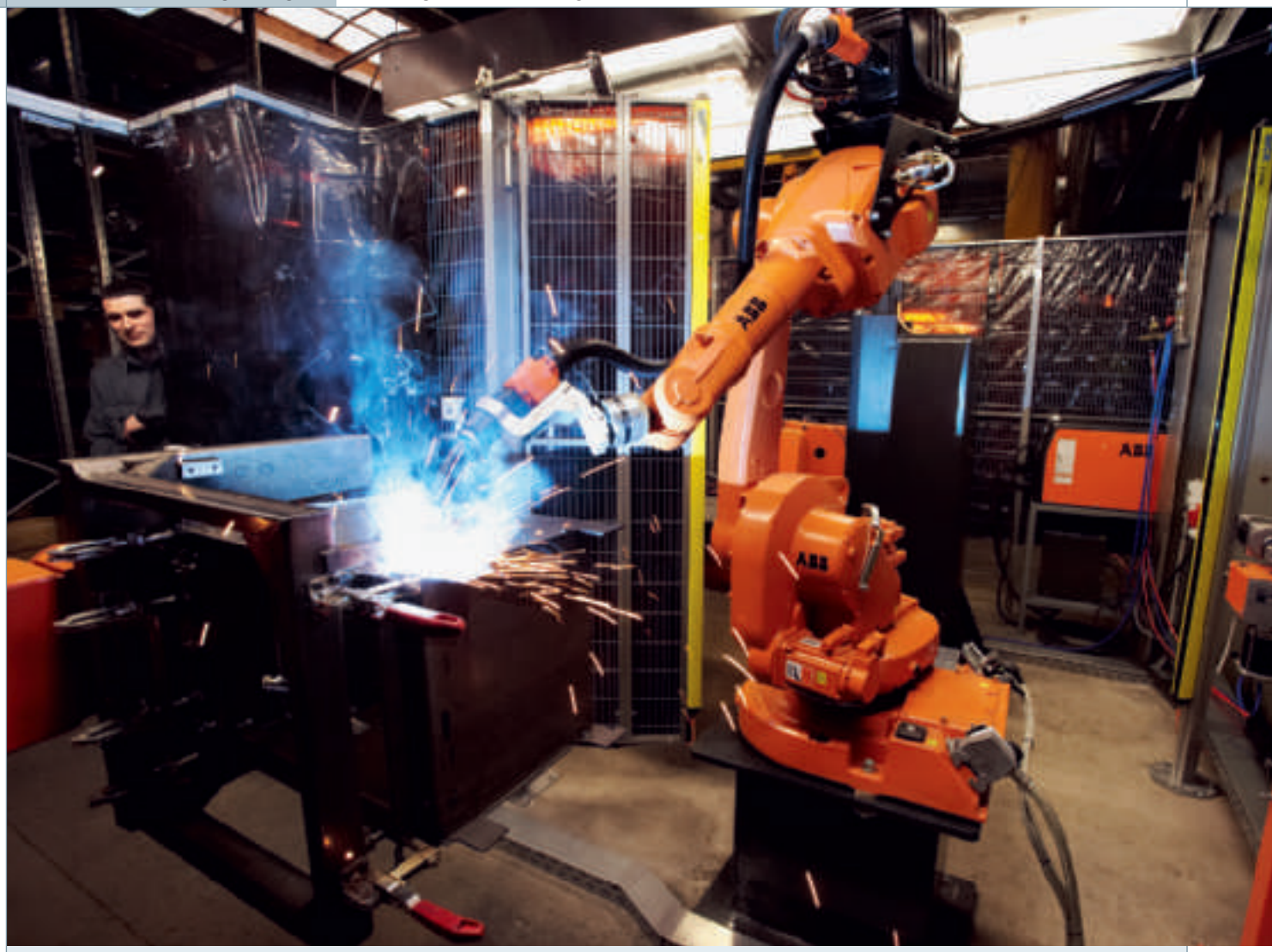
New MigRob 500
Improves productivity in welding

ABB introduces the latest generation of integrated inverter power sources (IGBT) – the MigRob 500, designed specifically for the robotic MIG/MAG welding of all materials used in metal fabrication industries today.

> The MigRob 500 supports robotic short arc, spray arc, pulsed arc and high-speed welding (rapid arc), and includes ABB's SuperPulse technology. Digital communication between the power source and robot controller provides excellent welding properties with a minimum of spatter, even at high welding speeds. The MigRob 500 weighs 66 kg and has a permissible load at MIG/MAG of 500A/39V - at 60% duty cycle - and 400A/34V, at 100% load cycle.

Both the power source and the robot controller are set up via the robot FlexPendant, using intuitive icons. Welding data, such as voltage and current data as well as error messages from the power source, is displayed on the robot FlexPendant. Three hundred ready-to-use synergic welding lines allow for easy setup and operation.

SuperPulse is a software-based low-frequency pulsing between two complete weld schedules, providing excellent welding results. This is, among other things, useful when welding on more demanding materials as well as for MIG Brazing.



One problem with manual welding is the akward working positions. The new system is designed to suit the operator's work.

Text: Martin Neander
Photos: Magnus Torle

The comfy route to cozy stoves

Providing coziness through exclusive wood-burning and gas stoves has been Krog Iversen's forte for almost 30 years. Lately, producing the stoves has also become much more comfortable, thanks to an ABB robot system.

> In the past few years, wood-burning and gas stoves have become more than strictly a means of providing heat; they have become a valued part of home décor. This trend has benefited Danish stove manufacturer Krog Iversen. Today the company's products are targeted to customers who also buy such high-end products as Bang & Olufsen gadgetry.

Krog Iversen started to manufacture wood-burning and gas stoves in 1978, just after a

A TSC, Torch Service Center, with BullsEye-precision is a valuable feature in Krog Iversen's new robot system for automatic welding.

major international oil crisis, and founder Henning Krog Iversen saw a great demand for alternative heating sources. Krog Iversen's SCAN stoves reflect the sleek Danish design tradition. Some 80 percent of the company's stoves are exported. Markets are diverse, including countries such as Japan, South Africa and the United States. The largest markets are the Nordic countries and Germany.

Environmental compatibility has long been important to Krog Iversen, and the company has been able to take advantage of the increasingly strict worldwide environmental regulations. "Our products are designed to minimize emissions," says Henning Krog Iversen. "We're also very interested in creating the best possible internal working environments at our plants."

This is where an ABB robot system for automatic welding of Krog Iversen's insert stoves comes in. At the beginning of February 2006, Danish ABB partner DanRob installed a new robot system at Krog Iversen's Vissenbjerg factory, including an IBB 1600 robot, two 250A manipulators, a MigRob 500, a TSC with BullsEye and an A316 wire feeder, operator panel and safety system.

>FACTS

Benefits for Krog Iversen with automatic welding

- Enables increased production.
- Offers optimal working positions for operators.
- Provides a more even and smoother welding of higher quality.

The robot system delivery from ABB in Västerås, Sweden, came with standard components; DanRob designed the fixtures and the complete system layout. DanRob also provided a 3-D tool for the robot studio layout. The company continues to offer Krog Iversen support and customized logistics, including robot components, through a service contract.

"About 10 years ago, ABB delivered the first robot system to Krog Iversen," says Frede Lysemose, sales and marketing manager at DanRob. "There's a very good relationship between the two companies, and DanRob has been able to install the new system, which will assist in welding four kinds of SCAN insert stoves."

>

"We're also very interested in creating the best possible internal working environments at our plants."

Henning Krog Iversen

DanRob has also provided the IRC5 software to control the new robot system.

"It's quite user-friendly in terms of employing different commands," says Henrik Jørgensen, software programmer at Krog Iversen.

Henning Krog Iversen says that apart from expectations that the new automatic ABB robot system will be able to produce more stoves (compared with the ones produced through manual welding), he also sees that it can offer optimal working positions for system operators.

"One problem with manual welding has been the awkward working positions," Krog Iversen says. "In the new ABB robot system, the manipulator is designed to suit the operator's work."

Krog Iversen specifically asked DanRob to ensure that the robot manipulator could be adjusted to the optimum level for each operator using it to put welded stoves on the loading pallets for delivery.

"We've implemented a way to raise and lower the manipulator, which can also be moved in sideways directions," Lysemose explains. "In this way, it's adapted to operator requirements in terms of working positions."

According to René Hannibaldsen, Krog Iversen's technical manager at the Vissenbjerg plant, it was crucial that the operator's working position be taken into consideration.

"We're very satisfied that ABB and DanRob didn't deliver a standard robot set, but rather a special solution tailor-made for us," Hannibaldsen says. "Whether we have tall or short persons operating the robot system, they can each have a comfortable working position. The robot is programmed to stop the manipulator in user-friendly positions, so the operator can decide in the programming the height from which the stove should be delivered to the loading pallet. Without doubt, this will save many problems with strained necks, shoulders and backs."

Previously, in the manual welding process, the stoves were put on a lift table that could only be operated in up and down motions. This led to unwieldy ways of welding the stoves.

"This new robot system allows us to carry out cross operations, as there are two manipulators that can weld the stoves at the same time," Hannibaldsen explains "Because the welding is automatic, it also provides a more even and smoother welding of higher quality than the manual one." ⊙

René Hannibaldsen (left) demonstrates how two manipulators allow for cross operations.

>FACTS

Krog Iversen

Krog Iversen & Co. A/S is situated in the small town of Vissenbjerg on Denmark's Funen Island. It has 225 employees working in two plants, making it one of the most important employers in the area.

In 2005, Norwegian company Jøtul AS made an agreement with Krog Iversen to acquire the companies that manufacture and distribute stove and fireplace products under the trademarks SCAN, SCAN DSA, SCAN Andersen and KAVANI steel chimneys from the Danish Krog Iversen family.

Text and photos: Dwight Cendrowski

A smooth ride with the Cadillac of robots

Wolf Robotic's 110,000-square-foot plant is nestled at the base of the spectacular Rocky Mountains in Fort Collins, Colorado. From here, Wolf Robotics designs, builds and installs heavy welding installations for large companies throughout North America. The welding system of choice is an integral part of Wolf's history.

> Wolf Robotics develops welding stations using the latest technology for customers that range from Caterpillar and Deere-Hitachi to the venerable motorcycle maker Harley-Davidson. From the time the company first used robots in its installations in 1976, its only robot supplier has been ABB. "We've grown up with them," says Marketing Coordinator Chuck Boyer. "They're kind of like our parents." In fact, before 2003, when Wolf Robotics became a part of the Rimrock Corporation, it had been a part of ABB's welding system division for 10 years.

However, Wolf doesn't stay with ABB just for sentimental reasons, says Boyer. "We think the ABB is the Cadillac of robots out there." Marketing Manager Chris Norris agrees. He sees customers using their systems with ABB robots for many years. "It's an integral part of the system in regard to the heavy welding tools and the adaptive capability. If you look at the install >

Gordon Wolschlager with the handheld controller, or teach pendant, unique to ABB.

base of the ABB, you're going to see customers with systems with hundreds of thousands of hours on a 20-year-old or older product."

Walking through Wolf's spacious, well-lit plant, Boyer points out details of the six separate customer installations at various stages of construction, from initial setups to those such as a large Caterpillar assembly being disassembled for delivery. These are MIG welding applications, where metals are fused together by a high-voltage electrical arc while a filler wire is fed into the arc for added strength. Host setups are fully enclosed, with walls and a hood that keep the bright arc light, smoke and contaminants away from the operator. The fencing or walls also keep the operator safe by preventing accidental contact with the robot.

Wolf uses four sizes of ABB robots in its projects, from the diminutive IRB 140 to the larger 4400, which handles loads of up to 132 pounds. Every installation is customized and built from the ground up. And key to every one is the ABB robot and controllers.

"We are not a low-cost provider," says Norris, "We think we provide our customers with the most value, and we've got very good customer loyalty. If you look at what we have, it isn't going to be 'robot in a box.'" Moreover, as a high-end provider of welding workstations, Wolf needs high-quality robots at the core.

After months of work building the cell for Caterpillar, workers this day are dismantling it for shipment and installation. Taking a break from this work, assembly technician Norris Samuelson offers his opinion of the ABB components. "They're really easy to work on," he says. "The cabinets are easy to wire and troubleshoot. If you get a short, with ABB's documentation, it's not hard to follow it down the line."

The handheld controllers or teach pendants that operators use to guide the robot feature an ABB-patented joystick that no one else in the industry is using. Customers like it, as do the children in school groups that occasionally tour the Wolf plant. Boyer laughs as he describes talking to youngsters about their video game expertise. "Future robot techs here," he says. "You're good with the joy sticks, and you're going to catch right on with our robots."

Operations Manager Darren Pape is checking a job in the plant, and he points out an older robot among the projects. Wolf is refurbishing the system, adding software updates. But the robot itself, while gritty from use, is still going strong.

Wolf employees are proud of the level of service they provide. It's an integral part of their success, according to Terry Merrifield, customer support manager. "We've got the best customer support engineers in the industry," he says. "They get training in programming, electrical, mechanical, tear-down and advanced heavy welding tools."

An important ABB product that lets Wolf give added value to its customers is simulation and off-line programming software called RobotStudio. After a customer sends a CAD drawing of the part to be welded, the off-line 3D modeling software enables Wolf engineers

Terry Merrifield and Chris Norris explain why Wolf needs high end robots: "We provide our customers with the most value."

Darren Pape appreciates the competitive edge offered by RobotStudio.

"There's a manpower shortage in the welding industry that's going to hit in about four years."

Chuck Boyer

to develop and evaluate a welding program for the part. "It's a really good program," says Boyer. "It will provide an accurate time cycle that lets us go back to the customer and say 'We can weld that in x number of minutes.' And after we sell the system, we also sell the RobotStudio to them so they can also use it to program parts in the future." It's a proven time saver on the production floor. Says Darren Pape, "It's more advanced than competitors' products, and we're probably the best user of it in the U.S. It's become more and more standard on these larger systems."

Another advanced ABB product Wolf uses to add value for its customers is the BullsEye. Looking much like a horseshoe, the unit uses an infrared light to let the robot continually calibrate itself and adjust its tool center point, greatly reducing downtime.

Wolf takes products such as the BullsEye and RobotStudio and customizes them to solve customer problems. It's teamwork, notes Pape. "Our niche and expertise is heavy welding. So it's a combination of the ABB capabilities in heavy welding tracking, the multiple seam paths and our knowledge and expertise in applying and enhancing it."

Robotic welding systems have been used for many years in heavy industry, and they form the core of Wolf's business. Smaller manufacturers, however, can be a tougher sell. Many of these "mom and pop" shops haven't seen as much need to automate, but they may be forced into change. "It's coming to a head pretty quick here," says Boyer. "There's a manpower shortage in the welding industry that's going to hit in about four years. People don't want to be welders. It's a dirty job, not the computer job everyone wants today." Reports state that by 2010, through retirements, the industry is going to be losing as many as 200,000 jobs, and newcomers are not lining up to fill those jobs. Boyer notes, "When we first started selling robots we thought we would come up against people protesting, 'Hey, robots are putting people out of their jobs.' But that's never been a problem, because nobody wants the jobs."

Also on the horizon is the newer technology of laser welding. Robots continue to spare workers from the most dangerous jobs, handling the most difficult and demanding applications, often in the most contaminated environments. And Wolf Robotics, backed by ABB, is there to provide answers to its customers' welding challenges. ⊙

>FACTS

A very special installation

A large welding installation for Caterpillar typifies the type of industrial applications built by Wolf Robotics. The parts being welded are for off-road construction vehicles. The setup includes:

- ABB IRB 4400 robot with S4Cplus controller
- 5,000-pound-capacity drop center positioner
- 30-foot robot track system
- 16-foot-tall column with robot mounted on a vertical lift arm
- BullsEye calibration unit, torch cleaner assembly, Advanced Weld Control (AWC) sensor and tandem wire Fronius welding power source and welding torch
- ABB RAPID robot programming language and ArcWare software.

For comparison, two different parts welded by this system measure 6 feet wide by 4 feet high and up to 8 feet in length. Each part can be welded in four hours by robot, but welding by hand would take 6.7 hours for one part, and 11 hours for the other.

Cindy Hartman and Don Hogue are proud over Wolf's level of service, and of its integral part in the company's success.

Text: Henrik Karlsson
Photos: Carl Johan Ericson and SSAB

The world chooses WELDOX

Construction steel for really hard demands

SSAB in Oxelösund produces the world's highest strength construction steel. WELDOX is light, but nonetheless strong, which makes it optimal for today's cranes. This makes it a huge export success.

> At SSAB, attempts to satisfy the apparently insatiable steel market are in full swing. The record growth in China and the general boom is pressing demand to even greater heights. A walk along the gigantic warehouse area in Oxelösund conveys a clear picture of the situation. At the time of this interview, it is almost empty here.

"The sheets barely have time to leave the production line before it is time for delivery," says Per Elfgren, Production Manager at WELDOX, while a trailer truck rolls away with the latest order.

"We have never experienced anything like this before. Demand usually varies between the continents, but at the moment, there is worldwide high pressure. Sales of WELDOX and other high-strength construction steel are increasing more than the market in general. This is due to automobile manufacturers searching for a way to reduce weight. Another important reason is the enormous investment in infrastructure taking place at numerous locations in the world."

The most typical application for WELDOX is cranes:

"When they cross the threshold to high strength steel, no customer goes back."

Anders Skirfors

"Our most recent launched steel, WELDOX 1300, is more than five times as strong as ordinary low-strength steel, which makes it possible to construct significantly lighter booms that can lift more. Alternatively, one can use WELDOX to produce longer booms and increase the range," says Anders Skirfors, Product Development Manager at WELDOX.

Twenty-five years ago, a typical crane could lift its own weight – a fifty-ton crane could lift fifty tons. With today's WELDOX, it can lift more than 500 tons, in other words, ten times its own weight.

"It is really not difficult to manufacture high-strength steel, you simply add carbon and suitable alloying material. The difficulties arise if you would like to weld, bend and drill into the steel, which is necessary if a crane is to be built, for example. The ability to weld is the snag that inhibited earlier development of high-strength steel," says Anders Skirfors.

After many years research, the steel industry has developed quenching processes and heat treatment methods which make high strength steel weldable; the name WELDOX means "Weldable Steel from Oxelösund."

In the normal steel process, if one were to try to produce steel with the same strength as WELDOX, the alloys would need to be increased to such a great extent that it would crack when welded.

Unfortunately, an engineering courses the world over, it is still being taught that if steel is quenched, it becomes hard and brittle, which would make it impossible to use in many instances.

SSAB usually has to explain to the engineers that with optimized production it is possible to produce steel that is strong, tough and weldable.

A crane consists of different sections. Furthest out on the boom, the material should be as light as possible, but nevertheless strong. WELDOX is used not only in crane booms but also in a large part of the crane's chassis.

>FACTS

SSAB Oxelösund

Oxelösunds Järnverk was established in 1913. The mill was opened at the beginning of the 1960s. Until the mid-1970s, almost the entire production went to the Swedish shipbuilding industry. In 1978, the company was renamed, after a merger of the iron works in Luleå, Borlänge and Oxelösund. Today, SSAB is a market leader in the production of high-strength steel. The largest competitors in Europe are in Germany.

A prerequisite is that the steel is very clean.

"When we launch a new WELDOX steel, our applications engineers visit customers and explain about the characteristics of the steel, how it should be bent and welded and how it can be used in construction. It is important for us to ensure that our customers start in a satisfactory way," says Per Elfgren, and continues:

"Often, a new construction solution is needed in order to utilize the steel in the best way. You don't just change to a higher strength if you want to achieve maximum capacity."

High-strength steel in crane manufacturing is still a novelty in the market, for example, in the former Soviet Union.

"They have not had anyone driving development; they are only now beginning to see the enormous advantages. In Western Europe, we began with high strength steel in the mid-1970s and no European crane manufacturers today can compete without this material. SSAB was there at the beginning and has contributed substantially to developing the market."

"When they cross the threshold to high-strength steel, no customer goes back," says Anders Skirfors.

In addition to applications with heavy sheeting, weldox thin sheeting is used in many car bodies and chassis components throughout the world to reduce the weight and increase the crash safety of cars. It is also used in light and heavy trucks. WELDOX raw materials are produced in Oxelösund. Today, SSAB Oxelösund is a world leader in development and production of high-strength steel.

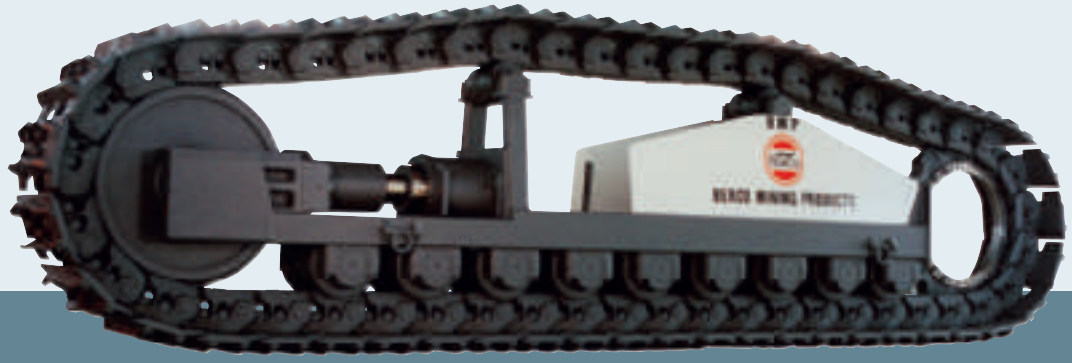
"We have the world's highest strength construction steel and we are one step ahead of our closest competitors in this sector," says Anders Skirfors.

An important part of the work is to inform on which applications that are not suitable for WELDOX. The usage possibilities are limited by the fatigue characteristics of the steel.

For a harbor crane that stands and lifts containers all day and uses maximum capacity in every lift, fatigue becomes a phenomenon that one has to take into consideration. In these cases, it is often better with low-strength steel since it is the fatigue resistance in the welding that creates the limits. But, for a mobile crane that lifts loads of varying weights, the high-strength steel can be utilized in a satisfactory way.

"Other areas of use for WELDOX. are large excavators and trailers, where the material is used in all structure parts with a load-bearing function. ABB Transformers has used WELDOX. in earthquake protection in an extensive project in California." says Anders Skirfors.

Text and photos: di Virna Bottarelli



Fertile climate for automation

In recent years Berco, the world's No. 1 manufacturer of tracked undercarriages for earth-moving machinery, has recorded an upswing in production from 80,000 to 200,000 product tons. A factor in this growth has been the gradual automation of the manufacturing process brought about by the introduction of ABB robots.

> Berco S.p.A. headquartered in Copparo, in Italy's municipality of Ferrara, began in 1920 as an expansion of the Bertoni & Cotti machine shop, and it has grown decade by decade to become the top manufacturer of tracked undercarriages in the world. In recent years, through gradual automation, the company's production has increased from 80,000 to 200,000 product tons. A critical element in this automation has been ABB's robots, which are deployed in a handling capacity at the company's Copparo plant, and for welding and hot-forming work in the group's other two factories in Italy.

Berco's production can be broken into two major constituents: undercarriages, which make up the group's core business, representing 97 percent of sales, and machine tools. The common denominator shared by the two areas is technological expertise. The company's "homemade" mindset has always caused it to stand out, explains Marco Balducci, who is in charge of automatic machinery installation and maintenance for Berco. "Since the 1920s, Berco has manufactured each component in-house, either by choice or because of the demands dictated by its geographical location, which is remote from large industrial centers. In recent times, the company's pride and joy has been the engineering group Berco, which is capable of independently developing the most sophisticated solutions to satisfy any customer's requirements. Thus, all phases of the manufacturing process are developed at the Copparo site, from project design to taking delivery of the raw material, including hot-forming of items to be assembled through machining, heat treatment and painting, varnishing and packing. Only in recent years has the term 'outsourcing' entered the company's vocabulary." Still, Berco makes 90 percent of the products it sells worldwide in-house.

In Italy, however, manufacturing companies offering Berco's range are now unique. "We are going against the general market trend, both because we choose still to manufacture everything in-house and because of our numbers: 200,000 product [metric] tons completed in 2004 and 3,010 employees," says Rodolfo De Carolis, business development manager at Berco. Apart from Copparo, the group employs the services of two other companies in Italy.

Berco has three branches outside Italy – Berco America in the United States, Berco Sul in Brazil and Berco Germany – and distributors worldwide.

Berco has always worked to improve performance and delivery of its solutions, plowing back profits to promote growth, research and product innovation. In the early 1990s, the company decided to automate certain processes by introducing ABB robots. "The first ABB robots were installed at Copparo between 1992 and 1993, with the aim of boosting production volumes and enhancing the quality," Balducci explains. "The robots have been used to manage operations that used to be handled manually.

"Using robots called for special analysis," he continues, "because it involved, on the one hand, designing the electrical interface with the interconnected machines to enable it exchange information to allow the two machines to work in tandem and, on the other hand, ensuring the safety of the operators employed on the robotized cells."

During the study phase, Berco relied on the support of ABB's technicians, who helped train Copparo employees with respect to automation and robotics. "We enjoyed the continuous backup and support of abb until 1997, after which a working party was formed at Berco to install and program robotized islands and deal with safety aspects of the cells," says Balducci. "Although we work as a self-contained unit in this respect, we still take advantage of ABB's consultancy for technologically more advanced projects, as in the case of the robotized lines installed at the Castelfranco plant, where we are engaged in welding. Finally, in association with ABB, we have a preventive and corrective maintenance contract to take prompt action in the event of a malfunction and to ensure maximum continuity of robot operations."

From 1994 to 2004 some 100 ABB robots were installed at Berco's three Italian factories, thus making the company ABB's main customer among those classified as robot end users. Balducci explains: "First, it should be made clear that a robot is no substitute for a person. Its introduction has resulted in operators acquiring new technical skills and enhancing their own level of preparation. Second, there are advantages in terms of quality, process, productivity, costs and safety, the latter being a consideration of special importance, given the weight and dimensions of the items being moved around. Third, the rise in productivity has made it possible to better study the machine cycle, with more accurate computation of production timing and manufacturing rates." For ABB, too, collaborating with a customer of Berco's caliber has had positive spin-offs. Besides the financial return from supplying a significant number of robots, ABB's relationship with Berco adds to the value of ABB Process Solutions & Services' capacity to develop ad hoc application technologies. ⊙

>FACTS

The benefits of automation at Berco:

- New technical skills and enhancement of operators' level of preparation.
- Improved process quality in terms of productivity, costs and safety.
- More accurate computation of production timing and manufacturing rates.

ABB anthropomorphic robots have been deployed to handle operations at Berco's Copparo plant.

All phases of the manufacturing process, design and raw material logistics take place at its Copparo plant.

>FACTS

No. 1 in the world

Founded more than 80 years ago in Italy as a small, specialized company servicing agricultural tractors, Berco has gradually grown to become a leading manufacturer worldwide in the field of production of tracked vehicle components, equipment for overhauling the undercarriages of earth-moving machinery and manufacture of machine tools for the reconditioning of internal combustion engines.

The experience it has gained over decades of activity, its constant search for new technological solutions and the high quality of its products are the company's key attributes.

Berco is now the largest company in its sector worldwide, with the biggest combined forging capacity. It is part of the Thyssen Krupp Group and parent company to Berco of America and Krupp Berco Deutschland.

Text: Renato Suzzani
Photos: ABB
Illustration: Istockphoto

Sweet music for productivity

A link between sheet metal and music? Yeah, right! Yet the link does exist in a company that has carved a specialty out of constructing musical instruments. In the process it has gained the know-how to successfully produce high-quality metal carpentry in ferrous, stainless and light alloy materials.

> The link between working with sheet metal on a jobbing basis and music may seem an unlikely one. Yet it is there at GAMA, a company situated in Castelfidardo in Italy's Ancona region that began as a manufacturer of harmonicas. The company was started in 1956 by Giovanni Sopranzetti, who, with Armando and Alessandro Mazzocchini and Mario Ciaccafava, set his sights on manufacturing harmonica components and, eventually, finished harmonicas.

Most people are unaware of how complex a harmonica actually is. Mechanically it can be compared to a watch. The instrumented originated in Ancona, and even today the region boasts a number of major harmonica manufacturers.

GAMA S.p.A. is arguably first among the Castelfidardo companies with roots entwined in harmonicas. Its harmonicas are recognized as being of the highest quality. In fact, GAMA instruments have evolved to a status where they are even accepted and studied at music conservatories.

Initially harmonicas were made of wood, but soon metals, steels and light alloys were incorporated into their design. To do this, the manufacturing houses had to convert their equipment to work with metals, and they had to acquire, develop and refine the very special, delicate technologies required to work sheet metal and transform it into parts of great complexity and precision. Thus a new metalworking specialization was born. Over the decades, as markets witnessed a drastic restructuring of musical instrument making, the specialization proved invaluable and provided the wherewithal to infuse life into high-quality metal carpentry jobbing.

These days, GAMA has a permanent staff of 35. It still maintains a workshop to produce harmonicas, but its core business is producing sheet-manufactured items for third parties in thicknesses of up to 3 millimeters. Massimo Mazzocchini, head of production, explains: "For third parties we will manufacture virtually any

component in a small thickness, in any dimensions and any grade, in batches ranging from the small through medium-sized and right up to the ceiling on the large series."

The coexistence of the the company's original livelihood, instrument manufacture, and its derived activity, metal carpentry, is unusual and possibly even unique, and it resulted is work of a very high quality.

Although GAMA makes manufactured sheet items for third parties, defining the company as a "third-party service" is actually an oversimplification. It also produces prototypes of new products by working with product designers as part of a team in the field of co-design, with a view to industrializing and fine-tuning the products prior to their actual construction. This is how metal furniture, metal frames, chassis and structures for coffee machines, vending machines and kitchen fittings have come about, as well as a range of other sheeting products, some of which have been destined for nautical purposes.

Constructing prototypes is particularly demanding, as every new occasion means that GAMA must tackle a completely new problems and invent special-purpose fittings and fixtures. But current production already makes great demands: Batches vary in consistency, and delivery deadlines are always tight. Furthermore, the third-party jobber generally finds himself caught between mounting costs, on the one hand, and purchasers haggling over prices, on the other. In such a quandry, the only recourse is to make the best use of the best production means with a view to reining in costs and streamlining the production cycle.

"In our line of work there is still a lot of manual labor, and as a result we're highly dependent on manpower, with all the problems that implies, such as costs, fatigue, human factors, accidents, fluctuations in quality," Mazzocchini says. "We have been looking for solutions, and in robotization we have found the scope to make our production faster, more reliable and more economical. Two years ago, we installed a small ABB robot to link up to a forming press. The results have been extremely gratifying. It has eliminated the operative on the machine, which can thus operate continuously, even at night; the consistency of workpiece precision has increased and, although the robot's bending cycle time is slightly superior to that of manual, operative-performed bending, the bottom line is also a reduction in costs and a gain in productivity."

The reliability and consistency of the work done by this piece of equipment is truly remarkable. During the two years since installation, it has run for more than 19,000 hours without requiring any repair action.

Based on this experience, GAMA has installed two additional robots of the same make. The second robot, which is larger, operates in a bending and calendering island (it comprises not only the bender but also a rotary press). The island also enables curved pieces to be manufactured, making the setup more flexible and responsive to the highly variable requirements of an advanced third-party service such as GAMA, which must be capable of producing anything requested by the market. ⊙

>FACTS

Three robots, infinite possibilities

Apart from the level of performance and dependability demonstrated by the three robots in operation at GAMA, they are worthy of attention for a number of other characteristics.

The first robot, the smallest of the three, is an IRB 2400 (maximum load 16 kg, range 1.5 m, six controlled axes, position repeatability 0.06 mm). The IRB 2400 is the most common industrial robot in operation, present in more than 14,000 installations worldwide. It comes in a full range of models capable of providing made-to-measure solutions for the most varied tasks, from arc welding through process applications to machine connections. The appliance boosts productivity, reduces production times and allows for more rapid product delivery. The arc welding variant attains a reach of 1.8 m, supports a 7 kg load, features slender arms and wrist, and can operate in a wide range of working environments. Other variants offer load capacities up to 16 kg with an arm extension of up to 1.8 m, excellent movement control and remarkable load misalignment characteristics and unlimited rotation of the sixth axis.

The second appliance, an IRB 4400 (permissible load 45 kg, maximum reach 2.7 m, position repeatability 0.7 to1 mm) is fast and compact, supports medium-heavy loads and is well suited to a vast range of applications. The balanced design and True-Move function allow the robot to complete swift, precise movements throughout the sphere of operation, thereby guaranteeing a high level of performance, for instance in applications such as cutting. Its great maneuverability makes the IRB 4400 suitable for applications where speed and flexibility are particularly important. Here again, the traditional sturdiness of ABB's design makes for long periods between maintenance. This robot can be fitted with a seventh axis, as it is at GAMA, by means of a swing foot system. The machine features plenty of scope for communications, such as series connections, user interfaces and field bus interfaces. This makes it simple to integrate the robot into either small operating stations or large industrial automation systems.

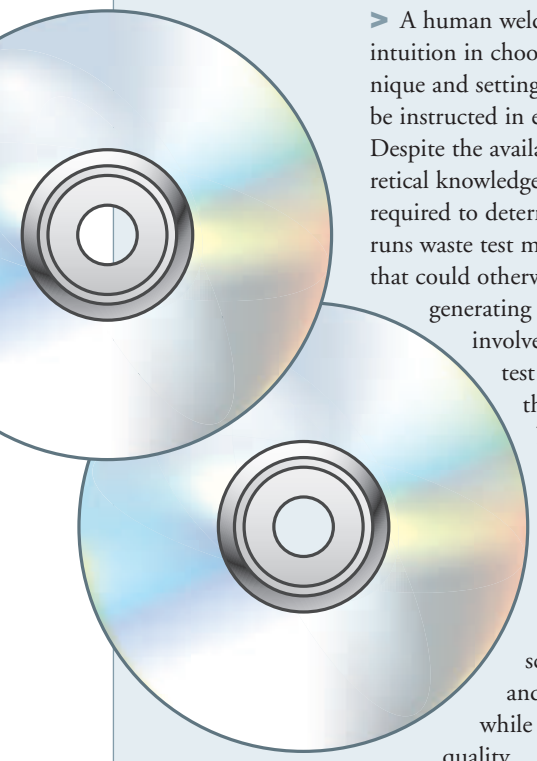
Finally, the third appliance, an IRB 6400, dimensioned for power (200 kg load, 3 m reach, six axes, repeatability ± 0.1 mm) is another of the more widespread robots; 10,000 of them having been installed around the world.

Text:Dick Skarin
Illustrations: Istockphoto and ABB

VirtualArc transforms welding

From "black" art to practical science

ABB has developed a software tool, VirtualArc, that provides programmers and process engineers with a rapid, yet detailed, evaluation of a weld. The reduced need for test runs cuts costs while optimizing productivity and quality.



> A human welder draws on experience and intuition in choosing the correct welding technique and settings, but a robot welder must be instructed in every detail of the procedure. Despite the availability of considerable theoretical knowledge, a series of test runs is often required to determine the correct settings. Such runs waste test materials and diverting robots that could otherwise be involved in revenue-generating activity. The costs and time involved mean that the number of test scenarios must be limited and the optimum setting can easily be missed. ABB has developed VirtualArc, a software tool that enables programmers and process engineers to reliably determine the result of a weld. It permits a rapid, yet detailed, evaluation of various scenarios, reducing the need for and cost of numerous test runs while optimizing productivity and quality.

For many years, welding using the MIG/MAG process has been considered something of a "black" art. Most people know that welding is the process of joining two metal parts together, but very few understand the parameters involved and their bearing on the result. This ambiguity confuses experts as well as ordinary people. It is said that when 10 welding engineers or welders are asked how a given task should be approached, 10 different parameter settings are suggested – all of them achieving the same result.

The MIG/MAG process is very complex. To fully understand the theory behind it requires in-depth knowledge of arc physics, fluid dynamics, material science, arc-electrode interaction and more. Few people in the world have this knowledge, and of those that do, it is unlikely that any have any practical, hands-on welding experience. But many very skilled welders in the industry perform perfect welds without any special knowledge of arc physics and the science behind it. Their choices are guided by a feeling for the process itself. Unfortunately, with retirement, the number of such highly skilled welders will most certainly decrease, making it increasingly difficult for the welding industry to be successful.

Welding equipment suppliers must combine the science behind the MIG/MAG process with practical expertise. Welding must evolve from today's black art to a modern fully controllable manufacturing process. The welding industry itself is interested in raising cost-efficiency by using simulation tools as much as possible for production optimization and planning. ABB has taken up the challenge of serving robot arc-welding customers by fulfilling these criteria.

ABB has developed a unique simulation tool, VirtualArc, to meet the arc welding requirements of customers. VirtualArc offers robot programmers, operators and welding engineers an expert system that provides in-depth analysis of the arc welding process, leading to improvements in process control, final welding quality and productivity.

The simulation tool incorporates state-of-the-art technology, facilitating prediction of the dominant phenomena in the weld. Implementation time and costs for automated processes are saved. The robust software package offers a user-friendly interface, which helps minimize process implementation time and reduces the costs of automated arc welding.

The technology behind the VirtualArc software is based on the combination of arc physics, a self-consistent two-dimensional wire-arc work piece simulation tool, practical experience with arc welding and experimental results. The software consists of modules that are strongly inter-connected with the entire process system, including power source characteristics and connecting cables. Weld profile and quality predications are obtained using Bayesian neural network technology. Predictions from arc simulations and heat and mass transfer to the work piece are used as input to the neural network to predict weld quality and profile as well as defects.

VirtualArc consists of modules with input pages with which the user enters data on the system parameters, the application and the weld process. The first page asks for information on the weld power source, gun, cables and wire feed system. The second asks for the materials, plate thickness, joint configuration, gap, weld geometry and weld class (B, C or D). The third asks for details of the wire and gas specifications and whether a short arc, spray arc or rapid arc will be employed. Armed with this data, the software then undertakes a pre-weld analysis using a Bayesian neural network tool. A further page graphically displays the predictions from the analysis of the weld parameters, the weld profile and the required or default speeds and torch angles. The user can inspect time graphs of current and voltage and a cross section of the weld. The latter shows the depth of weld penetration and profile, enabling the user to assess the quality and, knowing the speed, estimate the productivity of the process. Entering the relevant data takes only a few minutes. The analysis is completed in seconds.

VirtualArc enables significant time-saving by eliminating the need for live weld test runs and the subsequent sectioning of the weld for inspection. In addition to costing time, such live test runs consume components and materials and remove valuable robots from the production process. VirtualArc also allows rapid appraisal of "what if" scenarios. In just a few seconds, the effect of different weld speeds and torch angles can be evaluated, making it easier to find ways of improving productivity and/or weld quality. In addition, there are cost and investment pages that enable the user to accurately and rapidly determine expenditure and justify the application before welding is undertaken. Whenever software replaces testing, the validity of the results is in question. Comparison of VirtualArc predictions with test welding data shows that the simulated weld profile is extremely close to its real weld counterpart.

Featuring an easy-to-use software interface, VirtualArc can be operated from a single PC or laptop. It provides users with efficient offline welding process tuning that predicts a wide range of results, including weld shape and penetration, weld quality and possible welding defects. Predicting such results brings substantial benefits, including shorter implementation time, optimized welding productivity and quality and well-documented welding procedures. In turn these considerations contribute to lower production costs. As well as saving time and money through better production, VirtualArc is also an efficient training tool for robot operators, programmers and production/welding engineers and an excellent platform for retrieving and storing arc welding process information for future developments. VirtualArc is also useful for comparing different weld procedures in cost per meter of weld.

RobotStudio is used to define and create robot programs offline without requiring any real robots to be diverted from their productive activities, and VirtualArc is used to evaluate and set welding parameters. Both tools eliminate risk and shorten the production time for new programs while maintaining plant productivity. ⊙

>FACTS

Program offline with RobotStudio

ABB's RobotStudio software is a tool for simulating the movement of robot arms. Traditionally, robot programming is performed by manually moving the arm of a real production robot through a series of reference positions, which are then recorded. This implies a production break for the robot – a costly and inefficient use of a valuable asset.

RobotStudio offers an alternative by allowing the program to be created on a virtual robot – one that exists only as a model inside the computer. This robot has exactly the same spatial and dynamic properties as the real robot and is controlled by the same program. RobotStudio models the robot in a virtual 3D environment so that potential collisions or spatial constraints can be recognized. This prevents unpleasant surprises or damage on the real production line later.

RobotStudio can also be used to compare alternative setups or to train staff. By reducing programming costs and downtime for production lines, the software helps customers achieve higher utilization and productivity on their production lines.

Text and photos:
Paolo Beducci

Five islands in a sea of flexibility

A leading player in the international hydraulic crane sector, the Italian Fassi Group chose ABB systems and definition software for the production of welded components.

> Often, whenever something big needs lifting, Fassi hydraulic cranes are called in to do the job. The Fassi Group is a holding company with four manufacturing units that export products to some 50 countries worldwide.

"This commercial diversification brings with it a great need for manufacturing flexibility," explains Managing Director Giovanni Fassi, "This is due in part to the regulations involved, but it is mainly due to the practices adopted in individual countries.

"Thus, manufacturing flexibility is essential for us," he continues. "The process of manufacturing hydraulic cranes is extremely painstaking, given the precision with which they must operate, and it brings with it a level of process control that is thorough, to say the least. If you imagine the risks to the operator if our product is not completely perfect, you can easily understand this fanatical attention to detail."

This is the reasoning that drove the Fassi Group to improve its welding plants, seeking out manufacturers able to guarantee manufacturing quality and excellent aftersales service.

The decision to improve a manufacturing plant does not stop at the purchase of a robotized welding system; a series of accessories, mainly software tools, is also required to streamline plant performance.

The Fassi Group turned to ABB to undertake the automation process. The cooperative venture dates back to 2000, when Fassi bought a welding system made up of one robot working along one travel line and driving two lathes. And in 2005, Fassi bought a new system with a twin-axis positioner. This new system is capable of carrying out the entire welding process involved in the manufacture of columns and unloading the finished components ready for painting. The load capacity of each of the two positioners is 750 kilograms; the robot used for the welding is an IRB 2400 L.

This single robot system with manipulators is complemented by RobotStudio, a software system that performs a series of vital functions to simplify the work of the Fassi engineers. Using simulation software, the RobotStudio can be used to check the true feasibility of a welding job at the design stage. The software creates a virtual representation of the welding island and calculates the paths taken by the various robotized island components before sending online instructions to the island. The Fassi Group is also licensed to use VirtualArc, a program that optimizes the offline welding process, and thus benefits productivity.

The welding process at Fassi involves a wide range of different-sized components, from parts weighing one or two kilograms each to others weighing up to 700 kilograms. These components can be made without problem on the welding islands, partly due to the fact that the machinery has been physically programmed offline to ensure that no problems arise over process verification or optimization. Apart from anything else, the offline programming system allows the Fassi Group to organize all the feasibility studies, programming and processing for the various components in work

>FACTS

Benefits of the ABB software

- RobotStudio simulation software used during the design stage checks feasibility of a welding job and sends online instructions to the robotized island, saving time, avoiding downtime and waste.
- VirtualArc optimizes the offline welding process and benefits productivity.

"The decision to improve a manufacturing plant does not stop at the purchase of a robotized welding system; an entire series of accessories, mainly software tools, is also required to streamline plant performance."

units that may be situated at different sites.

"Our relationship with ABB," Fassi concludes, "started off on the right footing, and we have always worked well together. We have decided not to leave Italy; we would rather invest in systems that help us reduce our costs in order to maintain our competitiveness. Altogether we have five ABB systems. The island we bought last year, for example, offers us enormous flexibility. It is also fast, simple and easy to use, and we are making full use of it. It is very important to work with a company such as ABB that is able to guide you through the process of change in the various workshop areas. In Italy we have always found people who are prepared to respond to their customers' needs in every situation. This is an essential aspect of customer relations that makes you feel as though your investment is being managed effectively at every stage." ⊙

>FACTS

The Fassi Group

The family-owned Fassi Group of Albino in Val Seriana is a typical Italian company, set up in a spirit of enterprise and a desire to capitalize on market needs. These needs were imposed by the radical changes that shook Italy during the period of industrialization between the end of World War II and the 1960s, before the market reached the form it is in today.

The Fassi family business dates back much further than this, however. It originally began as a timber-trading company local to Val Seriana, which developed into a goods haulage service and then a body manufacturing business. The switch to engineering came about with the transition from logistics to bodywork and, more specifically, to tipper trucks, special trailers and conversions.

Text: Stefan Eggers
Photos: Agency Trio

Kirchhoff Automotive

Counting on automation

Do lower wages mean more manual labor and less automation? Not for Polish automobile supplier Kirchhoff Automotive. Welding cells from ABB warrant high-quality production of structural automobile parts at its Mielec plant.

> Despite the low wage structure found in Poland, manual labor takes a back seat to automation at the Kirchhoff Automotive plant in Mielec, Poland.

"Kirchhoff Automotive's philosophy is to meet the customers' quality demands and group standards with secure processes in low-wage countries such as Poland and Hungary," explains Markus Selzle, who works with the company. "Kirchhoff Automotive directs its investments toward the product," he says. "The company follows its customers and meets their quality demands, regardless of the location."

At Kirchhoff Automotive's plant in Mielec, Poland (one of the company's two production sites in the country), the company manufacturers structural car parts for customers such as Ford, Opel, BMW, DaimlerChrysler, SAAB, Por-

Kirchhoff Automation follows their customers all around the world to meet their quality demands.

> "The customer must be able to depend on manufacturers who work worldwide and who make spare parts available to him within a reasonable response time."
>
> Damian Sojka

sche, Suzuki, Skoda and VW. However, despite the low cost of manual labor in the area, at the plant there is but one portable manual spot welding gun; ABB robots dominate the plant's activities in inert gas shielded arc welding.

Five ABB standard welding cells have been in operation in Mielec since 2003: two industrial IRB 6600 robots for spot welding and three IRB 1400 robots for MAG welding.

ABB engineered the welding cells and created the programs for the system controls (SPS). Kirchhoff Polska designed, constructed and built the welding devices. The Polish workers were quickly able to work with the robot technology. "Kirchhoff Polska's professional realization of tasks must be emphasized," says ABB service technician Damian Sojka.

Kirchhoff Automotive is counting on standardization for welding cells. It prefers a self-supported pipe construction, including the standard elements, turning table, robot and welding technology. The compact cells provide flexibility in layout changes as well as quick restarts at the setup location and close-to-serial production prior to moving the systems.

Availability and global service are two important criteria for Kirchhoff Automotive's selection of a robot supplier, says Selzle. "The customer must be able to depend on manufacturers who work worldwide and who make spare parts available within a reasonable response time," he explains.

ABB also offers the advantage of dependable delivery deadlines. "According to the customer, that is not true of all suppliers," says Selzle. ⊙

>FACTS

From component to module

Part of the Kirchhoff Group, Kirchhoff Automotive is one of the large medium-sized automobile suppliers with more than 2,000 employees worldwide. It has facilities in Germany, Ireland, Mexico, Poland, Portugal, Spain and Hungary. The core competencies of this family-run company are engineering of automobile modules and processes for sheet-metal formation, welding, installation and surface treatment.

Text and photos: Paolo Beducci

Easy rider Italian style

The Italian company MT, manufacturer of motorbike and scooter frames, has 21 welding systems. If this seems a lot, consider that it produces hundreds of thousands of frames each year for all the best-known Italian and foreign motorbike brands.

> There is so much passion in the work of Guido Giovenzana, an owner of Italy's MT, a manufacturer of motorbike and scooter frames. Before starting his own business, Giovenzana worked with Fantic Motor, one of Italy's legendary moped companies. "At the time" Giovenzana explains, "a generational change was taking place in the company's management and a new management was brought in. I decided to try and go it alone. It was very tough at the beginning. The space that we could afford was too small, and we didn't have any money. So we began as subcontractors – working really, really hard."

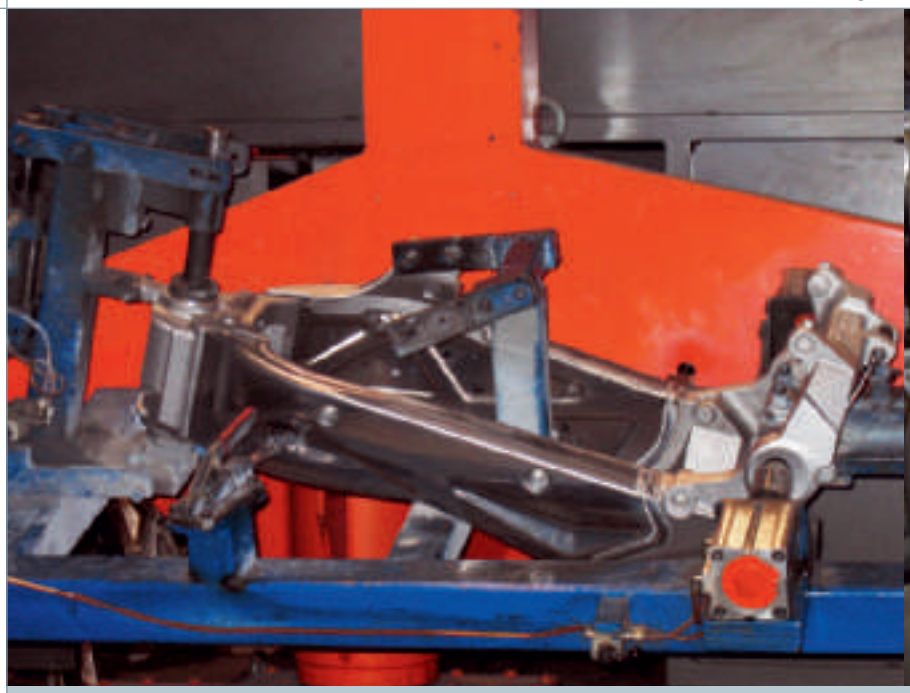
The turning point came a few years later with the advent of scooters with frames and the development of welded aluminum frames for motorbikes.

Welded aluminum frames for motorbikes was a turning point for MT.

"About fifteen years ago, Japanese manufacturers started producing welded aluminum frames," Giovenzana explains. "We went to Japan to discover how these companies worked. It was the beginning of robotized welding, and the company that was doing it was owned by ABB. It left a great impression on us, not just because of the kind of parts it was processing but because of its new and highly productive way of working. When we got back to Italy we bought the same welding system. I remember ABB came to give us a demonstration, and the welding island the company showed us produced such good results that we decided to buy one straight away.

"It didn't stop there, though," Giovenzana continues. "I insisted that ABB send us the very same welding system we had seen in the demonstration. It was a big investment for us, an unprecedented leap of faith that left no room for error. The cost of the automated system was equal to about 90 percent of our annual turnover at the time, so you can begin to appreciate what a risk we took."

Today MT has 21 welding systems, and the company is made up of two manufacturing units, each specializing in a certain kind of motorbike product. The original company headquarters at Garbagnate Monastero, Italy, produces motorbike frames, while the Santa Maria Hoè plant in Lecco, Italy, makes scooter frames. Says Giovenzana: "Modern scooters have a plastic body that covers everything, and so we have to produce welds that are effective but do not necessarily have to look great. For motorbikes, however, it is important that the weld look very good. During the heyday of the scooter, we were producing upwards of 500,000 scooter frames



The motorbike manufacturers know who to trust with their fine-tuning.

An important new project is to improve the look of the welds on motorbikes.

"We are trying to improve the look of the welds on motorbikes with visible frames. This is a task that many thought was almost impossible."

Guido Giovenzana

in a season. Today the figures have stabilized at around 300,000 units per year."

MT works in close collaboration with motorbike designers, discussing all the strategies available to enhance product industrialization. It is a painstaking task that Giovenzana's employees carry out with great care because the quality of the finished product depends greatly on this initial phase of development.

There is an ongoing cooperative relationship between MT and ABB that concerns all aspects of the welding process. The relationship has been very profitable in terms of product quality and reliability and in reducing the number of units discarded as substandard. This is an aspect of the business that cannot be underestimated because, says Giovenzana, "when building motorbike frames, the tiniest error is enough to turn a product designed to support and withstand extremely high stresses without breaking into a vulnerable product that is unfit for use."

Even now, the way is being paved for the introduction of a new, important technological development in frame production. Says Giovenzana: "Our work has been able to progress due partly to our ongoing cooperation with ABB. We are an important testing ground for ABB, and the company is just as important to us as a technological partner. Now, for example, we are trying to improve the look of the welds on motorbikes with visible frames. This is a task that many thought was almost impossible."

All this qualitative and productive success is encapsulated in a tiny MT logo, positioned in parts of a motorbike frame that are almost impossible to reach. Not many motorbike component manufacturers are good enough to brand their products, even though the components they produce may well go on to become associated with major, world-renowned names. But the MT logo is there – a mark of quality important enough to be spoken of in the same breath as the names of many of the high-performance bikes that turn heads on the streets today. ⊙

>FACTS

Advantages with automized welding allow for

- **Fine-tuning throughout the production process.**
- **Improving the look of the weld on motorbikes with visible frames.**
- **Mass production with handmade quality.**
- **One producer to specialize in several different models/ products.**

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