

SVETSAREN

THE ESAB WELDING AND CUTTING JOURNAL VOL. 61 NO. 1 2006

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FOCUS ON CUTTING

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MARATHON PAC™ - TOTAL MIG/MAG EFFICIENCY

Svetsaren

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*Focus on cutting.
ESAB enhances
cutting productivity
with innovative
solutions.*

ESAB CUTTING SYSTEMS - Number one for the industry.

Dear reader,

As the world's leading supplier of plasma, oxyfuel, laser and waterjet cutting systems, ESAB CUTTING SYSTEMS strives to enhance customer productivity and provide international industry with the resources to optimise important manufacturing processes.

During 2005, our activities in the global cutting marketplace were dynamically expanded with the opening of our new factory, ESAB Cutting and Welding Automation Co. Ltd, in Shanghai – a landmark event. This ultra-modern production plant (presented elsewhere in this issue of Svetsaren) strengthens our position in Asia - Pacific and enables us to serve an industry facing dazzling challenges and developments.

It was also a successful year in Europe, the Middle East and emerging markets, especially with our mechanised plasma machine range. As a system supplier, we have proven to be in the technological vanguard, offering innovative turnkey solutions.

During the 'Schweissen & Schneiden' international welding and cutting fair in September 2005, we were able to surprise our visitors with many new cutting developments. These included the COMPLEX System developed to achieve integrated automated cutting processes that take into account material flow, handling and environment.

Innovation is also the objective in 2006, with new products to provide customers with significant competitive edge. Our slogan 'Profit from productivity' is the motivation for all our activities and quality awareness, be it small machines or large installations, distribution or service.

This issue of Svetsaren - with its special focus on cutting - highlights our latest developments. The articles and product news sections clearly indicate how customers can benefit and increase profits. Good reading.

ACHIM DRIES
Global Director, ESAB CUTTING SYSTEMS

DIPL. ING. ACHIM DRIES (43) IS WORLD-WIDE DIRECTOR OF ESAB CUTTING SYSTEMS, RESPONSIBLE FOR ALL ESAB CUTTING ACTIVITIES - INCLUDING PRODUCTION SITES IN GERMANY, UK AND CHINA.



ACHIM DRIES



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Made in China

New ESAB cutting equipment factory in Shanghai

MICHAEL STANDAR, ESAB WELDING AND CUTTING PRODUCTS (SHANGHAI) CO. LTD. CHINA.

To ensure its continued fast rate of development in the Chinese and Asian cutting markets and to reach its ambitious goal to be the main supplier of cutting products globally, ESAB has built a large new factory in Shanghai for the production of a range of cutting machines as well as for components for its cutting factories in Europe and the US.



Jon Templeman delivering the opening speech

ESAB Cutting has been present in the Chinese market from the early 80s, directly selling German manufactured cutting machines. In the mid 90s, it decided to establish its own factory in a joint venture with a local company. This became a fully owned company in 2003, when ESAB purchased the minority shares. Space limitations and outdated factory equipment, were key factors in ESAB's decision to build a modern new factory in

Shanghai, and to be able to meet the rapidly growing demand from China and Asia and to serve their customers even better. This decision must also be seen in the light of ESAB's ambitious goal to be the leading global supplier of cutting products. ESAB is well underway to realize this objective, and this is clearly underlined by an unprecedented sales increase after the relocation in October 2005.



ESAB's new cutting Factory in Shanghai



The opening ceremony of the new cutting factory was held on 24th November 2005 in the presence of ESAB group CEO Jon Templeman and senior government officials from the Jia Ding district.

Serving the market with machines from China

ESAB Shanghai manufactures all series of ESAB Cutting machines, with the exception of laser machines, from small size FXA types to middle size EXA and big size TelereX machines serving the differing requirements of the many Chinese industrial segments.

The small size FALCON, FXA, was introduced in 2003 and has subsequently been extremely successful, both in and outside of China. At the moment, the main customers are located in the Middle East and East Asia, but it will be available from all ESAB sales offices around the globe.

Low cost, good quality, simple technology and easy operation are features that make FALCON's highly competitive over other complicated machines. The serial production of FXA has already started and the capacity will

be gradually stepped-up.

The EXA type of machine is the most commonly manufactured machine at ESAB Shanghai, and is able to cover a major part of the cutting business requirements in China. The original gas cutting equipment on this machine has been replaced by plasma cutting, making it a versatile plasma machine that covers almost all applications.

The VBA Expert system with 400 Ampere plasma is now the growing trend in shipyards. After its introduction in 2004, during Schweissen and Schneiden in Germany, VBA Expert has been successful in Korea where sales sky-rocketed and increasingly Chinese fabricators find this new system attractive.

Some facts about the new factory and organization

The new factory is located in the Jiading district, in Malu town, a suburb of Shanghai, and covers a total area of above 6000 square meters, divided into two buildings; the assembly workshop and the machining workshop/warehouse. The number of staff is around 100 and is expected to double in two years time.

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Global solutions for local customers – everywhere

ESAB's motto equally valid for cutting products.

CARL BANDHAUER, ESAB CUTTING SYSTEMS GMBH, GERMANY.

ESAB Cutting System's business objective is as ambitious as it is straightforward: to be the first point of contact, whenever fabricators consider installing or optimizing high-precision cutting installations. Our future lies in a consistent focus on our customers and their cutting applications. A successful year in 2005 and a strong start to 2006 endorses our confidence in our chosen strategy.

Global thinking and local delivery drive forward many of ESAB's trend-setting developments. Be it variable chamfer aggregates for plasma and laser, machine concepts and controls, complete solutions for palletising, alternating tables and shelf concepts or innovative solutions for job security and environmental protection - all convincingly demonstrated by ESAB during last year's Schweissen und Schneiden welding fair.

ESAB's wide product range, complemented by problem solving capabilities, a unique service and one-stop supply, provides the basis for appealing, customized cutting solutions. The ever-changing requirements within many sectors of industry are regarded as a challenge, rather than a problem, as testified by the success stories of Thyssen Nordseewerke and Donges Stahlbau, published elsewhere in this special cutting issue of Svetsaren.

Success equally depends on the selection of strong business partners, of which the co-operation with Triumph in the area of laser technology is a shining example. The new 6 KW laser resonators and adapted process optics are unique. Coupled with our own knowledge and technology, they result in exceptional system solutions with numerous unique benefits.

Plasma beveling is typically an area where we have been able to expand our lead with innovative technology and unique benefits. An example is the VBA ExpertPro, introduced into shipbuilding - the industry where ESAB traditionally maintains a

global leading position - as well as the metalworking industry. The all new VBA Wrist for the cutting and beveling of 3-dimensional parts, such as pipes and dished heads has been equally well received. It is especially suited for system suppliers of halls, pressure vessels, pipelines and oil and gas distribution infrastructure, working with anything from sheet to thick-walled materials with various geometries. Both VBA ExpertPro and VBA Wrist are extremely easy to program and operate - even complex parts such as pressure vessel floors and pipes with multiple branches and flanges are cut efficiently. This saves time and increases our clients' productivity.

For high quality cutting, state-of-the art plasma systems are available. The outstanding new m³ generation of plasma machines can be equipped with both VBA systems and include SpeedLoader, MFC gas control and new Plasma torches. The great acceptance of m³ plasma in the market place creates another milestone in the success story of our company.

With just one head, a complete cutting range from 1-150 mm is covered, which is unique in the market. New manual plasma cutting machines - a logical extension of the development of mechanized systems - compliment the range.

But what are complex, well designed technical solutions without intelligent regulation and control? Based on the latest developments in high precision motion control, while using the most modern

technology, we have developed a family of control units that skillfully covers all applications. With VISION CNC 51, 52 and 55 we can offer our clients the future in control systems for all sorts of applications – from horizontal cutting to very complex 3D tasks. The significantly improved vision and human machine interface (HMI), in particular, have given VISION CNC the reputation of “the best control system available world-wide”.

Such a high level of innovation can only be realized when a pioneer mentality and team spirit, combine and act in harmony with superior know-how. Our primary production sites in Florence (USA), Andover (UK), Shanghai (China) and Karben in Germany embody this philosophy, working together day by day and internationally. Continuous co-ordination between the three sites – whether concerning design concepts or procurement strategy - are tuned and

synchronized. In Asia, the Shanghai plant has taken the technological lead. Expansion of production facilities, and investment in the most modern equipment, has enabled the development of new cutting systems such as the FALCON that are successful both locally and outside Asia. ESAB in Dubai, United Emirates, has become market leader in the segment for FALCON with an exceptionally high market share. And the flight of the FALCON will continue in Europe where the machine will be launched shortly.

The competitive edge and future of our company will more and more depend on its performance to customers and suppliers. The systematic planning of logistic procedures will become decisive. We have done our homework for all aspects of our business - be it development, lead times or service. In everything we do, we have one thing in mind – to find the best solution for the

requirements of our customers and to come up with systems that have the best productivity/cost ratio in the entire industry.

In this issue of Svetsaren, we invite you to join us on a journey through the world of laser, oxyfuel and plasma cutting, presenting you stepping-stones for success.

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The new Berliner Bridge in Halle on the river Saale

Donges Stahlbau relies on innovative ESAB cutting technology.

ESAB CUTTING SYSTEMS GMBH, KARBEN, GERMANY.

Since 1916, the centre and the east of Halle, in Germany, have been connected by a suspension bridge crossing a large railway track. The expanding city and the rapidly increasing traffic, resulted in the city planning a new bridge, which was also to become an architectural landmark. The fabrication of the giant steel pylon and other steel components was a human and technological challenge - with a key role to be played by an ESAB SUPRAREX P3 oxyfuel cutting installation.

Family owned Donges GmbH in Darmstadt, Germany, was responsible for the complete steel construction, suspension construction and corrosion protection on the new Berliner Bridge. Dr. Peter Schäfer, Production Manager for Donges Stahlbau GmbH, the construction company, recalls, "The Berliner Bridge was an interesting project with a variety of special requirements, the most extreme being the 73 m tall, 650 tons all steel pylon."

The two base piers meet at a height of 35 m to form an A-shaped gate over the highway. Above, the pylon's pinnacle, anchor point for the suspension cables, rises sheer into the sky.

The 24 orifices in the pinnacle, accommodating the anchoring tubes for the suspension cables, are geometric contours cut with millimeter precision into the steel plates. Peter Schäfer explains, "What made this job challenging was to cut oval-form bevels in geometrically complex steel plates, in which both the co-ordinates and the angle of the bevels were to be observed with great precision. Later, the tubes were welded into these orifices under exactly the same corner as the suspension cables. The bevel angle varied between 14 and 45 degrees to plate plane."

The oval and bevels were produced in two steps. The cutting head mounted on the SUPRAREX



The new Berliner Bridge

covered bevel angles up to 25 degrees. Angles between 25 and 45 degrees were milled to their final angle.

Soeren Carlsson, Sales Manager at ESAB Cutting Systems GmbH in Karben, Germany, explains why the SUPRAREX portal cutting system was the obvious choice. "For this kind of specialist cutting task a fully equipped system was needed, adapted to the specific requirements of Donges Stahlbau.

Donges not only required a high performance installation to cut up to 150 mm material thickness, they also needed a flexible cutting head to produce oval shaped orifices with varying bevel angle. We decided on an infinitely rotating three-head oxyfuel burner unit suited for K-, Y-



Figure 3. The SUPRAREX installation suited for material thicknesses up to 150 mm.

and V-joint preparations. The installation was completed with another single torch oxyfuel head and a plasma marker."

"We were immediately convinced of the cutting performance", says Peter Schäfer. "Not only were the cutting quality and cutting speed in line with our expectations, the new SUPRAREX also enabled us to achieve a variety of other beveling jobs that are common in steel bridge construction."

An intelligent programming system

During the production planning process, the ESAB Columbus programming system proved to be a sophisticated and flexible tool. After a short training period, Donges personnel were able to,

independently, program the cutting of the bridge components via a PC, and download the cutting plan to ESAB's Vision control system connected to the installation. Even complex geometries such as oval cuts could also easily be integrated in the programme sequence.

Peter Schäfer, again, "Decisive for us was that the COLUMBUS cutting software is very easy to operate, has a logical structure and concentrates on the most important functions."

Precision in detail

Precision work was required during the assembly of the pylon's pinnacle at the Donges factory site. Both sides of the pinnacle were laid out on the assembly line and the anchoring tubes, complete with flange and ribs, were fitted into the oval orifices for welding. Step by step, the outer plates and the bulkhead plates were precision fitted and welded. The pinnacle was much too heavy for road transport, so was transported to Halle in two sections.

Erection of the bridge

The erection of the bridge was an enormous challenge for all parties involved in the Berliner Bridge project, involving the transportation and assembly of some 2,300 tons of steel in total. Assembly was divided into three stages.

First, one section of the future highway was constructed on soffit scaffolding and concreted. Simultaneously, the massive pylon foundation was built.

The second stage involved the erection of the giant pylon, consisting of five single elements.

During the third stage, the remaining superstructure of the bridge was installed by way of cantilever construction above the tracks below.

To ensure that the static system remained in balance throughout the erection, suspension cables were attached and anchored in the cross ties of each bridge section placed, by means of a hammer head.

The construction of the Berliner Bridge began in June 2004. In January 2006, the bridge was opened for passenger cars. Its scheduled completion is set for September of this year.



Figure1. Erection of the 73 metre tall, all steel pylon.



Figure 2. The oval orifices and their bevels; a challenging cutting job.



Figure 4. An infinitely rotating three-head oxyfuel burner unit suited for K-, Y- and V-joint preparations.

Donges

Donges GmbH was founded in 1872 and employs around 300 personnel. With branches in Berlin and Dinkelsbühl in Germany and Doha in Qatar, Donges is a member of the group of leading steel construction companies. Donges specialises in air traffic and power plant constructions, bridge and industrial construction, as well as offices, multi-storey car parks, sport halls and railway stations.

Recent work includes the Berliner Bridge, architectural buildings at the new Berlin central station and the multi-storey car park at the new fair in Stuttgart.

In the Berliner Bridge project, the family-owned company was responsible for fabrication, delivery and assembly of the complete steel construction, including cable constructions and corrosion protection.



Figure 5. Assembly of the bulkheads and anchoring tubes.



Figure 6. Assembly of the pylon's outer plates.



Figure 7. One half of the pinnacle; ready for transport.

ESAB supplies large plasma cutting machine to Thyssen

SOEREN CARLSSON, ESAB CUTTING SYSTEMS GMBH.

During autumn 2005, ESAB Cutting Systems GmbH installed an unusually large TelereX plasma cutting machine at Thyssen Nordseewerke GmbH in Emden, Germany, that now forms an important, component in the company's shipbuilding panel production line.

The TelereX machine is one of several ESAB cutting systems delivered to Thyssen Nordseewerke, part of ThyssenKrupp Marine Systems, over the years. These included a complete laser cutting installation to cut plates for the panel production line.

The new TelereX machine plays a major role in the shipbuilding panel production line. It provides flat panel plates, composed of single sheets, with the correct geometry and bevels for subsequent panel production. The installation is 28 m long, 20 m wide, has a total weight of 26 tonnes, and produces plates measuring up to 18 x 15.5 m and weighing up to 60 tonnes. It is equipped with ultra-modern plasma beveling heads, an ink jet marker, two arc markers and a Vacublast installation for the fast removal of primer. The installation is designed as a COMPLEX System - all secondary functions are integrated in

one system. These include the cutting table with exhaust equipment, dust filter, roller beds for loading and unloading, and the turntable for the horizontal turning of the panels.

Thyssen uses A to E36 shipbuilding quality steel with zinc-phosphate primer in plate thicknesses ranging from 3-40 mm. The TelereX machine has a cutting capacity in excess of Thyssen's range.

Explaining why his company opted for the new TelereX cutting installation, Thyssen's Production Manager, Jann-Jürgen Weber, said, "ESAB was capable to deliver a machine that meets our special shipbuilding requirements, with excellent cutting quality and a good price/performance ratio."

ESAB also trained Thyssen's machine operators and maintenance personnel to ensure optimal use of the new installation. This included a period of production line support. In summary, Jann-Jürgen Weber comments, "With ESAB, you have a competent partner at your side when undertaking major projects such as this."



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Alpharex laser cutting machines popular choice in North America

US and Canadian steel service centres save time and improve cut quality on large plate.

ROBERT SMALLWOOD, ESAB NORTH AMERICA, FLORENCE, USA. - A WHOLLY OWNED SUBSIDIARY OF ANDERSON GROUP INC.

The Alpharex laser cutting machine has proven to be a popular choice for customers looking for a robust cutting gantry to cut large plate and maintain tight tolerances. Russel Metals, Ryerson Inc. and General Dynamics explain why.



“Our customers are getting better educated about what’s out there for equipment,” says R.J. Weisner, plate processing manager for Russel Metals, a steel service centre located in Edmonton, Alberta, Canada”. Customers know that laser cutting provides tighter tolerances and better quality cuts that reduce the need for secondary clean-up at their end, so they have begun to ask their steel service suppliers if they offer laser capabilities. They know they can get savings by being more stringent with their requirements,” Weisner notes. “We want to stay ahead of our competitors by always offering a better product.”

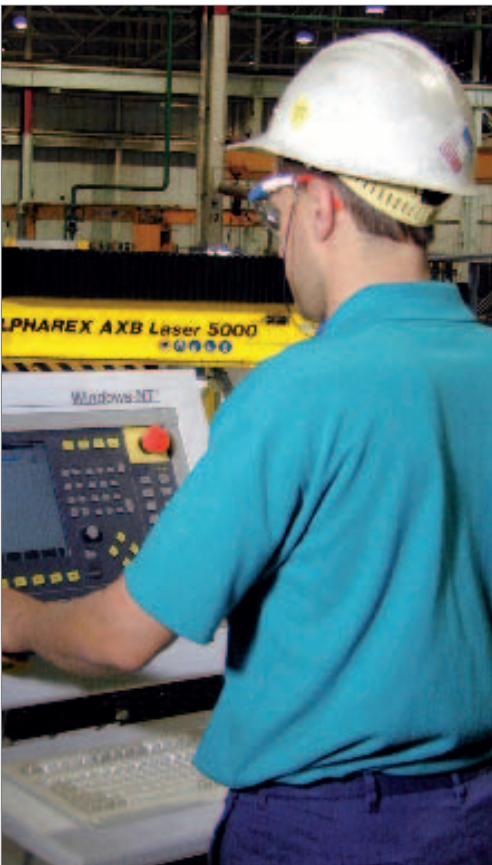
Weisner selected the Alpharex for its laser cutting needs largely because of the size of plate it can cut. Their machine cuts 10 ft. (3 m) wide and 61.5 ft. (18 m) long. He also likes the machine’s ability to run unattended for “lights out” operation, and that the self-diagnostic controllers can sense the plate and adjust the speed of the cut or power to the laser head to ensure cut quality without operator intervention. Russel Metals had a long-term relationship with ESAB, having purchased a number of ESAB plasma cutting machines over a nine-year period, and Weisner was pleased with the reliability, uptime, parts availability and overall support ESAB provides.

Russel Metals’ plant in Lakeside, Nova Scotia, Canada, also recently purchased the Alpharex machine. Operations Manager Mike Raoul also

had a long-term relationship with ESAB for his plasma machines. “We wanted to upgrade to laser because of the tight tolerances and better cutting laser can give you,” he says. Although Russel Metals is the largest steel distributor in North America and the third largest service center based on sales, Raoul still considers the company to be “like a job shop, catering to a large variety of customers.” In particular, a number of his customers produce boat kits, and Raoul needed to be able to cut large pieces with tight tolerance holes. “There are lots of small lasers around but not too many large gantries,” he says. He feels the laser machine will open up new markets that Russel currently cannot serve with plasma cutting and give the company the ability to process materials they have not been able to handle in the past.

“The Alpharex is a visually robust machine,” he says. He also likes ESAB’s teaming with Trumpf for its laser system. “Trumpf has a good reputation in the world of lasers,” he says. “And ESAB has a good reputation for guidance systems.”

Ryerson, Inc., one of the largest steel service centres in the United States, purchased an Alpharex system in 1999, and the Chicago, Illinois, center can vouch for the machine’s benefits. They also purchased the Alpharex because the gantry style machine gave them the ability to cut long plate widths and lengths and cut up to 5/8-inch (1.6 cm) thick carbon and



3/8-inch (1 cm) stainless steel, according to Operations Supervisor Steve Schwake.

Ryerson uses two tables, one 120 in. (3 m) by 21 ft. (6.4 m) and the other 130 in. (3.3 m) by 32 ft. (9.8 m). Before purchasing the laser machine, if they had a part that required tight tolerance holes, they would flame cut the plate to size and send the part out to a subcontractor to do the holes. "It saves us a lot of time to do this work in-house," Schwake says. "I would recommend (the Alpharex machine) to cut anything over 20 ft (6 m)." Schwake estimates that approximately 40 percent of Ryerson's current workload is done on this machine.

In Lima, Ohio, the Alpharex is supporting the U.S. military. General Dynamics Land Systems, a leading government contractor, is using the Alpharex to cut hull structures, protective armour and gating and other parts for armoured tanks. According to Randal Hatten, manufacturing engineer for this General Dynamics plant, they purchased their first Alpharex machine in 2002. The US defense department was concerned about the security of the Abrams tanks that were used for urban defence. They discovered that enemy munitions could enter the tank's exhaust system and blow up the tanks. They quickly designed an armoured grill to block the exhaust system and explode enemy rockets before they could enter the tank. They needed 300 grills produced in a hurry. With the Alpharex's easy programming capabilities, General Dynamics was making parts within hours of receiving the designs. The Alpharex ran continuously for three days to complete the job. "ESAB has really jumped ahead in the field of lasers," Hatten says. "They use the best components in the industry to produce their machines. The piercing ability has improved and, with the Alpharex, we can etch on stainless steel and aluminum that we couldn't do before. And ESAB's bevel capability is the best we have worked with." Beveling is an important part of the work done at General Dynamics, because most of the parts that are cut need to be welded together in final assembly. Alpharex's beveling capability saves the company a great deal of time by producing weld-ready parts. This has been very important in responding to the increased

demand due to the war effort. General Dynamics' Lima plant is currently running three shifts per day, five days per week and often on weekends.

Hatten also praises the Alpharex's ability to maintain consistent quality over a large work envelope. One of the parts they produce requires thousands of holes, approximately 0.0350 in. diameter cut in 1/2-inch armour plate. Alpharex produces these holes with consistent quality and "almost drilled quality," Hatten says. The machine performs equally well when running unattended, on occasions when an operator may not be available.

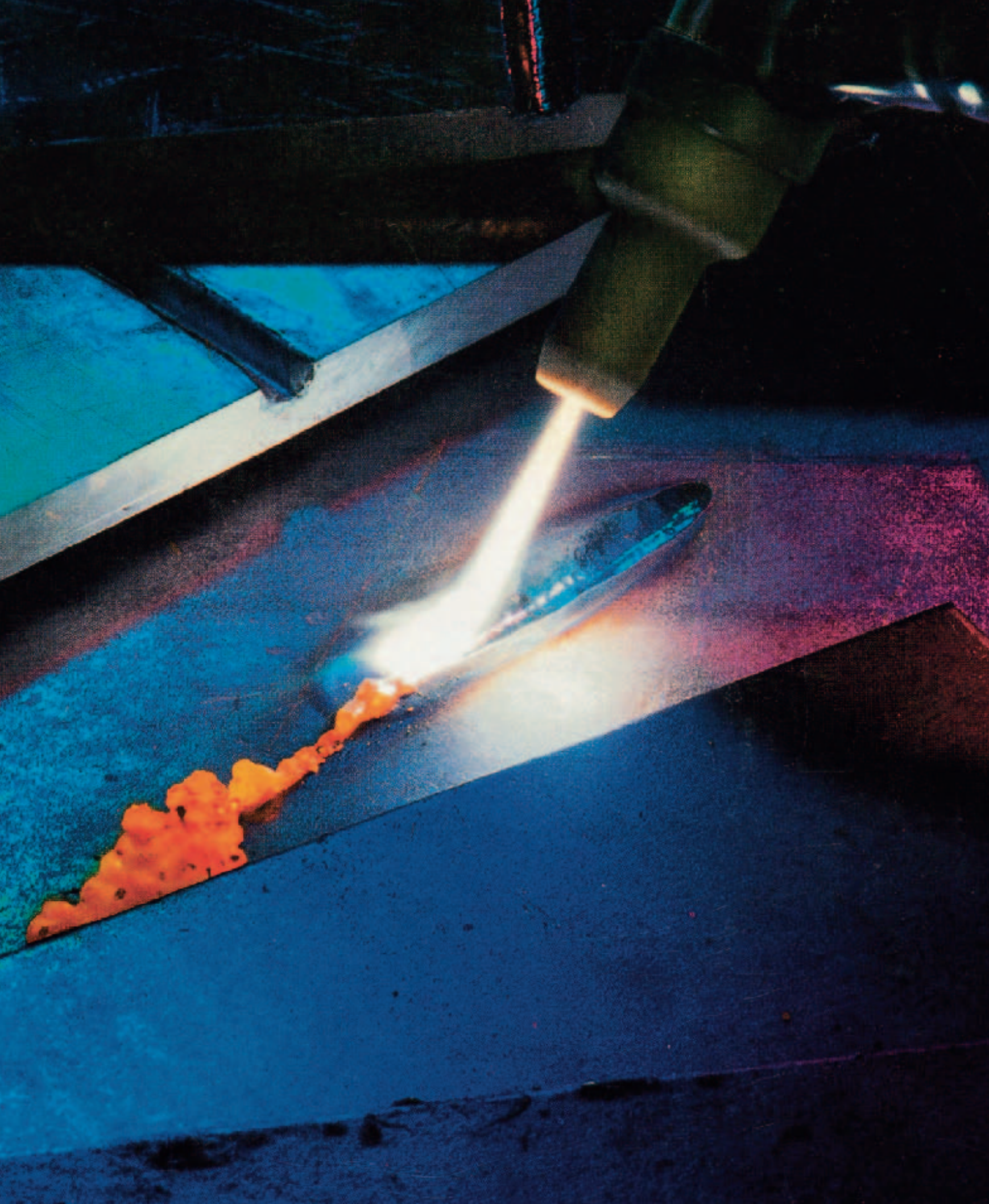
General Dynamics also frequently produces prototypes of new tank designs, as the government constantly strives to provide better protection for their troops. One prototype design was cut from composite materials, which can be very tough to machine. The Alpharex handled the job without a problem. General Dynamics liked its first Alpharex so much, they recently ordered a second machine to use in its armour room.

Service and support from ESAB are also exceptional, Hatten says. "Our ESAB serviceman, Tom Cronberger, is really excellent. If we're having trouble with a part, he will give us suggestions on how to do it better. It means a lot to have support people that really step up to help when you have a problem."

From tanks to boats to ordinary parts...and even the not so ordinary...the Alpharex laser cutting machine is proving every day why ESAB technology continues to set the standard in cutting.

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Plasma gouging versus traditional methods

ROBERT FERNICOLA, ESAB NORTH AMERICA, USA. - A WHOLLY OWNED SUBSIDIARY OF ANDERSON GROUP INC.

Plasma gouging is a variation of the plasma cutting process that, although in existence for a number of years, is seeing renewed interest by the metal cutting industries because of increasing emphasis on environmental and quality issues.

Plasma cutting was invented in 1954 at the Tonawanda Laboratories of the Linde division of Union Carbide. A young scientist, Robert Gage, found that by taking a TIG arc and forcing it through a small orifice - in a process not unlike focusing a beam of light through a lens - the temperature and intensity of the arc could be greatly increased. By using a fairly high gas flow through this focused arc, it was found that it could be used to cut metal. The intense high temperature arc, typically at temperatures of 24,000 Kelvin, or more, melted the metal and the high intensity gas flow blew the molten metal out of the kerf, severing the material. Since the gas in the arc was in a superheated state known as a plasma, the process was called plasma cutting. With the advent of low cost and portable systems in the 1980's plasma cutting has become an extremely popular process and continues to be a fast growing sector of the market.

The concept of plasma gouging, also around a number of years, has only recently begun to be recognized and widely used. Plasma gouging is a small step backwards from plasma cutting. In cutting, the plasma arc is squeezed and focused as tightly as possible to give the greatest energy concentration and cutting power possible. With plasma gouging, the arc is slightly defocused by increasing the hole size in the constricting orifice to something quite a bit larger than what would be used for cutting. This defocused arc is then used differently than a cutting arc. A cutting arc is directed downward through the metal to blow the molten metal down and out through the kerf to cause the two pieces of metal to separate. When plasma gouging, the torch is inclined at an angle to the workpiece, and the arc is used to plough-out a groove on the surface of the material and

blow the molten metal off to the side.

This illustrates why a slightly defocused arc is required. If the intense tightly focused cutting arc were used in this manner, the groove created would be a deep and very narrow shape that would be useless for most applications.

The groove created by plasma gouging is similar to grooves in metal created by other more traditional methods. One, the more popular method of creating grooves or gouges in metal, is called air carbon arc gouging. In this process, an electric arc at the end of a consumable carbon rod melts the metal and a continuous blast of compressed air blows the molten metal away. Similarly, oxy fuel torches with specially shaped nozzles can be used to burn grooves in carbon steel in a manner similar to oxy fuel cutting. There are also mechanical means for grooving or gouging, for example, grinders, routers, pneumatic chippers, etc.

The ability to groove or gouge metal is an essential industry requirement. One of the greatest requirements is in maintenance and repair work. Often, welds or metal must be removed by this process to replace a worn or defective part. Gouging is also used to remove worn hard faced deposits so that the part, be it a steel mill roll or dredging bucket, can have the hard facing reapplied. In the welding industry, gouging is used to remove defects in welds, so the part can be rewelded, and to gouge out the back side of welds to sound metal in applications where both sides of a plate are to be welded. In the foundry business, gouging is used to remove fins, risers and defects from castings. Wherever there is metal being repaired or fabricated, there is often a need for a gouging process. Plasma gouging can often be the preferable

method for accomplishing these gouging tasks for a variety of reasons. First, it is a low fume process. Many of the alternate means of gouging produce large quantities of vaporized metal fumes and the attendant problems. Second, plasma gouging can often produce a higher quality result than other methods. This is particularly important when the gouged parts are to be rewelded. Third, for these and other reasons, plasma gouging may be the overall lowest cost alternative when the total cost of the gouging operation is considered.

Fume emission

Increased awareness in the workplace regarding safety and environmental issues has brought the fume issue into sharp focus. Air carbon arc

gouging, for example, is a prodigious creator of fumes. As the arc at the end of the carbon rod melts the metal, a strong blast of air violently blows the metal out of the groove. The constituents of the molten metal react strongly with air blast since its force tends to vaporize much of the molten metal into fine droplets creating a high level of fume that consists of metal vapor, carbon dust, and metallic byproducts that are the result of the reaction of the molten metal with the air. Typically, the fume level of an air carbon arc gouging operation is far beyond the allowed exposure level to welding fume in the workplace and, depending upon the material being gouged, exposure to particular toxins that are constituents of the base metal can also be a problem. On the positive side, air carbon arc gouging does not produce much in the way of ozone or oxides of nitrogen as the arc itself is fairly well shielded from the surrounding atmosphere.

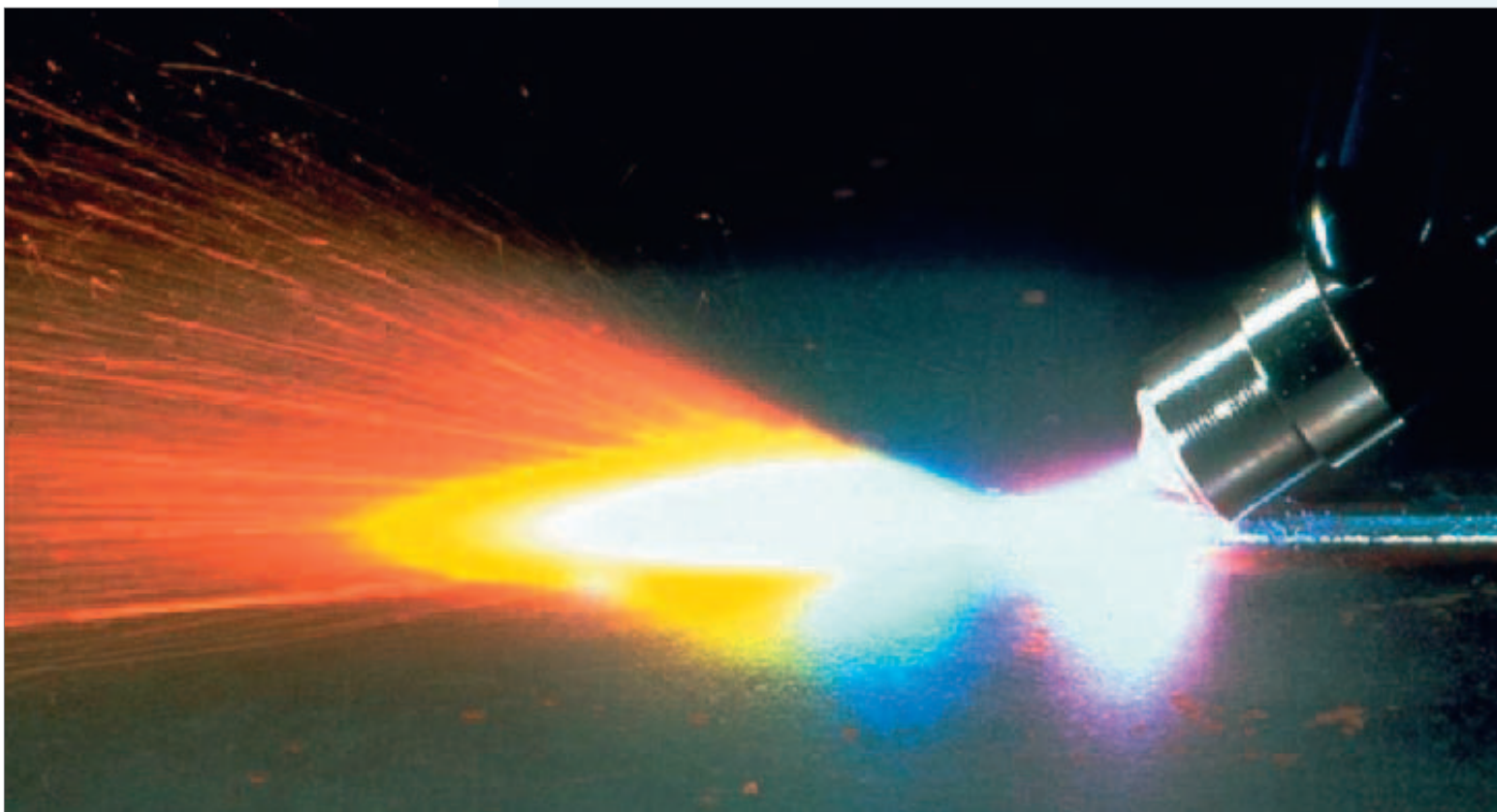
Table 1. Typical Cost Comparison. Plasma gouging vs air carbon arc gouging.

	PLASMA ARC	AIR CARBON
A. Cooling Gas	\$.003/liter (Ar)	0 (Air)
B. Flow Rate	132 l/min	1700 l/min
C. Plasma Gas	\$.008/liter (H-35)	NONE
D. Flow Rate	61 l/Min	NONE
E. Speed	2.5 m/min	.63 m/min
I. Gas Cost (A X B) + (C X D) X 60 min/hr	\$.32/m	\$0.00/m
F. Labor and O/H	\$30.00/hr	\$30.00/hr
II. Labor and O/H Cost	\$.20/m	\$.80/m
G. Electrode Cost 3m X 8mm	\$0.00	\$0.563
H. Gouge Length per Electrode	N/A	1.07 m
III. Electrode Cost Per Meter	\$0.00	\$.537/m
I. Power Supply Power Consumption	28.5 kw	24.8 kw
IV. Power Cost	\$.019/m	\$.066/m

When plasma gouging is used to accomplish the same task, the fume generation issue is quite different. Like air carbon arc gouging, plasma gouging uses an electric arc to melt the metal to be gouged out. However, unlike air carbon arc gouging, the plasma gas itself is used to push the molten metal out of the groove rather than a blast of air. This is done with considerably less violence than air carbon arc gouging and, as a result, there is much less vaporization of the molten metal and a much lower occurrence of metallic vapour and reaction with the surrounding atmosphere.

When air is used as the plasma gas, there is still some reaction with the air in the plasma stream producing some fume. However, the volume produced is considerably lower than that with air carbon arc gouging. When plasma gouging is accomplished with an inert gas for the plasma gas mix, fume reduction is very dramatic. The molten metal in the gouge is now protected from the surrounding atmosphere by the inert gas of the plasma stream and has little chance to react with the surrounding atmosphere. The result, in most cases, is a very low fume level.

One exception is aluminum, where its lightness and strong affinity for oxygen cause some fume as the molten aluminum is ejected from the gouge and reacts with the surrounding air.



Because of the strong ultraviolet content of the radiation from the plasma arc, there is some increase in the amount of carbon monoxide, ozone, and oxides of nitrogen generated. However the amount of these gases is generally below threshold limits. Plasma gouging can be a very effective alternative for fume problems in air carbon arc gouging applications.

Noise levels

An added benefit of plasma gouging over air carbon arc gouging is that it generates less noise. In typical equivalent applications, plasma gouging generates about 10 dB less noise than carbon arc gouging. Hearing protection is still required when using plasma gouging and actual noise levels will vary with the current level and distance from the arc. However, tests performed indicate that the noise levels of air carbon arc gouging can be so high that the noise reduction one gets with standard hearing

protection is still insufficient to bring the level at the operators ear down to levels that can be tolerated for more than a few minutes per day. The lower noise levels of plasma gouging combined with standard hearing protection bring the level down to one that can be tolerated for most of the workday. As always, noise measurements should be performed at the particular application to determine the proper level of noise protection and operator exposure time.

Groove quality

When it comes to quality, plasma arc gouging really shines particularly when compared to air carbon arc gouging. With air carbon arc gouging, for example, there is the problem with the carbon rod itself. During the air carbon arc gouging process, the carbon rod itself is consumed, releasing carbon. Usually, there is a layer of molten metal in the gouge that is not

blown out by the air blast but, instead, re-solidifies in the gouge. Carbon from the gouging rod can dissolve in this molten layer during the air carbon arc gouging process and cause a carbon rich layer to form. This can be a problem when gouging steel as this layer is very brittle and can cause welding and cracking problems.

There is a similar problem when air carbon arc gouging stainless steel as, in addition, this carbon rich layer can be a place for corrosion to start. There is also a problem with the air itself when air carbon arc gouging. The air reacts with the layer of molten metal on the surface causing an oxidized layer to form. This is not much of a problem with carbon steel, but

with stainless or other corrosion resistant alloys, this layer must be ground off before welding can be accomplished.

When used on aluminum, a black sooty layer of oxides is formed which presents a substantial cleanup problem.

Plasma gouging, with no carbon rod, gets around the problem of carbon pickup entirely. This is particularly important where high quality results are required. The gas that is used when plasma gouging greatly determines the condition of the final groove. With carbon steel, the oxidation left by using air as the plasma gas is usually of little problem. However with stainless and other corrosion resistant alloys and aluminum, an inert gas should be used as





the plasma gas. In this way, the groove is shielded from the atmosphere and is generally free of oxidation and other contamination. In most cases, the groove can be rewelded by almost any welding process without additional cleanup.

Productivity and costs

All the advantages of plasma gouging aside, the real issue boils down to cost. Obviously, the gouging job whatever it may be, can be done by other means - but the cost often can be much higher than plasma gouging.

Consider, for example, the actual cost per meter of gouge, which includes gouging materials consumed, gas costs, power and labour rate. Shown is a cost comparison of 150 amp plasma gouging with an inert gas, versus air carbon arc gouging with a 5/16 inch electrode which gives a similar metal removal rate and groove size. (Table 1) The calculations show that plasma gouging with inert gas has a greater cost than air carbon arc gouging which uses compressed air. Although the cost of compressed air is not free, many users consider it to be so and, as such, the benefit of the doubt goes to air carbon arc gouging.

Where plasma gouging has a distinct advantage is travel speed. It is four times faster than air carbon arc gouging. At a labour and overhead rate of \$30 per hour, this results in a much lower cost per meter of gouge than air carbon arc gouging. The carbon electrode is consumed so there is a cost per metre of gouge for the electrode.

With plasma gouging there is no consumable rod, however the torch electrode and nozzle have to be replaced, periodically. In plasma gouging, the electrode and nozzle last much longer than typical plasma cutting parts, typically 6 hours or more. Although their cost is higher than a carbon gouging electrode the cost per metre is insignificant.

The power consumed by plasma gouging, being a more efficient heat source is lower than that consumed by air carbon arc gouging contributing further to the savings.

Clearly, the direct cost of plasma gouging versus air carbon arc gouging is considerably lower on a cost per metre of gouge basis.

Additionally, indirect cost savings vary from

application to application. First, there is the grinding and cleanup cost required. This may be negligible on carbon steel, but with stainless steel or aluminum the secondary cleanup when air carbon arc gouging is used can be a substantial labour cost and material expense with grinding wheels and labour. This is avoided with plasma gouging, particularly if an inert gas system is used. Second, there is the cost of coping with the fume generation problem with air carbon arc gouging. Depending on the duty cycle, location (inside or outside), local environmental laws, size of the workshop, etc. this can be no problem or a huge problem. The installation of fume removal equipment can be very expensive to the point of being prohibitive. If fumes are a major problem, plasma gouging may be the only practical choice. On the downside, there is a much higher initial investment required to get into plasma gouging than that required for an air carbon arc system. For air carbon arc gouging, users often use existing welding power supplies and air supply and just add a gouging torch - for an investment of normally a few hundred dollars. A plasma gouging system will generally cost in the order of \$7,000 to \$10,000 . However, payback is usually quite rapid.

How to start with plasma gouging?

Selection of equipment is the first step in considering the application of plasma gouging. Most plasma equipment manufacturers offer gouging nozzles that fit their plasma cutting torch. However, there is more to the creation of an effective plasma gouging system than just putting a different nozzle on the torch.

The power source is an important part of the system. Most plasma gouging is done at 100 amps and above. Plasma gouging can be accomplished at lower currents, but metal removal rates are low and gouge sizes small. Plasma gouging generally requires a much higher arc voltage than plasma cutting. This is for a variety of reasons.

First, since the torch is operated at an angle to the plate, the nozzle-to-work distance is inherently longer than when plasma cutting, requiring a higher arc voltage. In addition, access problems that are common when using plasma gouging to do repair work, cause the nozzle-to-work



The ESAB Powercut 1500, an excellent machine for manual plasma cutting and gouging.

distance to be even longer, further increasing the arc voltage demands on the power source. Typical plasma cutting operates at around 120 volts. When plasma gouging, arc voltages of 200 volts or more may be required. Most power supplies designed originally for plasma cutting cannot supply this kind of arc voltage without significant current drop-off or arc outages. To be a practical production tool, the plasma power source used for plasma gouging must be able to supply full output current at high arc voltages.

Second, the design of the torch is very important. With normal plasma cutting the heat and molten metal is directed downward and away from the torch so the torch body is usually not heavily splattered with molten metal and does not see most of the radiated heat from the plasma arc. In plasma gouging the arc is actually on top of the plate and much of the heat is radiated directly onto the plasma torch head. This puts a heat load on the torch head that many plasma torches were not designed to withstand. The result can be short torch head life due to failure from the external heat. In addition, in many plasma gouging applications, obstructions in the gouging area deflect some of the molten metal being ejected from the groove back onto the torch head, further accelerating torch head deterioration.

The best approach is to have a torch head molded out of special high temperature glass filled polymers. In addition, auxiliary protection devices such as Fiberglas/silicone mittens that wrap around the torch head can be used to give additional protection. Air plasma torches can be used for carbon steel gouging with somewhat higher fume levels, but inert gas plasma torches give the lowest fume level and are what is required for stainless steel and aluminum gouging. Dual gas type construction is the best where a secondary shield gas can be used to further shield the gouging zone from atmospheric contamination and further help clear the molten metal from the groove.

Gas selection

The conditions and parameters for plasma gouging are very important to ensuring success. The first is gas selection. The use of air as the plasma gas is really an option only when gouging on carbon

steel. There will be a somewhat higher fume level than when an inert gas is used, but still considerably lower than with air carbon arc gouging.

For aluminum, stainless and other high alloyed materials, an inert gas for the plasma gas is the best choice. The two to choose from are nitrogen or an argon/hydrogen mix. Nitrogen, generally speaking, lacks the intense arc heat of an argon/hydrogen mix and, as a result, the metal removal rate is lower. An argon/hydrogen mix is generally the best choice as it does not produce surface contamination and the high temperature plasma arc it produces maximizes the metal removal rate.

When a dual gas torch is used, the secondary gas should also be inert. Argon is the best choice, but nitrogen can also be used with results that are almost as good. When gouging aluminum, if the current is over 200 amps a dual gas torch is a must, as without a secondary shield at this higher current, atmospheric contamination causes oxidation of the exposed molten metal and unsatisfactory results occur.

The current selected is usually a function of the metal removal desired. Usually, 100 amps is the minimum current for any meaningful plasma gouging, however small repair work and defect removal can be done at lower currents. Groove size is a function of current level travel speed and torch angle. In addition, in manual applications, the torch can be held at a shallow angle and moved side to side in a washing motion to skim off metal or remove hardfacing.

The best torch angle to start with is 35 to 40 degrees, and an arc length of 1/2 to 1 inch. The amount of metal removed in one pass when gouging in the flat is subject to an upper limit. Since plasma gouging does not eject the metal from the gouge with the same force as air carbon arc gouging, there can be difficulty in removing the metal from deep grooves in one pass. For instance, the maximum recommended at 150 amps with one pass is 5/16 inch. Obviously with multiple passes deeper grooves can be obtained.

Industrial applications

Many industries have picked up on the advantages of plasma gouging and are using the

process with great advantage. One of the first to use it is the rail car and locomotive repair industry in Canada. Plasma gouging substantially reduced the amount of smoke in a workshop where there may have been 30 or 40 gouging arcs going on at the same time. In addition, the control of the metal removed was much greater than with air carbon arc or oxyfuel gouging that was previously used, and access into tight places was substantially easier. In addition it worked particularly well on aluminum and stainless steel tank and passenger cars.

Similarly, plasma gouging is an excellent maintenance and repair tool in truck and off-road equipment repair. Rebuilding and repair of truck bodies, many of which are made of stainless steel or aluminum is similar to rail car repair and a widening use of the plasma gouging process. Typical users are refuse truck and aluminum flatbed trailer repair facilities.

Roll repair is another use of plasma gouging in the repair and rebuild of the variety of turning rolls that have to have worn hard facing removed and reapplied. Coal crush rolls, steel mill rolls, paper calendering rolls, and the like, have the worn hard facing layer removed prior to rebuild. Plasma gouging works very well in a lathe type arrangement to skim off the residual layer quickly and with minimal damage to the underlying roll. Previous methods were carbon arc gouging or grinding with diamond wheels.

Foundries find plasma gouging an excellent tool for fin and riser removal. Using a pad washing technique, the plasma process produces considerably less smoke than the traditional method of air carbon arc gouging.

Plasma arc gouging is being increasingly used in the repair, rebuild and maintenance of plants where a large amount of stainless steel, aluminum or corrosion resistant alloys are used. Some of the common applications are in power plants, chemical plants, refineries, paper mills, and food processing plants. There is also the traditional application of weld back gouging in a variety of fabrication situations where high integrity, two sided welds are required such as in pressure vessels and cryogenic tankage. Here plasma

gouging's high quality results are the major advantage. The freedom from carbon pick-up problems and the need for additional grinding and cleanup offers drastically reduced cost and improved quality.

Another typical application is in the retrofit of armoured personnel carriers. These vehicles are made of aluminum and repairing or retrofitting them with, for example, new gas tanks, is difficult using weld removal techniques such as air carbon arc gouging which requires extensive cleanup or mechanical methods which are slow and costly.

In summary.

Plasma gouging can, when compared to air carbon arc gouging, reduce or eliminate potentially severe fume problems, improve the quality of the result, particularly on stainless steel and aluminum, and lower both direct and indirect costs. Although there are plasma gouging accessories available for many types of plasma cutting systems, there are some specific requirements for the equipment to result in a useable plasma gouging system. Lastly, rather than a limited use process, there are many potential applications for plasma gouging throughout industry where its advantages can be effectively used.

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Plasma gouging: A faster, cleaner, and quieter alternative to carbon arc gouging - II

New ESAB Plasma Gouging System configuration to increase productivity!

ALAAELDIN ASSAL, ESAB CUTTING GmbH, KARBEN, GERMANY.





ESP-150 plasma gouging used for the removal of weld defects in the manufacturing of large tubes.

In the previous issue of Svetsaren we outlined the successful implementation of ESAB Plasma Gouging systems in windmill applications. Since then, plasma gouging has become widely accepted and implemented in many other industries as a viable alternative to carbon arc gouging for removing weld defects. ESAB plasma gouging systems now remove weld defects in applications such as LNG containers, LNG compressors, pressure vessels, etc.

Plasma gouging has many advantages over carbon arc gouging, one being a substantial reduction in noise level. One ESAB customer has conducted tests to determine the actual level in noise reduction, the result being around 12dBA (Table 1).

The plasma gouging process has the additional advantage of being suitable for any metal - carbon steel, stainless steel, and aluminum. By using the correct gas combination for the gouging and shielding gas, the plasma gouging process produces a very clean surface with much less fume generation.

The plasma gouging process is also a much faster way of removing weld defects, thereby increasing the productivity of the manufacturing cycle of any product.

An additional advantage reported for ESAB plasma gouging systems is the long life of wear parts. The gouging nozzles are usually much larger in diameter than the cutting nozzles which significantly reduces stress on the nozzles and the electrodes. The result is a significant reduction in the cost of removing and repairing weld defects.

The ESAB ESP-150/PT-26 and the Duce Pac ESP-150/PT-26 manual and mechanised plasma gouging systems are now used in many applications around the world.

To increase the productivity of the gouging process, ESAB has introduced a new configuration of the well established Duce Pac ESP-150/PT-26 - developed in response to customer demand for increasing the productivity of the process. Performance, reliability, and high productivity are combined in one package.

The new system can be easily connected as two independent 150A gouging systems with two PT-26 torches. Each 150A system can remove weld defects up to 12-15mm deep in one run.

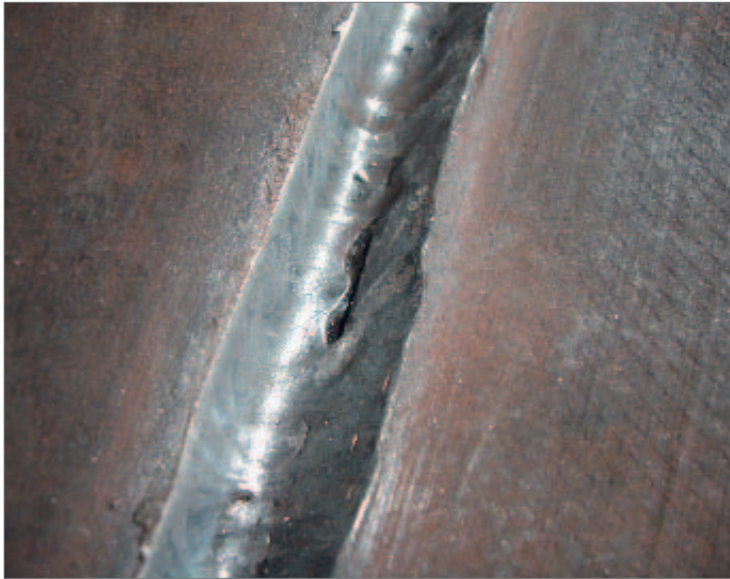
The same system can be connected as one 300A gouging system working with one PT-26 torch. The 300A system can remove weld defects up to 25-30 mm deep in one run. It can also cut stainless steel up to 80 mm in thickness.



The Duce Pac ESP-150/PT-26. The system can be equipped as two independent 150A gouging systems or connected as one 300A gouging system.

Table 1. Noise levels from carbon arc gouging and plasma gouging.

	0.5 m distance	1 m distance	3 m distance	6 m distance
Carbon arc gouging	127 dB	124 dB	109 dB	105 dB
Plasma gouging	118 dB	110 dB	97 dB	92 dB



Duce Pac 300A gouging system used for removing spot weld defects in an LNG compressor body.

Industry reports noise reduction from plasma gouging

A major European construction company measured noise levels at distances from the operator of 0.5 m, 1 m, and 3 m, while gouging the same material with both carbon arc and plasma gouging processes. Table 1 gives an overview of the test results. The difference between the two methods is approximately 12 dB- a considerable reduction on the logarithmic dB scale.

With carbon arc gouging, the company was not able to meet the recommended 85 dB for a full working day; only 15-30 minutes would be acceptable. Hearing protection brings the noise level down by approximately 30 dB, but becomes less effective at levels above 100 dB. With plasma gouging and standard hearing protection, the actual noise level would be around 90 dB, still not optimal - but far better than carbon arc gouging. Another difference is how individuals experience the noise from the two processes. The noise from carbon arc “stays longer in the air” and is therefore found to be more of a strain.

Product News Cutting

VBA-WRIST

NEW MACHINE TECHNOLOGY FOR OPTIMISED PLASMA CUTTING OF THREE-DIMENSIONAL COMPONENTS

MARIO KÖNIG, ESAB CUTTING SYSTEMS GMBH, GERMANY.

For more than 15 years ESAB Cutting Systems has supplied automated bevel cutting heads for efficient weld preparation on flat sheet metal components. While this technology has become an industry standard, automated plasma cutting of three-dimensional work pieces is still fairly uncommon because of the unique requirements of these components. ESAB has now introduced the innovative VBA-Wrist to target these issues and provide a cost and labour savings to the vessel, container and pipe industry.

TECHNICAL ADVANTAGES

The new VBA-Wrist (patent pending) bevel cutting head was created especially for plasma cutting of three-dimensional parts such as dished-ends, profile sections and pipes. A single plasma torch is controlled via servo motors in five axis, pivoting around the tool centre point. To provide best cutting results, the system is guided in high precision linear bearings - a significant advantage over robotic systems. All mechanical components are totally enclosed to protect them from abrasive iron oxide dust.

TOLERANCE COMPENSATION

Key issues in cutting three-dimensional parts are the large tolerances of the raw work

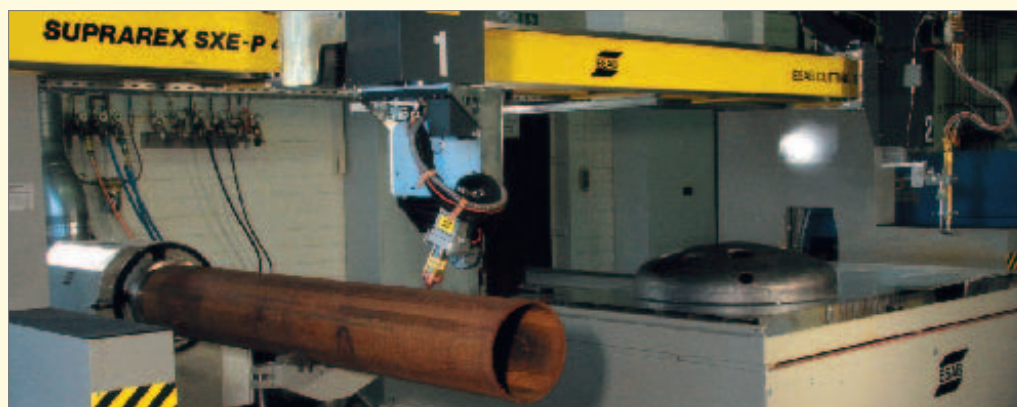


Figure 1. Cutting Machine SXE with VBA-Wrist and Pipe Cutting Device.

pieces and the difficulties in defining the base points. ESAB's intelligent laser-based measurement system reduces set-up time to a minimum. Based on the resulting data, the base point is calculated and the cutting programs automatically fine-tuned to follow the actual, not the theoretical surface, of the work piece. Accuracy is significantly improved.

EFFECTIVE PROGRAMMING

Software available provides accurate programming and increased productivity. After just a short training period, operators and programmers are able to create sophisticated cutting programs. For error prevention, the results are visualized in three-dimensional graphics.



Figure 2. Dish-End-Cutting.

FLEXIBILITY

Whilst the VBA-Wrist is designed to achieve cost savings, particularly on three-dimensional parts, it also facilitates accurate cutting of plate materials that have both, bevel and straight areas. With this flexibility, an investment in a VBA-Wrist brings the benefits of high machine efficiency and low cutting costs.

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FALCON

THE RELIABLE AND COST EFFICIENT CUTTING MACHINE FROM ESAB

CARL BANDHAUER, ESAB CUTTING SYSTEMS GMBH, GERMANY

The versatile and robust Falcon can be used for oxy-fuel and plasma cutting or a combination of both. The machine delivers the best cost/production ratio in its class and can be upgraded for changing cutting demands.

The machine can accommodate plate widths up to 2200 mm (one torch) or 2 x 1250 mm (two torches). The solid, reinforced main beam ensures stiffness over the entire machine width. The low level outboard rail is mounted below the height of the cutting table to allow easy loading and unloading - by forklift - and to minimise the risk of collision with the machine. The transverse and longitudinal drive system with AC drives offers the highest accuracy throughout the entire cutting area.

Sophisticated mechanical design

The Falcon features a transverse drive motor with precision rack and pinion gear, together with backlash-free gears and drives to provide high positioning and cutting speeds.

Linear guiding by AC motors ensures accurate travel of the torch carriage with smooth, rapid acceleration. Well-proven, high quality design ensures low maintenance costs and long mechanical service life.

The tool carriages are attached to a zero-backlash steel band which –contrary to conventional steel ropes –is not susceptible to slag deposits. Rapid-action coupling ensures efficient manual positioning of the tool carriages.

Plasma cutting

Various ESAB plasma cutting systems are available for cutting mild steel, stainless steel and aluminium. Precise setting of cutting torch height is achieved, automatically, by initial height sensing and maintained during the cutting process by an arc voltage height control. The ESAB anti-collision system

immediately stops the cutting process and shuts down the machine in the event of a collision or crash.

Oxy-fuel cutting

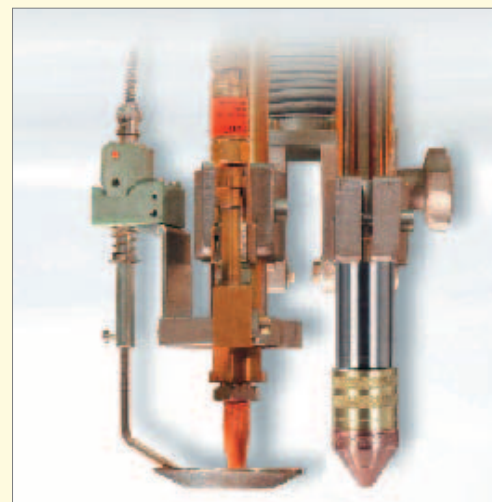
The Falcon can be fitted with two oxy-fuel torches for cutting mild steel plates with thickness up to 150 mm. Each tool carriage is provided with a reliable automatic ignition device. Solenoid valves on the carriage facilitate automatic piercing. Cutting height is determined by a capacitive ring, which automatically maintains the torch height to ensure the optimum cut quality.

Numerical control system

The Falcon is a versatile oxy-fuel and plasma cutting machine with all processes controlled by a CNC system. Extensive control functions, interfaces and an integrated cutting database with 65 fixed programmes deliver reliable, reproducible quality cut parts. The CNC systems are easy to use, resulting in low costs and high productivity.

Operational data and specifications

Machine size (B)	3000 mm
Cutting with one torch (A)	2200 mm
Max. piercing	60 mm
Cutting with two torches (A)	2 x 1250 mm
Max. piercing	60 mm
Base rail length	8000 mm
Rail height	1020/550 mm
Cutting thickness with one torch	200 mm
Cutting thickness with two torches	150 mm
Recommended process speed	50-6000 mm/min.
Position speed	9000 mm/min.
Number of tool carriages	2
Fuel gases	acetylene propane/natural gas.
Main voltage	230/50 V/Hz
Power input	~ 2000 VA
Machine length	1950 mm
Machine height (D)	1900 mm
Cutting table height	700 mm
Machine width (C)	3400 mm



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ALPHAREX WITH 6 KW LASER HEAD FOR LARGE PLATE DIMENSIONS

HANS-PETER BARTHOLET , ESAB CUTTING SYSTEMS
GMBH, GERMANY.

The ALPHAREX AXB 7000 with the new 6 KW AXD laser head increases the cutting speed. Cutting, welding and marking can be performed with the same laser head.

The ALPHAREX, from ESAB Cutting Systems, is a highly successful laser cutting machine - some 60 systems have been delivered, worldwide, since 1993. The laser system travels with the machine in the X-direction, making it extremely suitable for large plate dimensions. The machine can cut parts up to 60 m long and 8 m wide.

Increased laser capacity

Over recent years, the development of new laser sources has led to higher laser power and improved beam quality. The latest generation of CO₂ cutting lasers generates 6 kW of power with a beam quality factor (k) up to 0.58, offering clear advantages for cutting applications:

- Higher cutting speed (table 1).
- Increased maximum thickness, especially in fusion cutting (stainless and aluminium).
- New cutting processes for stainless steel are possible when the laser power exceeds a certain level of intensity, increasing the speed by about 50% for dividing cuts.
- Higher initial costs for investment are returned by lower cutting costs per metre with increased machine capacity.

Laser welding

Not only cutting performance is improved. Laser power of 5 or 6 kW is also sufficient for welding - at a reasonable process speed (Figure 2). The availability of increased laser power has enabled ESAB to change the design of the ALPHAREX to produce a machine that can be used for cutting, welding and marking - with the same laser head.

Laser power	kW	3.2	4	5	6
mild steel	mm	20	20	25	25
cutting speed	mm/min	800	850	800	900
stainless steel	mm	12	12	20	25
cutting speed	mm/min	230	410	400	250
Aluminium	mm	8	8	12	15
cutting speed	mm/min	350	750	500	400

Table 1. Laser power vs cutting speed for various materials.

The design is based on a modular laser process head that covers all three processes, while allowing straight and bevel cuts. The design with focusing mirror and ZnSe window is less sensitive, all mirrors are water-cooled and can endure up to 8 kW power (Figure 3). To make life even easier, ESAB developed a patented focusing system to cut every material and thickness without changing the optic. The benefits of this technology are reduced operating costs and increased productivity, combined with easy operation.

The new AXD laser head enables:

- Oxidation cutting.
- Fusion cutting.
- Bevel cutting for weld preparation (cutting +/-50°).
- Marking.
- Removing primer.
- Laser welding with seam tracking.
- Hybrid welding (Laser + MIG process).

Integrated process control

Piercing, cut quality and stability are monitored for:

- Faster production of parts
- Safer part processing
- Big increase in productivity

All cutting data CNC controlled

All parameters are taken from the database. The operator only has to choose the material and the thickness required or it is already pre-programmed. All other cutting parameters are selected automatically by the numeric control. This guarantees repeatable cutting results - even without an operator. Ghost shifts increase productivity.



Figure 1. Some laser cut samples

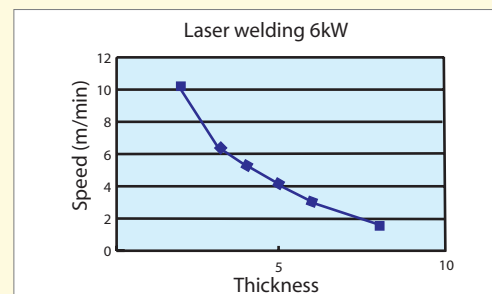


Figure 2. Welding speed on mild steel with a 6 KW laser.

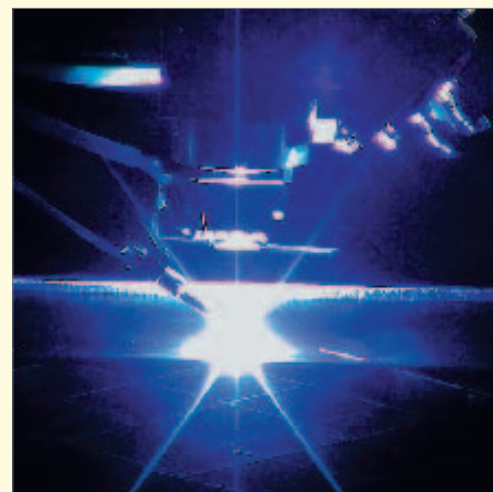


Figure 3. The AXD laser head.



m3 PLASMA™

**ONE MECHANISED PLASMA CUTTING SYSTEM
FOR MARKING, HIGH QUALITY CUTTING, HIGH
SPEED CUTTING AND HEAVY PLATE CUTTING.**

CARL BANDHAUER, ESAB CUTTING SYSTEMS GMBH,
GERMANY

For the first time, multiple cutting and marking is available in a single easy-to-use system. High speed/ low cost standard plasma cutting - high quality precision cutting and marking - and high current/ thick plate cutting- can be achieved with a single plasma torch.

When configured for 600 A operation, this remarkable system quickly and accurately cuts and marks material from 2 mm to 150 mm, without sacrificing cut quality – a capacity beyond the reach of any high-definition plasma system. The m3 plasma system produces a consistently superior cut surface and virtually no dross.

Torch innovation

ESAB has set a new industry standard in torch design that results in superior cutting and marking over a wider range of materials and thicknesses while using the least consumable parts.

The new PT-36 torch (Figure 1) replaces up to three single-purpose torches (heavy plate cutting, precision cutting and marking). No other system offers the reliability, economy and productivity of the m3 plasma system. Fabricators benefit from superior cutting and productivity, with minimal set-up time, downtime and consumable cost.

The proven PT-36 plasma torch meets all demands for both high quality and high speed cutting. For currents up to 600 A the torch accurately cuts material thicknesses in the range of 2 – 150 mm.



Figure 1. The new PT-36 torch replaces up to three single-purpose torches for heavy plate cutting, precision cutting and marking.

In combination with VBA-Expert Pro, the tool is used for accurate bevel cutting of plates and is fully programmable to cut parts that have both beveled and straight edges. The torch can also be combined with the innovative VBA-Wrist, for precise and variable bevel and profile cutting of three-dimensional parts such as pipes, dished boiler ends, profile sections and plates.

Plasma marking

ESAB m3 plasma systems have the capability for plasma marking with the same torch and the same wearparts. The operator can control the marking current, marking speed and the marking gas. This facilitates control of the marking line width and depth at a marking speed up to 20 m/min.

Consumables cost and lifetime

The PT-36 torch uses the industry's least number of

wear parts – 30 consumable parts to cover the full cutting range. Other systems require up to 66 parts without covering the same cutting range. This results in reduced purchase and stocking routines.

In addition, m3 plasma features the most accurately controlled and consistent flow of gases through the torch which, combined with ESAB's Ultra-Life Technology, maximises consumable life at lower operating cost.

Speedloader™

The SpeedLoader is another innovation that increases the productivity of the cutting process. The PT-36 uses only one single electrode in the 50 – 400 A cutting range; the rest of the front end parts can be preloaded reducing downtime to a minimum. The special SpeedLoader fixture allows preassembly of the nozzle, nozzle retainer, diffuser,

shield, and shield retainer. The operator can swap out pre-assembled consumable sets quickly and easily, minimising down-time for consumable replacement or changover. The SpeedLoader requires no expensive torch bodies and does not break any of the fluid connections when swapping parts - eliminating the risk of O-ring damage or leaks.

Precision

The ISO 9013 specification sets international standards for cut edge quality. ESAB m3 plasma precision mode surpasses the competition – achieving higher cut quality throughout the life of the consumable (Figure 2). ESAB m3 precision mode achieves ISO 9013 range 3 or better edge quality over a wider range of materials and power settings than any competitive system.

Precision, production or sever quality modes can easily be selected and more than one mode can be used in the same part programme. Because the PT-36 torch uses the same electrode over the entire range of oxygen plasma, from within the 50 to 450 A range, cutting modes can be quickly switched without changing consumables. This facilitates maximised cut quality on interior holes and cut-outs while maximising speed on exterior cuts.

ESAB m3 plasma systems feature the most advanced gas control system available – fully automated by ESAB's Vision CNC. Great flexibility in selection and mix of shield gases allows an operator to produce the best cut quality on any material.

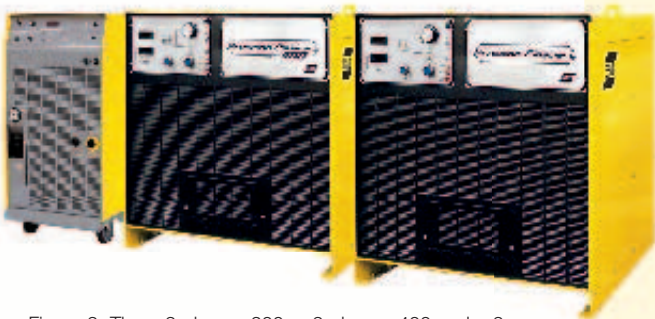


Figure 3. The m3 plasma 200, m3 plasma 400 and m3 plasma 600 power sources.

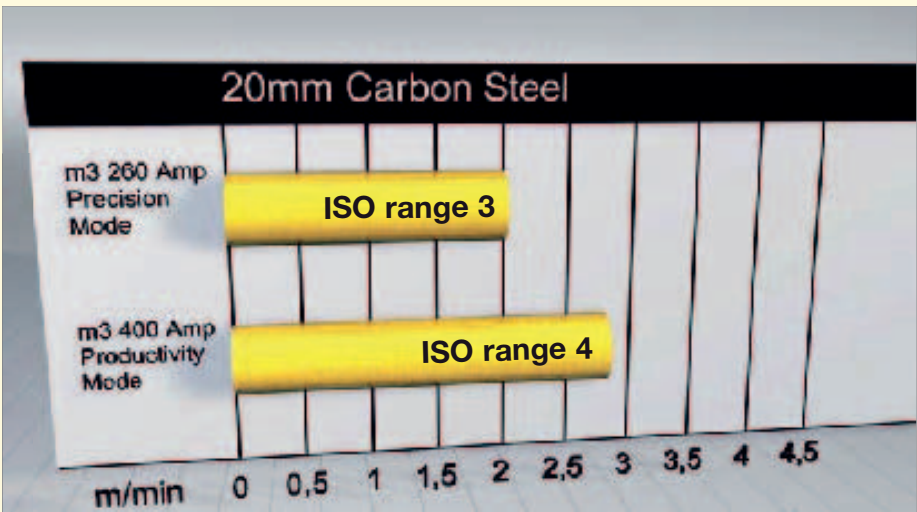
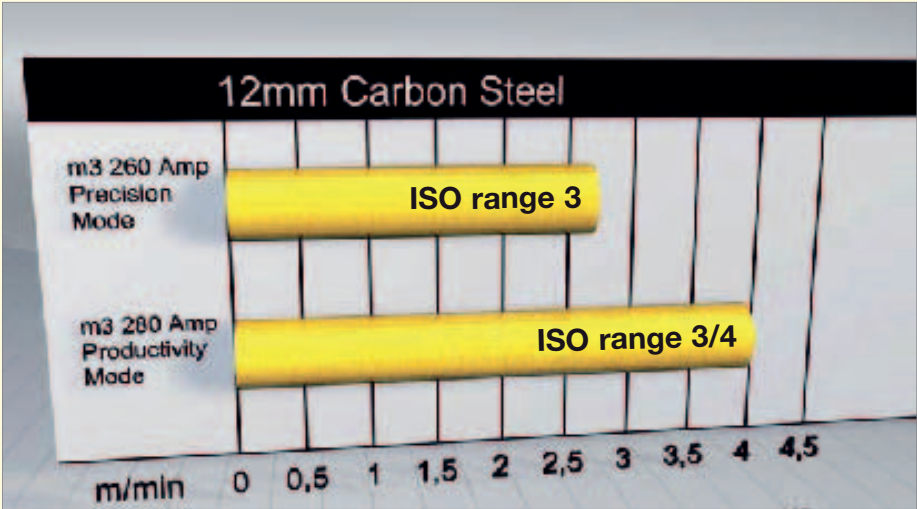
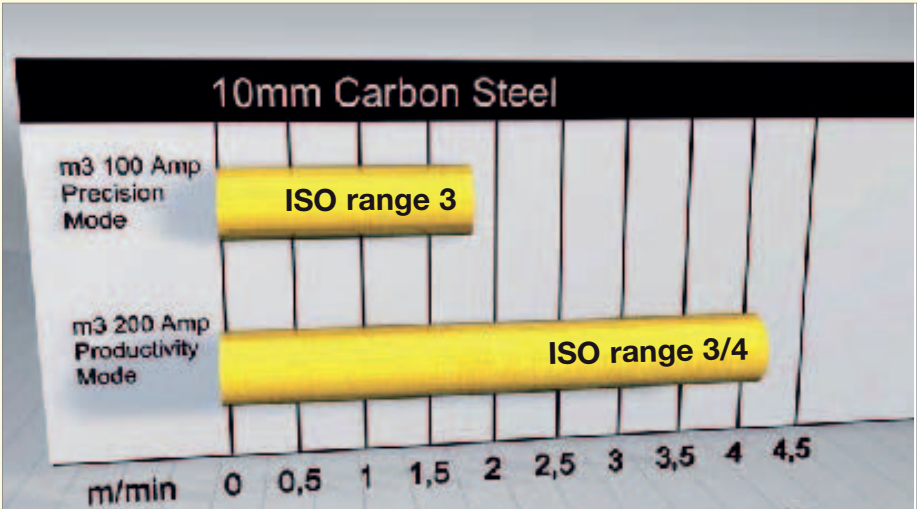


Figure 2. ISO 9013: 2002 quality standards for precision and production cutting with m3 plasma.

Simply select the material type and thickness, and the Vision CNC automatically selects and mixes the optimal start, cut and shield gas combination. Process parameters for most plasma cutting and marking applications are preloaded in the Vision CNC, and custom parameter files can be easily created as needed.

m3 plasma power supplies

The new m3 plasma power sources feature a widely adjustable output current and a proven reliable design to provide the best range of cutting capabilities with the reliability needed for the most sophisticated applications. It can operate as low as 12 A or as high as 600 A at 200 VDC with 100 % duty cycle. The advanced solid state design gives smooth, well regulated output current and is constructed for maintenance free operation in the most demanding environments. Features include digital current and

voltage meters, and “fan-on-demand” technology to reduce intake of dust, resulting in extended maintenance intervals. ESAB m3 plasma power sources rank among the most efficient power sources available, with power factors in the range of 91 – 95%.

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Figure 4. m3 plasma facilitates maximised cut quality on interior holes and cut-outs while maximising speed on exterior cuts.

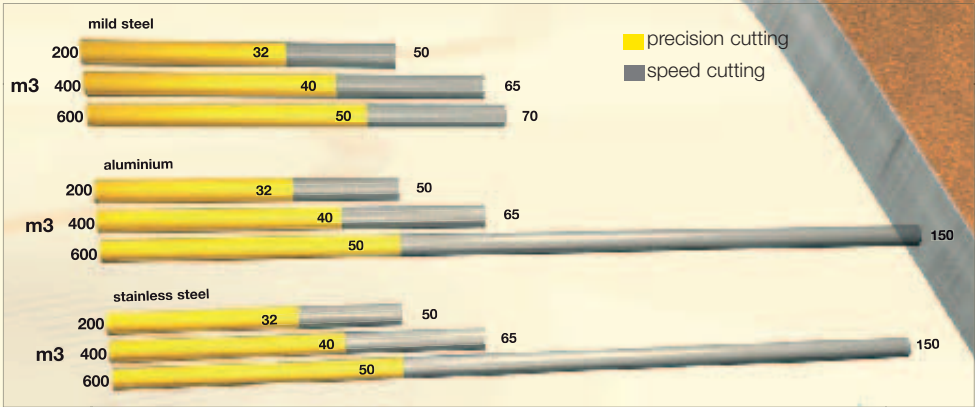


Figure 5. The m3 plasma system can perform precision (Q) and speed (S) cutting – with the same torch and without changing torch consumables. The figure shows maximum cutting thickness for precision cutting and speed cutting in steel, aluminium and stainless steel at 200, 400 and 600 A. The m3 plasma system offers a choice of power sources with corresponding output capacity.

VISION CONTROLS – THE NEXT GENERATION

OLAF KEMPERS, ESAB NEDERLAND B.V.,
THE NETHERLANDS

ESAB numerical controls for cutting machines are evolving. The Vision family is not only capable of 2D control but, at the top end, provides 3D control for use with VBA Expert and VBA Wrist modules.

ESAB's Vision 51 is the basic high performance PC-based control, designed specifically for cutting machines. It is fast and easy to use and offers features that are focused on plate cutting. Along with the graphics, the Vision 51 shows the outside dimensions of the part and gives the operator an extraordinary level of control for shape cutting.

The Vision 51 has many more advanced features than competitive controls, for example, multitasking, program parking, plate alignment, program graphics with real time display of running point, graphics shape library and kerf override. In addition:

- an 8-position joystick for easy, fast machine positioning.
- a sealed key panel with Easy Touch buttons which are easy to feel and give a positive "click" when pressed.
- a durable panel that is sealed against dust and liquid.
- part program/on screen graphics that show real-time tool position during program execution, graphical selection of shape library programs, graphical preview of dimensioned shapes and graphics to text program and coloured graphics for contrast and operator comfort.
- Showing the parts graphically, allows the user to confirm, immediately, the cutting operation. The operator checks the part before starting and can minimise scrap parts. This feature also reduces production time because, being able to see the part graphically, reduces the number of dry and test runs.



ESAB Vision 51 is the successful synthesis of a wide functional scope and easy operation for modern portal cutting machines. The network-compatible numerical control system, whose particular strength is the control of complex processes, ensures reliable reproducible quality, even under heavy-load industrial conditions. ESAB Vision 51 system software is easy to operate, has numerous interfaces, high basic functionality and can easily be adapted to individual requirements.

Vision 52

ESAB Vision 52 has separate software for machine commands and operator controls. It allows third-party software to be added without affecting the machine controls. It also has a bigger (12 inch) screen than the Vision 51 controller, providing an improved view of cutting parameters.

Vision 55

When controlling complex processes, such as bevel cutting with VBA expert or VBA Wrist, ESAB Vision 55 demonstrates its versatility. The network compatible numerical control system for advanced portal cutting machines ensures reliable, reproducible quality even under heavy-load industrial conditions, whilst being easy to operate and providing numerous interfaces. System software, separated for machine control and operation panel, provides exceptional basic functionality that can be easily adapted to individual requirements. Vision 55 also allows automation of all cutting processes without limitations.

ABOUT THE AUTHOR

OLAF KEMPERS IS SALES REPRESENTATIVE INDUSTRIAL CUTTING SYSTEMS AT ESAB NEDERLAND B.V., UTRECHT, THE NETHERLANDS.

Numerical controls	Processes	Functions	Software
VISION 51	Oxy-fuel & Plasma	Parallel data-input Control for max. 12 carriages Pneumatic clamping of torch carriages Flashram 128 Mb for system information X2-axis for double sided longitudinal drive, including software for Vision 51 with the options: • Program repositioning • Shifting of program start point • Prompting of text • Program parking Timer- en counter module for administration of: • Number of starts • Record cut distance • Maintenance call etc. Teach and trace software Network connection Integrated cut parameters for oxy-fuel, plasma en marking 81 standard symbols	 Windows CE 5.0
VISION 52	Oxy-fuel Plasma Marking (plasma)	Vision 51 + TFT color screen 12" Manual plate alignment Magnifying glass function Automatic flame control (oxy-fuel) DDE interface Water table level control	 Windows CE 5.0
VISION 55	Oxy-fuel Plasma Laser Water jet Marking (plasma) Printing (ink jet) VBA Mechanical tools	Vision 52 + External keyboard Controls for tool carriages (drilling/grinding/pneumatic marking) Automatic plate detection Automatic plate alignment Programmable torch carriages clamping Vertical nest (EOS) Integrated cutting table for laser cutting Additional torch carriage control traverse direction (Y) Automatic positioning of two independent torch carriages on Y-axis Rotating of Z-axis maximal 2 torch carriages (VBA) Welding preparation cutting oxy-fuel/plasma/laser X, K, V	 Windows XP

NEW AFTER SALES SYSTEM FOR CUTTING SPARE AND WEAR PARTS.

IMPROVED LOGISTICS FOR ACCURATE DELIVERY.

In 2004, ESAB Cutting Systems GmbH, in Germany, became ESAB's first supplier of cutting spare and wear parts, and embarked on a programme of improving delivery efficiency to customers worldwide.

Controlled cutting data.

As a result, all after sales functions are now the responsibility of the new Supply Chain Department which handles the order desk, stocking and logistics, as well as replacement parts and guarantee issues. This has resulted in improved service to customers who benefit from faster reaction times, increased flexibility, and correct, on-time delivery. Customers still order spare and wear parts through their national ESAB sales office but, behind the scenes, ordering routines have been simplified. Crucial in this is the implementation of EDI, a system that allows

ESAB sales offices to directly place orders from a PC. This saves on manual input and administrative work, avoids copying orders and, above all, it results in shorter lead times. The system does not yet cover orders, worldwide. However, all European countries will be connected in the near future.

ABOUT THE AUTHOR:

HORST KOEHLERT, IS SUPPLY CHAIN MANAGER FOR ESAB CUTTING SYSTEMS GMBH, IN KARBEN, GERMANY.

QSet™ - a breakthrough in welding technology!

Short arc MIG/MAG welding with a single button.

HANS WOLTERS, ESAB GROUP B.V., THE NETHERLANDS AND PER ÅBERG, ESAB STANDARD EQUIPMENT AB, SWEDEN.



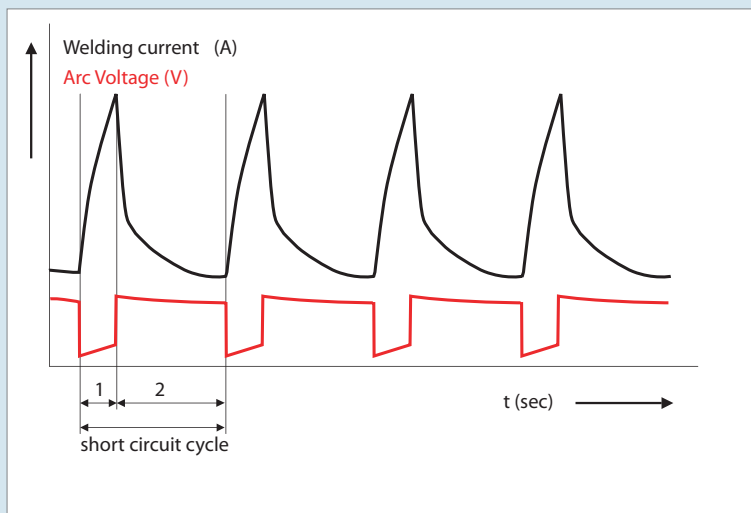


Figure 1.
The short arc AV diagram.

1. Short circuit time.

During the short circuit phase, current increases and arc voltage becomes minimal.

2. Arc time

As soon as the droplet is detached the arc ignites again and the wire end heats up. A new droplet is formed. The current drops and arc voltage increases, until the next short circuit.

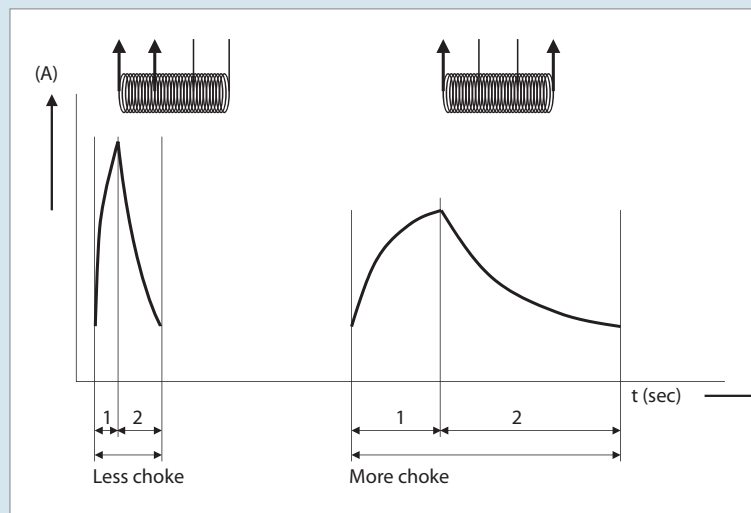


Figure 2.

Less choke gives a high short circuit frequency and a shorter arc time resulting in a cooler weld pool. More choke gives a lower short circuit frequency with a longer arc time and a warmer weld pool.

QSet is ESAB's latest innovation in MIG/MAG power sources, an innovation set to change short arc welding - forever. A push on the QSet button, and a few seconds of test welding, is all it takes to find optimal short arc parameter settings - automatically! Benefits include savings in time and improved weld quality.

Finding the right balance between wire feed speed and burn-off rate is crucial to successful short arc welding. To achieve this, the arc voltage and wire feed speed need to be carefully matched. A skilled welder will choose an approximate setting, then adjust arc voltage and wire feed speed until the optimal setting is found. The process will then operate at a proper short arc frequency with its characteristic sound (Figure 1).

This procedure will be repeated for different welding positions, plate thickness, wire type or shielding gas, because they all have an effect on the short circuit frequency. The short circuit frequency is also influenced by the stick-out length and choke setting.

The choke setting also affects heat input, along with the arc voltage and wire feed speed. More choke results in a longer arc period, a lower short

circuit frequency and a higher heat input (Figure 2). Less choke gives the opposite - shorter arc period, a higher short circuit frequency and less heat input.

QSet™ – ESAB's latest innovation in intelligent digital welding

Modern electronics enable engineers to design



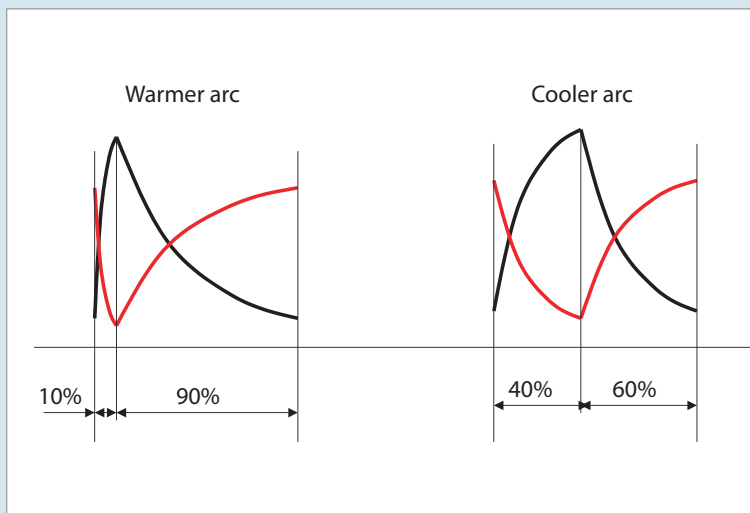


Figure 3.
With QSet, the ratio of arc time and short circuit time can be adjusted to obtain a warmer arc, while the short circuit frequency remains the same.

software that supports welders in controlling the welding process. Nowadays, we are familiar with extensive memory functions to store and retrieve optimal settings for the process parameters. QSet is ESAB's latest innovation in intelligent digital welding.

With QSet, by pushing one single button, the machine automatically selects the optimal short circuit frequency for the gas/wire combination installed, which is maintained when the welder adapts the wire feed speed to the level required for the application. It just needs a few seconds of test welding. The same procedure is repeated when changing wire type or diameter and/or shielding gas and the machine will, again, find the optimal arc setting.

It couldn't be easier! Welders will save valuable time in arc setting and can concentrate energy and skills on producing the perfect weld. Time will also be saved on weld cleaning - the curse of

even the best welders! - because the ideal arc setting will reduce spatter to an absolute minimum.

ESAB has introduced QSet installed on a 300 A inverter in a compact version, the Origo™ Mig C3000i with MA23a panel, and a version with a separate ESABFeed 30-4 wire feed unit, the Origo™ Mig 3000i with MA23a panel.

1,2,3 welding

Here's the use of QSet explained in three steps:

• Step 1

Make a test weld at any wire feed speed. As soon as the machine is switched on, or after any change of wire and/or gas, make a test weld. Continue welding until a stable short arc is established. QSet will find, and start using, the optimal settings for the chosen wire/gas combination four seconds after the arc is established.

• Step 2

Adjust the wire feed speed to a value that is suited for the joint type, material thickness and position of the work piece. QSet will maintain the optimal short arc setting and welding can begin, immediately. Naturally, if the wire speed setting is known in advance, it can be set, directly.

• Step 3

Change the wire feed speed whenever needed, during welding or between welds. When a different joint geometry, material thickness or welding position requires a different wire feed speed, the optimal parameters will be maintained and a stable short arc for high quality welds will be ensured. Just continue welding! QSet will also keep the short arc process stable with variations of the stick-out length when the geometry of the work piece changes. This helps welders who might otherwise experience difficulties in, for example, narrow corners.





How does it work?

The digital revolution in power sources started in 1986, when ESAB pioneered the use of micro-computers to control the welding process to the smallest time intervals in the weld procedure. Over twenty years, these control systems have advanced and, today, they are the basis for QSet.

In a stable short arc process, the ratio of short circuit time and arc time lies within a relatively narrow range. If a process control maintains the ratio within this range, it keeps the welding process stable and ensure optimal welding.

This is exactly what QSet does. It continuously measures and controls the short circuiting pattern and adapts the voltage accordingly. And, what's more, it does not need any information, in advance, about wire type and diameter, shielding gas, stick-out length or other factors that influence short arc conditions. It only needs a test weld to find the optimal short circuiting ratio and, from then, takes digital control of the short arc process.

The operation of QSet can also be described in another way. Imagine an ongoing stable welding process and, then, an increase in wire feed speed. The duration of short circuits will increase and, thus, the short circuit ratio (short circuit time vs arc time) will increase. In reaction to this, the control will increase the average voltage and, thereby, reduce the short circuit ratio again.

Spray arc area

Q-set is a valuable development for short arc welding, but it is also possible to utilise the automatic voltage control of QSet in the spray arc area. It does, however, require the "voltage setting" to be increased to almost maximum.

Using choke with QSet

A warmer or a cooler arc requires a different ratio of arc time and short circuit time. This can be adjusted by rotating the QSet knob (Figure 3). By turning clockwise, the arc time will lengthen at the expense of the short circuit time and the result will be a warmer arc. Turning counter clockwise, the opposite will happen and the arc will get cooler.

In addition to making the arc warmer or cooler, regulation by choke is also possible, as explained earlier. There is no real choke on the machines, but

an almost stepless choke effect is available. In comparison with conventional equipment, the combination of QSet with choke regulation offers more freedom to fine-tune the parameter setting and obtain the best possible results in the short arc mode.

The benefits of QSet™ – a summary

In addition to easy arc setting, QSet offers the following advantages:

- **One knob control.** After QSet has found the optimal settings with a test weld, only one knob is needed to adjust the arc power to changing weld geometries or welding positions.
- **No synergic lines.** The welder does not have to spend time on programming and entering primary data such as wire type and diameter and shielding gas.
- **A very stable arc.** QSet always finds the most stable arc under all circumstances.
- **Stick-out variations.** QSet makes it easier for the welder to cope with changes in position and stick out variations due to work piece geometry.
- **Less spatter.** The automatically adjusting arc setting and a stable short arc results in less spatter. This saves on costly weld cleaning.

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PER ÅBERG – THE INVENTOR OF QSET - MANAGES SOFTWARE AND WELD PROCESS DEVELOPMENT AT ESAB STANDARD WELDING EQUIPMENT AB, LAXÅ, SWEDEN.

AristoMig 400 – a strong work-horse in rail repair

User-friendly power source does the job all year round.

BEN ALTEMÜHL, EDITOR OF SVETSAREN

After initial testing, a year and a half year ago, Banedanmark Enterprise, in Denmark, decided to invest in 15 ESAB AristoMig inverter power sources, for the hard surfacing of worn rail components using stick electrodes and self-shielded cored wires with Railtrac equipment. This ESAB process solution operates under all conditions.

Copenhagen-based Banedanmark Enterprise is a state-owned company active in the maintenance of Danish railways. The company employs some 1000 people – 55 active in the on-site repair of worn railway components such as crossings, bends and switch blades. The work requires a thorough knowledge of rail materials, repair techniques and specialist welding procedures, as well as a great awareness of safety procedures for railway workers. Although state-owned, Banedanmark Enterprise has no exclusive arrangements with Danish Railways but competes with other companies in this sector. Efficient planning, organisation and performance is crucial

to the company.

The purchase of ESAB AristoMig 400 inverters fulfills Banedanmark Enterprise's efficiency objectives for an easy-to-use power source with special characteristics for rail repair work. The company became familiar with AristoMig 400 at Banskolan Ängelholm, in Sweden, an institute specialising in the training of rail repair technicians.

Subsequently, ESAB, Denmark, provided Banedanmark Enterprise with a trial machine. After thoroughly testing the equipment on all types of repairs, the decision was taken to

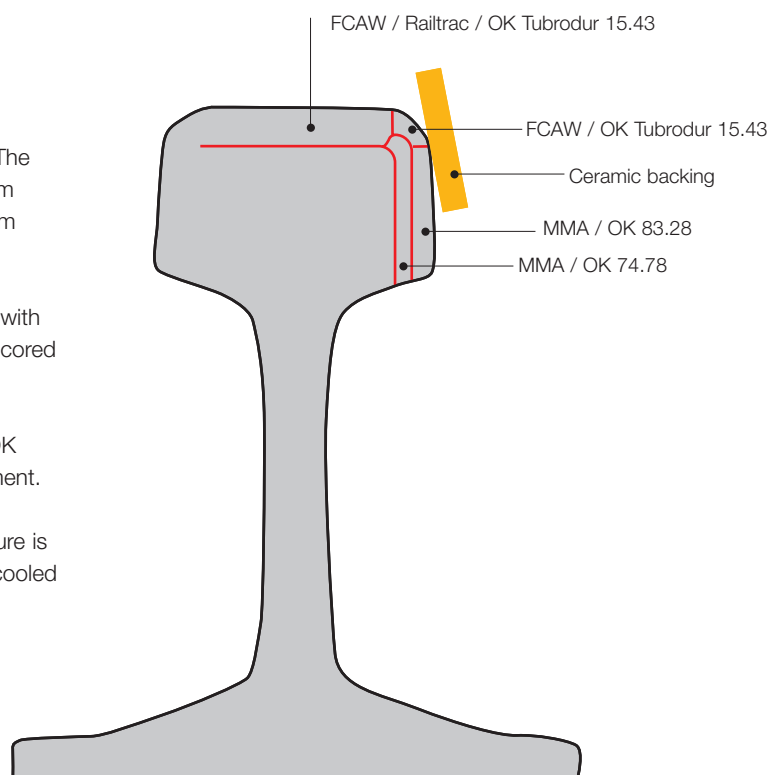


Figure 1. Repair of a crossing in UTC 60 steel (EN: R260Mn). The sides are repaired manually with MMA using OK 74.78- ø 5 mm (E 55 4 MnMo B 120 20BH) to build-up and OK 83.28- ø 5 mm (DIN E1-UM-300) for the wear resistant top layer.

Subsequently, the edges of the rail head are built-up manually with FCAW with OK Tubrodur 15.43- ø 1.6 mm self-shielded basic cored wire, using ESAB ceramic backing to support the weld metal.

Finally, the rail head is deposited by mechanised FCAW with OK Tubrodur 15.43- ø 1.6 mm and ESAB Railtrac BV1000 equipment.

The preheat temperature is 400°C and the interpass temperature is maintained above 350°C. After grinding the welded parts are cooled down under an isolation blanket, in the case of low outdoor temperatures.



purchase 15 AristoMigs - with an option for more machines in the near future. In Svetsaren issue 2-2005, we described the AristoMig 400 and 500 in great detail, including processes, process functions and intelligence in relation to the different operation panel options. This article concentrates on the operation of the machine for railway repairs.

A machine with railway repair intelligence

Banedanmark Enterprise opted for the AristoMig 400 with AristoFeed 48-4 wire feeder and air-cooled PSF 405 torches, equipped with an MA6 panel on the wire feeder. The deal included the development of synergic lines for the repair of railway parts in the ESAB Process Centre in Gothenburg.

Figure 1 (INSET) is a sketch of a railway crossing in UTC 60 railway steel to be welded by a combination of manual MMA and mechanised FCAW with self-shielded cored

wires. Table 1 shows the ESAB consumables used for MMA and FCAW. The sides are built-up with stringer beads whereas, for the rail head, weaving over the full width is applied.

The AristoMig 400 with MA6 panel is a two-process machine (MMA and MIG/MAG), including synergic MIG/MAG and synergic pulse MIG/MAG. Also, arc gouging is included. In the basic set-up it contains 29 of the most commonly used synergic lines, stored in the MA6 memory, but these can be adapted to specific applications.

Banedanmark Enterprise made use of this by asking ESAB to develop synergic lines for OK 74.78 and OK 83.28 (MMA) and OK Tubrodur 15.43 (FCAW) for the repair of crossings and other lines for different rail repair applications. A delegation from Banedanmark Enterprise attended a two-day session at the ESAB Process Centre, in Gothenburg, to test and approve the synergic lines.

With these synergic lines, Banedanmark Enterprise benefits from an extremely user-friendly power source that features one-knob control for all types of repair, after selecting the process from the MA6 panel. This selection is simple and straightforward - very much like the menu of a mobile phone (Figure 3). An extra option included for Banedanmark Enterprise is a remote control on the wire feeder, allowing a choice between setting the wire feed speed either on the feeder or by remote control.

Strong and reliable

The AristoMig 400 is a strong, reliable machine with features that provide clear advantages to fabricators. It has an Alutech™ aluminium chassis which is strong, lightweight and corrosion proof, designed for long service life under tough working conditions, both indoors and out. Air cooling is built-in for trouble-free service - separated from the electronics. Air cooling is a "fan on demand system" which is



Figure 2. ESAB Railtrac BW1000 equipment used for hardfacing the rail heads of a crossing with OK Tubrodur 15.43. It is lightweight equipment – programmable with a control unit and operated by remote control. Shown here is the Railtrac BV1000.

only activated during welding and shuts-off automatically. This saves energy and reduces wear and maintenance. The integrated dust and metal particles filter is easily reached for cleaning. The design enables three minute service – unique in the market.

Banedanmark Enterprise confirms trouble-free service with minimum maintenance. The AristoMig power source is located on a railway repair carriage which is fully serviced once a year, power source included. Only wear parts such as contact tips and liners are replaced when needed.

Acknowledgement.

We thank Alex Meisner, Welding Supervisor, Jan Hedengran and Bjarne Hedengran, Welding Technicians, at Banedanmark Enterprise for arranging our visit to a rail repair site and for providing us with the information for this article.

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Table 1. Consumables for the on-site repair of railway crossings in UTC 60 grade steel.

	UTC 60	OK 74.78	OK 83.28	Tubrodur 15.43
C (%)	0.55-0.75	0.06	0.1	0.14
Mn (%)	0.80-1.30	1.5	0.7	1.1
Si (%)	0.10-0.50	0.4	<0.7	0.3
Cr (%)			3.2	1.0
Ni (%)				2.2
Mo (%)		0.4		0.5
Al (%)				1.5
Rm (MPa)	880 - 1039	650		
HRC			30	30 – 40

Step 1. Synergic welding selected.

Step 2. Wire type selected (basic cored wire).

Step 3. Shielding gas selected (self-shielded)

Step 4. Wire diameter selected.

Step 5. Ready for welding.

Figure 3. Selection of synergic FCAW with OK Tubrodur 15.43 self-shielded basic cored wire within the MIG/MAG menu. All selections are confirmed by the “next” button on the right. The MA6 panel features 15 languages - shown here is Danish. The wire feed speed can be set with the knob on the panel or with the remote control. The Voltage knob is used for fine-tuning only.

The Origo YardFeed 200 and Aristo YardFeed 2000

Light, portable and intelligent wire feeders for shipyards.

JOHN VAN DEN BROEK, ESAB GROUP B.V., THE NETHERLANDS, AND **ANDERS ALLANSSON**, ESAB WELDING EQUIPMENT AB IN LAXÅ, SWEDEN.

The new Origo YardFeed 200 and Aristo Yardfeed 2000 are sturdy, lightweight feeders developed in co-operation with shipyards for a long service life under demanding conditions.





The development of the new yard feeders resulted from a survey of shipbuilding applications and requirements carried out in co-operation with shipyards across Europe. One conclusion was that the ESAB range lacked a portable wire feed unit accommodating 5 kg (8") wire spools, not only for ship- and offshore yards, but any production site handling large objects, indoors or out.

Shipyards have very demanding conditions. Much of the work is done outdoors, all year around and under all weather conditions. Welders work in uncomfortable conditions, often deep inside ship structures reached via ladders and manholes as small as 40 cm at distances up to 50 m from the power source. One of the survey's key requirements was, therefore, to have a lightweight feeder to reduce the weight to be carried by welders. The combination of feeders with 5 kg spools, a trend in most European countries, offered the best answer to this requirement. Additional demands were small dimensions, a sturdy construction and easy operation of all important process parameters at the wire feeder itself.

In the development and testing of the new yard feeders, support and input was received from various shipyards, and ESAB's own sales engineers. One of the yards, Ferus Smit Shipyard in Westerbroek, The Netherlands, provided recommendations that resulted in the final design. The Origo YardFeed 200 and Aristo YardFeed 2000, launched in December 2005, have been well received by welders in heavy construction.

Two versions – analogue and digital

The Origo YardFeed 200 is the analogue version for communication with step- and thyristor controlled power sources. The feeder is provided with a so-called M13Y-panel (MMC- man machine communication) with the following functions: wire feed speed, voltage setting, 2/4 stroke, inching and gas purge at the front panel. Adjustable burn-back timer and manual valve for gas flow are inside the cabinet.

The Aristo YardFeed 2000 is designed for communication with CAN-based power sources and features ESAB's MA6 panel. The main

difference between the MA6 and M13Y panels being the availability of (synergic) pulse functions, pre-programmed synergic lines and the ability to store settings in 10 memory positions. Both feeders feature a robust housing made from high strength steel treated with a powder coating. Powder coating is relatively hard, abrasion and corrosion resistant - ideal for demanding work conditions.

The feeder is equipped with a protective frame, made of steel tubes to protect controls and connectors during transport and operation. The door for changing spools has its hinge on top the housing and is easy to open and close. The well-balanced, integrated handle makes it easy to carry, with or without spools. A sledge underneath facilitates effortless sliding across the floor. An optional protective shield protects the control panel from, for example, spatter and grinding sparks.

Both feeders are equipped with Military Standard heavy duty Amphenol connectors which ensure good contact after many connections and disconnections. Both types of feeders are available for air cooled- or water-cooled torches. When using the water-cooled variant, the feeder is equipped with ESAB's LogicPump ELP-system, an automatic switch to ensure safe working and prevent overheating of the torch. Welding cables are lightweight with reduced diameter. Quick connectors are used for fast installation. A safety chain between the wire feeder and the cables prevents the quick connectors from becoming tensioned by the weight of the cable.

The ESAB True Arc Voltage system installed in both feeders guarantees welding with the selected arc voltage, independent of cables or torch length. The feeders meet the IP 23 safety standard.

The Origo YardFeed 200 is for MIG/MAG welding in short arc and spray arc. The Aristo YardFeed 2000, additionally, has the facility for (synergic) pulse welding and an outlet for the MMA process. Both feeders are suitable for welding mild steel, stainless steel and aluminium, with solid- or cored wires with wire diameters up to 1.4 mm meeting the increasing demand for larger diameter cored wires in shipbuilding.



Figure 1. Origo Yardfeed 200 in use at Ferus Smit Shipyard.

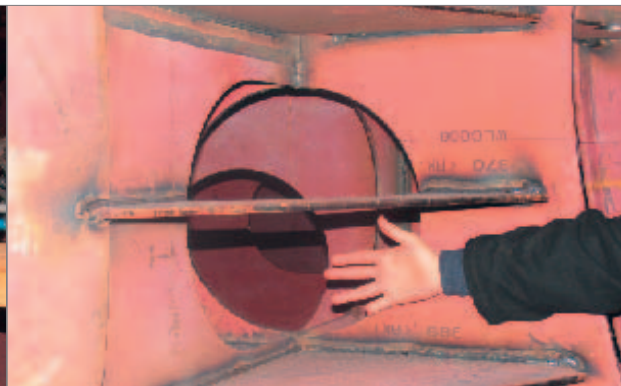


Figure 2. View of a small manhole in a new ship design at Ferus Smit Shipyards. The hand indicates the size of the hole.

The electronically controlled 4-wheel feeder mechanism, with 30mm diameter wheels, ensures stable feeding under all conditions. A 'long-life' inlet nozzle is used to ensure nearly maintenance-free feeding performance.

Productivity demands dictate that cored wires are used for almost 50% of all weld metal deposited in today's ship- and offshore yards. ESAB's feeders, therefore, have excellent characteristics

for rutile, basic and metal-cored wires used in mixed gas or CO_2 .

Heating element

A useful option is a built-in heating element that enables sensitive consumables to be heated during standstill hours, to prevent moisture absorption. It is very useful, for instance, when welding aluminium or duplex materials. A switch on the front of the panel activates the heating.

Another option is to have a gas flow regulator built-in inside the wire feeder where it is well protected from dust.

Yard experiences

Prototypes of the feeders were tested at several European yards resulting in positive feedback. At the Ferus Smit Shipyard, welders tested a number of feeders under almost every production condition - downhand, vertical-up and horizontal-vertical - including functionality in pre-assembly and double bottoms. The results were regularly reported by Ferus Smit Welding Engineer, Herbert Winkelmann, through ESAB Sales Engineer, Sjabbe Datema. The welders, who were familiar with previous yard feeder systems, particularly appreciated the small dimensions of ESAB's

new feeder which they used in the construction of a new ship design with manholes as small as 40 cm. These experiences resulted in

Ferus Smit buying a total of 26 Origo YardFeed 200 feeders for daily use.

At Ferus Smit Shipyard, the feeders are used almost exclusively in combination with OK Tubrod 14.12 all-position metal-cored wires (1.2 mm diameter), allowing all work to be done with the same consumable. It has a good reputation for downhand work on primed and non-primed plate, as well as for the vertically down welding of small fillet welds with secure penetration. In addition, it is the only wire allowing vertical-up welding in the semi-spray arc mode at settings of about 180 A in 80%Ar/20% CO_2 shielding gas. Improved overall productivity and availability on 5 kg Eco basket spools were the key issues in favouring this consumable.

Acknowledgement

We would like to thank Ferus Smit Shipyards' Welding Engineer, Herbert Winkelmann, for his support and co-operation in testing the new ESAB yard feeder prototypes.

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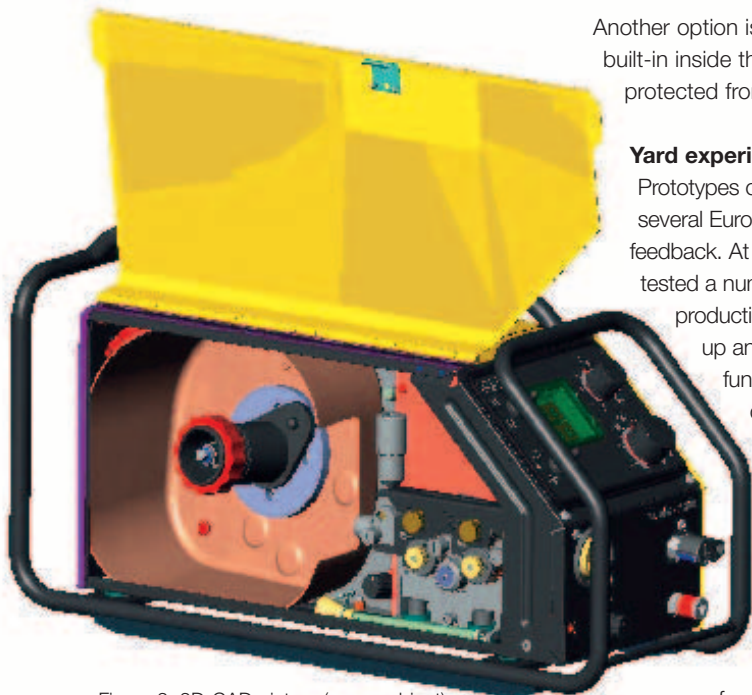


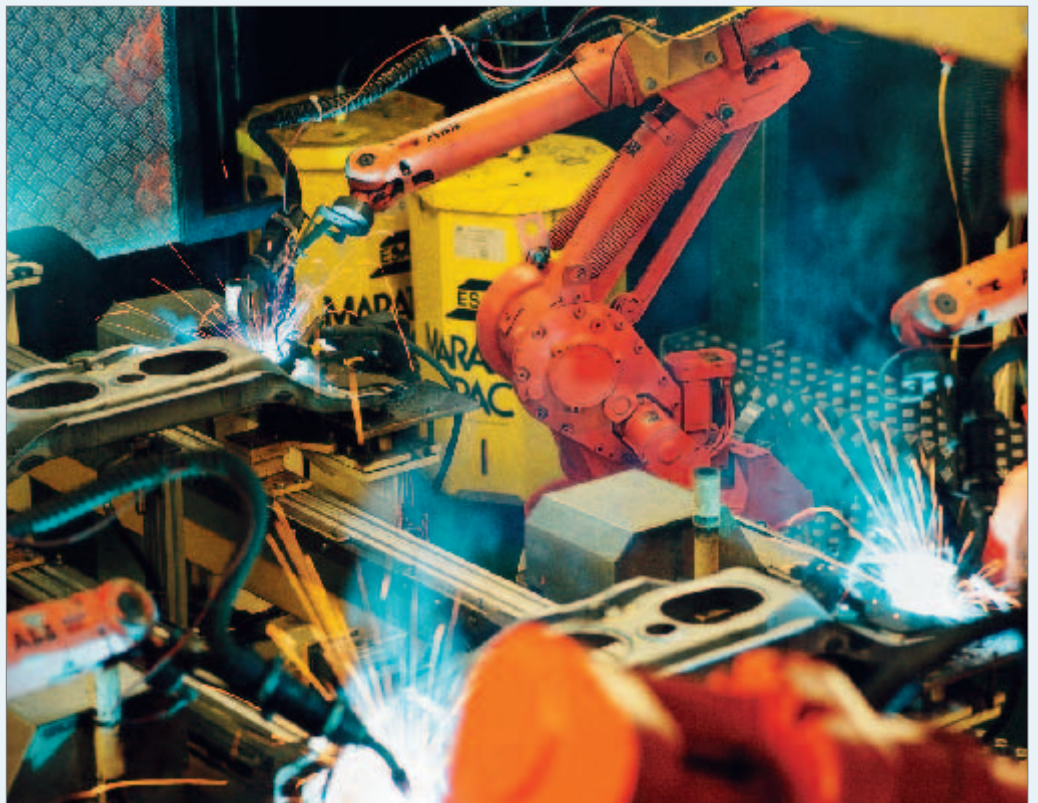
Figure 3. 3D-CAD picture (open cabinet).

Marathon Pac - Total MIG/MAG efficiency

Gain a new world of savings

PETER JEIRUD AND PER SUNDBERG, ESAB AB, GOTHENBURG, SWEDEN.

In the previous issue of Svetsaren, no. 2/2005, we reviewed the Marathon Pac family of bulk drums and associated efficiency benefits for individual users. This article covers Marathon Pac MIG/MAG efficiency in detail, with cost calculations based on our own experiences and on the findings of major European manufacturers in the automotive and other industries.



Savings along the entire MIG/MAG production chain.

Marathon Pac delivers savings right along the MIG/MAG production chain – from manual through to robotic applications – irrespective of local labour costs. Although important and most obvious, savings on downtime for wire spool exchange are not, by far, the only cost benefit users enjoy when using this advanced bulk wire system. Savings on for example, post-working and weld rejects, wear of feeders and replacement parts, and handling time and spool

disposal costs are more difficult to quantify. However, individually or together, they can be many times more than the savings on downtime, depending on the type of fabrication. It is also incorrect to believe that Marathon Pac savings are insignificant in low labour-cost countries or in situations with just a few manual MIG/MAG stations. In a low-labour cost environment, Marathon Pac will still save a minimum of nine eurocents per kg of welding wire on downtime alone - and that is before adding in all the other benefits.

Table 1. Typical cost savings for professional users – 18 kg spools vs 250 kg Marathon Pac.

	Low labour cost environment	High labour cost environment	Highly mechanized environment
Operating cost EUR/hr	10	50	250
Cost saving - EUR/kg wire used			
Downtime	0.09	0.43	2.15
Weld quality	0.20	1.00	2,00
Equipment wear parts	0.05	0.10	0.20
Total EUR/kg wire	0.34	1.53	4.35
Total EUR for 250 kg MP	85	383	1088
Total EUR for 475 kg MP	162	727	2066

This overview is based on actual tests and reports obtained from Marathon Pac users from various branches of industry.

Typical cost savings for professional users

Table 1 gives an overview of typical cost savings when comparing Marathon Pac with 18 kg wire spools. The overview is based on actual tests and reports obtained from Marathon Pac users from various branches of industry. It is valid for all professional users of MIG/MAG welding wires, regardless of where they are located and regardless of their manufacturing and sales conditions. The figures must be seen as indicative – to be quantified more precisely by means of a study before and after a change to Marathon Pac. The table reviews savings in low labour cost and high labour cost environments and a fully mechanised production environment.

• Operating costs

The industry applies a variety of cost calculation methods to assess the hourly cost of a welding station. Without debating this in any detail, it is essential to use a figure for the complete operating costs of a welding station, rather than just the net hourly wages of the welder, which is only a part of the costs.

First of all, indirect costs such as social charges, pension, sick payments, holiday and overtime allowances, productivity and quality bonuses, etc, must be included in the hourly wage. In discussions, fabricators appear not always to be aware of this. Secondly, it is not enough to only consider a fully covered welder. He or she definitely needs a welding station, the costs of which are depreciated

over a number of years. When talking about highly mechanised installations, these costs are not only obvious, but also very significant. Then there is the requirement to have a factory building with auxiliary equipment such as overhead cranes, forklift trucks, etc. All of this has, in our opinion, to be included in the operating costs.

Finally, each welder or operator has to generate the revenues to cover his part of the overhead costs such as supervisors, forklift drivers, QC inspectors, management, HR, administration and sales.

Calculating the operating costs is, therefore, not as simple as just taking the annual direct labour costs, e.g. 6000 Euro, and dividing it by, say, 2000 hours to end up with 3 Euro/h. It is much higher than this.

A realistic level for the operating costs in a low labour-cost environment is, at least, 3 times as high as the direct labour costs - but sometimes even 5 to 10 times higher. ESAB's estimation of the operating costs, are conservative, at a rate of 10 Euro/h.

In a high labour-cost environment, various Western European customers have confirmed to a rate of 50 Euro/h.

For highly mechanised manufacturing, 250 Euro/h is typical for a welding station with a couple of robots and manipulators. Again, staying on the conservative side, some just-in-time suppliers in the automotive industry allow 2,000 Euro/h for downtime of their installations.

• Downtime costs

The downtime of a welding station for spool exchange depends on factors such as the set-up (accessibility of the wire feeder, liner length, etc),

Table 2. Downtime cost savings – 18 kg spools vs. 250 kg Marathon Pac.

Spool weight	18 kg	250 kg MP
Spool changes/ton of wire	55.6	4.0
Spool change time (min)	10	10
Total time per ton	9.3	0.7
Downtime saving (hr/ton of wire)	-	8.6



Spool type 93
Marathon Pac
W x H= 513 x 830mm.

Spool type 95
Mini Marathon Pac
W x H= 513 x 500mm.

Spool type 94
Jumbo Marathon Pac
W x H= 595 x 935mm.

Marathon Pacs are made of strong corrugated board with a moisture barrier. Sizes are valid for the drum only. Add 135 mm for the trolley and 355 mm for the plastic hood of the Jumbo Marathon Pac.

management focus on lean manufacturing, including ABC costing and six sigma techniques, and whether operators are paid by finished piece. Last, but not least, it is influenced by the distance to the location where spools are stored.

Table 2, gives a calculation of typical downtime for exchanging 18 kg spools versus 250 kg Marathon Pacs, based on the approximation that exchanging a spool or a Marathon Pac takes the same time, 10 minutes.

The savings on downtime in Eur/kg wire have been calculated for the three operating cost levels discussed above, and re-appear in the second row of table 1.

The above is based on a problem-free welding situation. When, for instance, feedability problems appear, downtime will easily be a multitude of the time lost in spool changing. Here lies another advantage of Marathon Pac. A spooled wire will always have a cast and helix. In particular, the helix (causing rotation, or "dog tailing" of the wire) is the cause of feeding and welding irregularities. Erratic feeding and, eventually, stopping of the wire transport, may result in downtime for

maintenance. Wire from Marathon Pac is straighter by nature due to a built-in pre-twist of the wire. The result is dependable feedability. Many users of Marathon Pac feed over large distances (37 m at Kvaerner Masa Yards, Finland) with minimal maintenance - and still report problem-free welding.

Another factor, not fully covered in the calculation, is simple storage and handling. Time lost in unpacking and transport to the welding station is a fraction of that needed to pick-up and unpack spools, box by box, for the same amount of wire.

Weld quality

Cost savings related to weld quality are even more difficult to assess. A general industrial requirement, however, is that welds need to be well positioned, with good penetration, without undercut and with minimal spatter. In this respect, there are always savings, to some extent, when changing over from spools to Marathon Pac. Stable feeding conditions lead to better joints, good penetration, less spatter and improved joint appearance under all circumstances, with less post weld repair. Welds are particularly well positioned, because the wire leaves the contact tip straight without arc wander. Marathon Pac is a must for any producer striving for six sigma.

Underestimated contributors to efficiency losses are components that have weld defects because a spool has become empty in the middle of a run. In most instances, these work pieces have to be repaired or, sometimes, scrapped. Such issues are largely avoided when using Marathon Pac and are eliminated when using Endless Marathon Pac.

Quantifiable results are available from a well known European mass production automotive components company that conducted a comprehensive costs study when changing from spools to Marathon Pac. In table 1, they would be somewhere between the high labour-cost and the highly mechanised environment.

Savings due to the reduction of welding defects, re-work, grinding, scrapped materials, etc, amounted to five times the cost savings on downtime only for the 50 Euro/h operating cost group in table 1. This means that their recorded



Marathon Pac also pays back in manual welding; even in a low cost environment.

benefits exceed 2 Euro/kg wire - purely due to improved weld quality.

In table 1, we again stay on the conservative side with 1 Euro/kg for the high cost environment, a level confirmed by other studies in this field.

For the low cost environment, we have reduced the quality savings to only 20% of the high cost group, mainly because re-work costs are lower. However, the value of high quality welds for a company in a low cost environment is probably higher, because they need to prove their abilities to get into the global quality market.

For the highly mechanised environment, 2 Euro/kg is used as typical saving, the figure given by the automotive component supplier mentioned above. Again, this can be seen as conservative, as welding defects in a highly mechanised environment with very few personnel are very costly to correct.

Equipment wear parts

The wire from a Marathon Pac is straight which, by itself, leads to a lower wear of the feed system, eg, liners, guiding tubes and feed rolls. Another explanation for reduced consumption of wear parts and feeder components is the absence of a spool weight to be turned - as with

18 kg spools. Each time the welding starts, the spool weight has to be pulled into motion.

With a Marathon Pac, only a few metres of wire has to be accelerated (6 g/m for a 1.0 mm wire). The feed unit motor will therefore last longer, less pressure is required on the feed rolls, and there is very little slip of the rollers when overcoming the initial friction of the feed system.

ESAB has studied the wear and spare parts costs for industrial users. Typical consumption is around 2 tons of wire/year per welding machine. Typical wear parts cost 200-400 Euro per year/welding machine (labour costs for replacement excluded). This fairly wide range is due to the dependence on the type of application. On the other hand, the cost for wear and spare parts don't vary as much as labour costs in many countries. Material costs for spare parts follow the global material price and account for, at least, half the cost.

A well known car producer in Europe provided ESAB with a report on their consumption of wear and spare parts when they changed over from spools to Marathon Pac. Consumption had dropped by an incredible 90%.

In table 1, we have again been conservative, using 50 Euro/hr as the benchmark, and taking 200 Euro

per year as a representative figure for spare parts. Divided by 2 tons of wire consumption, the saving amounts to 0.10 Euro per kg wire.

For the low cost environment, the conservative assumption is taken that the cost for spare and wear parts is never less than 50% of the above, so 0.05 Euro/ kg wire.

In the highly mechanised environment, manufacturers should work with a higher safety margin in terms of preventive maintenance, as downtime is so costly. Therefore, it is realistic to double the cost in comparison with the high labour-cost environment.

The above example of the car manufacturer saving 90% on wear and spare parts in an operation cost environment, between high cost and highly mechanised, would compare to 0.18 Euro/kg wire.

Marathon Pac pays back.

Changing to Marathon Pac will always give pay back, regardless of the cost environment. The total savings in the low operating cost column of table 1, are not necessarily "typical" - but minimum. From the higher cost columns, anyone buying MAG wires will understand that under "typical" conditions, the savings will be at least the same, or exceed the cost price of the wire. Marathon Pac is, therefore, more beneficial than spools for any professional customer in any environment - and could even become free of charge.

Endless Marathon Pac is the latest step in MIG/MAG efficiency, with no stopping at all for wire exchange. All of the benefits highlighted above are equally valid for Endless Marathon Pac - a system with many advantages for true lean manufacturing in just-in-time production and multi-robot stations.

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OK AristoRod and Marathon Pac an unbeatable combination for crane fabrication.

BEN ALTEMÜHL, EDITOR OF SVETSAREN.

OK AristoRod copper-free MAG wire and Marathon Pac again proves to be an unbeatable combination when it comes to MIG/MAG efficiency, providing process stability, minimal downtime and good weld appearance - as reported by crane components fabricator TMC.

Torneria Meccanica Costruzioni poi Costruzioni Meccaniche (TMC) in Cadelbosco Sopra, Italy, produces components for well-known crane fabricators such as PM, Pahlfinger and Ferrari, and to their associate company, Basket. The company was founded in 1975 and is owned by two brothers and two sisters of the Scillia family. TMC employs 16 personnel, including sons and cousins. In 2005, the family acquired Basket, a fabricator of small to medium size mobile cranes. TMC operates four welding robots, for different crane components, and one manual station for tack welding and other semi-automatic MAG

jobs, consuming some 50-60 tonnes of wire per year. Production involves two steel grades; normal strength steel welded with OK AristoRod 12.50, and high strength steel 38NCD4 (tempered and annealed, Rm: 1300 N/mm²) welded with OK AristoRod 13.29 (ER100S-G / G Mn3Ni1 CrMo). Both are fed to the robot stations from 250 kg Marathon Pacs. Mixed gas 80% Ar/20% CO₂ is standard shielding gas for all stations. High strength steel parts are pre-heated to 200 °C. The robots operate at around 70% duty cycle depending on the part to be welded – one shift of 10 hours a day.

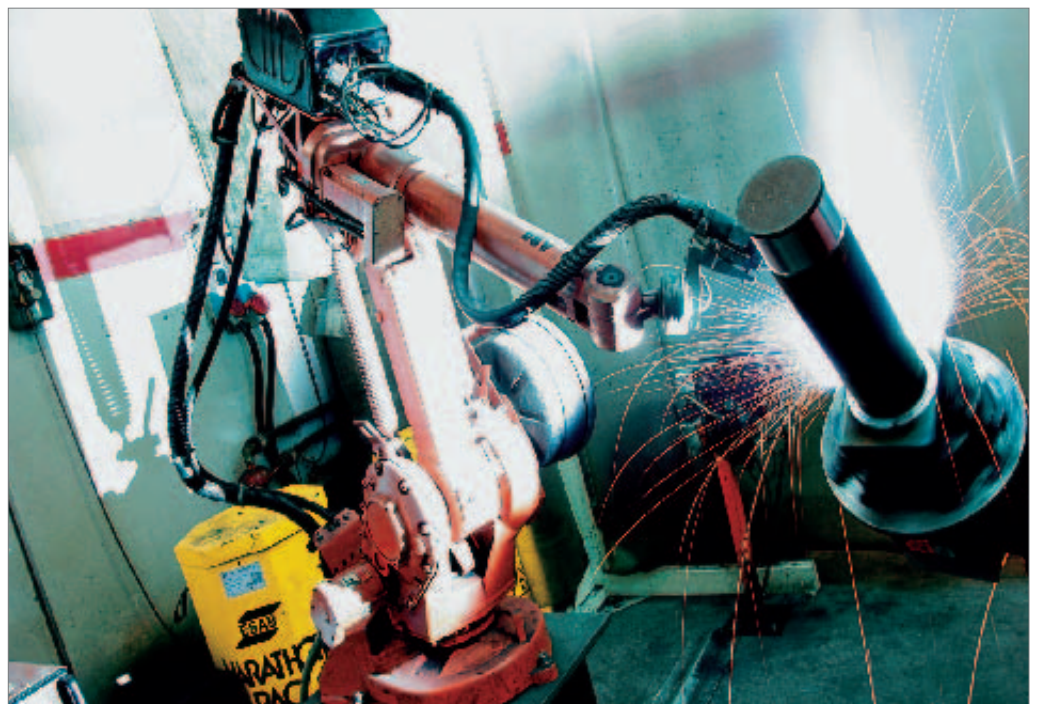


Figure 1. Robotic welding of crane pivots - the part around which the crane arm rotates in the horizontal plane. OK AristoRod 13.29 diameter 1.0 mm from 250 kg Marathon Pacs is used to produce the heavy fillet welds which connect the high strength steel pivot to the foot plate. Welding is performed at a current of 300 A, 28-29 V arc voltage and 1- m/min. wire feed speed.



Figure 3. Production of crane front parts with a gantry robot, using OK AristoRod 12.50. The Marathon Pac is placed on a scaffold – the relatively long liner not standing in the way of problem-free feeding and a stable arc.



Figure 4. Lifting of a Marathon Pac by overhead crane utilising the certified lifting yoke.

Efficiency and savings

TMC moved from a situation where copper-coated metal-cored wires were used for high strength steel components and copper-coated solid wires for parts in normal strength steel, to

using OK AristoRod 12.50 and 13.29 copper-free wire. One of the greatest overall benefits reported by the company is a significant reduction in the amount of spatter and, thereby, substantial time savings in the grinding of welded components. Before, copper flaking was a frequently occurring phenomenon that caused feeding irregularities, arc instability and spatter. In addition, liner cleaning is necessary less frequently and the cleaning procedure is easier, which saves on robot downtime. It is now sufficient to blow out the liners with pressured air whereas, previously, the company chemically cleaned in a bath.

Consumption of contact tips remained at the same level – in line with ESAB's claim that the new generation of ASC treated OK AristoRod brings contact tip wear from copper-free wire down to the level of copper-coated wires. Another ESAB claim - that ASC solved the traditional problem of corrosion on the wire surface of copper-free wires – was, likewise, confirmed by TMC management. At a cycle time from stock to weld of up to 2 months, no problem, whatsoever, has been encountered.

Marathon Pac and AristoRod – an unbeatable combination

Before changing to OK AristoRod in Marathon Pacs, TMC had been using bulk wire drums, so the company already enjoyed an important benefit – drastically reduced downtime for spool exchange. Nevertheless, TMC management reports a number of additional advantages for the Marathon Pac system.

Importantly, the good feeding properties and stable arc of OK AristoRod are complemented by the force free unspooling of the wire from the Marathon Pacs for which no decoiling equipment is needed. The wire feeder on the robot only pulls the weight of the length of wire in the liners. This provides the high level of process stability needed in high duty cycle robotic welding. Another aspect emphasised by TMC, is easy installation and logistics. It takes just ten minutes to renew a Marathon Pac, clean the liner and change the contact tip.

TMC is particularly pleased with the facility to lift Marathon Pacs by overhead crane using the certified lifting yoke (Figure 4). Two of the four robot stations are gantry types with the Marathon Pac placed on scaffolds. Another feature appreciated by TMC is that Marathon Pacs can be folded flat after use and do not take up any space before disposal.

In summary

OK AristoRod copper-free wire in Marathon Pacs provides benefits and savings to a small, but highly efficient manufacturer of crane components – most importantly a significant reduction in spatter and weld cleaning and process stability in high duty cycle robotic welding.

Acknowledgement

Our thanks go to the Scillia family for an interesting and, above all, very pleasant visit.

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Product News

THE ARISTOPENDANT U8 CONTROLLER – NOW SMARTER THAN EVER

THOMAS RISBERG, ESAB STANDARD EQUIPMENT AB, LAXÅ, SWEDEN.

The previous issue of Svetsaren (nr. 2/2005) highlighted the AristoMig 400/500 series digital power sources and their operation in combination with a variety of control panels. The AristoPendant U8, the most intelligent control unit available, now features more memory positions, new synergic lines and new process functions.

The number of welding parameter memory positions has been increased from 99 to 255

allowing the storage of more settings for different applications. In addition, the AristoPendant U8 is now equipped with a Compact Flash Memory which the operator can use to transfer settings from one controller to the other or for downloading onto a PC for transmission to other Aristo users via e-mail. Quality data automatically monitored by the system for each weld - arc time, minimum and maximum current, voltage and power - can be stored on the Compact Flash Memory and used as quality documentation for the welded objects. A file manager system allows the operator to manage the files and folders and to organise the data in a structured way. Negative hot start is a new process that reduces post weld labour in the



circumferential welding of tubes. It deposits less weld metal during the start, resulting in an even weld all around the tube. This is also an advantage when starting on tack welds.

THOMAS RISBERG IS AREA SALES MANAGER FOR ESAB STANDARD EQUIPMENT AB, LAXÅ, SWEDEN.

INCREASED SAW EFFICIENCY WITH 1000 KG EcoCoil BULK WIRE SYSTEM.

MARTIN GEHRING

EcoCoil is a popular, customer approved package, for both bulk users and users of standard 30 kg spools. Easy handling, smooth decoiling, environmentally-friendly recycling and absence of spool return logistics are the main features appreciated by customers. ESAB's new EcoCoil bulk wire system reduces time lost in spool changing by a factor of 33 when compared with 30 kg wire spools, gaining valuable arc time for production.

EcoCoil is available for non-and low-alloyed SAW wires such as OK Autrod 12.20 (S2), OK Autrod 12.22 (S2Si), OK Autrod 12.24 (S2Mo) and OK Autrod 13.64 (S3MoTiB) in diameters from 2.5 – 5.0 mm, according to end user requirements. All product information as well as handling, general and legal information is stated, visibly, on the upper part of the cardboard core. EcoCoil is well protected from moisture and dust by the exterior shrink foil and

the interior cardboard core. The shrink foil can be partially or fully removed. Many users prefer to unwrap partially to keep the wire protected during use. There is no need to damage the packaging for sample taking or material inspection. The upper end of the wire is guided into the cardboard core and samples can be taken from there.

EcoCoil is delivered on Europallet for handling by forklift and pallet truck. Steel lifting eyelets facilitate internal transport by overhead crane. Alternatively, to save extra time, the EcoCoil can be placed on a spider frame in the warehouse, unwrapped and transported ready for use to the welding station. After emptying the EcoCoil, the spider can be returned to the warehouse, manually, saving overhead crane capacity. The spider can be used time and again; there are no return logistics to the wire supplier, as with returnable spiders or other bulk spools. After use, only fully recyclable materials remain; PET wrap foil and strip, four steel lifting eyelets and a cardboard tube which is recycled as paper. All these components are separated from each other for easy, environmentally-friendly disposal. Although only recently introduced by ESAB, EcoCoil has quickly become established in the



SAW production of both bulk users, such as pipemills, as well as many smaller volume users who benefit from increased SAW productivity.

MARTIN GEHRING IS GROUP PRODUCT MANAGER NON- AND LOW-ALLOYED SAW PRODUCTS.



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