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Advances in Cutting & Welding

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IN SERVICE TO THE WELDING COMMUNITY
Editorial

Dear Readers,

It is a pleasure and honour to place in your hands this new edition of "Weldworld Spectrum" Newsletter. It is an historic occasion, as with 2018 we have now entered our Silver Jubilee Year of publication. Our sincere gratitude to all the regular readers for their cooperation and making our journey to this day a success. Your feedback and comments are solicited to enable us to improve upon the contents and make it more interactive. To begin with, subtle changes are made to give a new fresh look, readable and interesting. Further, some changes in the editorial board have also been effected. With Industry 4.0 manufacturing the new buzz-word, the new generation equipment are expected to be Agile & automated - Dynamic & predictive - Personalised & customised - Smar factories/Decentralised. This issue is primarily focused on the recent advances in the development of process technology and equipment for fabrication. Removing unwanted attachments of welded components is tricky and cumbersome, a solution is now provided by Husqvarna, who have now modified their plasma torch, whereby it is possible to flush cut, "Transformation of the Power Source" from traditional to modern machines interconnected through IoT (Internet of Things) along with information on "Automating Processes of Welding". Innovation in Mig Arc welding are the highlights of this issue, included is the information on the new technology for high speed welding in the form of "Active Wire-feed Welding Process". This was demonstrated in the recent Dusseldorf Trade Fair, it is hoped, that you enjoy reading this edition together with the other regular feature.

Sincere thanks are due to Dr. S. Bhattacharya for dedicately editing the Weldworld Spectrum for last 25 years.

Ashok Rai
Editor

News From Industry

- Sandvik Materials Technology has signed an agreement to divest the welding wire operations to ESAB, a global leader in the welding industry and part of CoForax Corporation. Acquisition includes production units in Scranton, Pennsylvania and Säviken, Sweden.
- Panasonic organized "Technical seminar on high precision arc welding technology" in partnership with CII & Association for Overseas Technical Cooperation & Sustainable Partnerships (ADITS Japan) in Pune on 7th November 2017.
- CII Welding Conference 2017 was held on November 29, 2017 in Mumbai. "WELD 4.0 - Intelligentized Welding in India" was the theme. While the welcome address was by Mr. A. Shiva Kumar - Conference Chairman, Dr. Prabhu Agarwal, O.P. Jindal University gave an Overview. A Keynote address by Mr. Rashid Bhat, Ador Welding Ltd and Technical Address by Mr. S. Suntaram, Lincoln Electric formed the Inaugural Session. The panel of speakers were: Dr. K. Bhanumathy - IIIT Mumbai; Mr. V. Kamath - Forge India; Mr. Khairam Banerjee - Kalyani Welding & Cutting; Mr. VM Nimbalkar - DDRD; Dr. GA Soman - Don Bosco Academy, Mr. Rashmi Ranjan Mohapatra - Kemppi India; Mr. Vikas Swamy - Koko Forgings India; Mr. Rajib Kumar Das - SDIC; Dr. IV; Mr. Ashok Malhotra - IIW; Dr. J. Krishnan - Former Scientist, BARC; Mr. SR Ramakrishnan - L&T Heavy Engg. The topics included: Intelligent Welding for industrial manufacturing, Aligning Innovation to Intelligent Welding; Workforce Re-skilling for the Fourth Industrial Revolution & the Indian Welding Sector; Welding monitoring, inspection, Quality & safety Mr. C.C. Girotra (MD), Mr. Sanjay Sahay and Mr. Ashok Rai represented Weldwell Speciality.

Stainless steel maker Jindal Stainless (Hisar) Ltd., one of the largest stainless steel makers in India has entered into an agreement with Defence Research & Development Organisation under which the government agency will transfer technology to manufacture high nitrogen steel for the defence sector to the company. This will boost "Make in India" for the Defence Industry.

TANDEM robotic cell

Other MIG Variants

Transferred Ionised Direct Energy Welding - TME is through application of higher density of welding current as well as compound gas shielding is a new variant of metal active gas welding.

Cold Metal Transfer - The CMT is a Dip Arc GMAW process with a new method of the droplet detachment from the wire. It allows achieving higher penetration welds than MIG/MAG with lower welds, thus leading to welds with shapes less prone to defects.

Surface Tension Transfer - STT welding is a GMAW with controlled short circuit transfer process.

CONCLUSIONS

- TANDEM welding process with the same current intensity as in the case of conventional MAG method make it possible to increase the welding speed and to reduce spatter both for butt welds and T-joints with filler welds. TANDEM welding process allows reducing welding costs of 1 m long joints even by 35% in comparison to conventional MAG. TANDEM welding assures good mechanical and plastic properties of welded joints made of non-loyed steel and thermo-mechanically treated steel.

Some TIG Innovations

TIG WELDING Variants - To increase conventional TIG with flux rate, other TIG variants have been developed such as "hot wire", "Narrow gap", "High current", "TK" - "TIG" techniques etc. The main aim is improving deposition rate which is the main disadvantage of conventional TIG. Hot Wire TIG - In conventional TIG, energy from the arc is required to melt the filler wire which is introduced into the leading edge of the weld puddle at ambient temperature, thus reducing the efficiency of the process. In hot wire welding, filler wire is resistance heated until close to the melting point and added to the weld puddle behind the tungsten. This prevents wire from chipping out the puddle and allows the filler to flow out across the weld puddle resulting in a smooth, attractive weld bead. The hot wire is fed through the trailing shroud which ensures sufficient shielding and protection.

Narrow-gap Gas Tungsten Arc Welding - frequently used to weld regular and multi-layer high-chromium steel for power generation boilers, stainless steel for nuclear power generation equipment, ISO/CGL- alloyed and other nitrogen-loyed steels, and thick-wall stationary pipes. This process allows uniform welding with first-layer penetration in all positions. The wire feed and base metal fusion rates can be controlled independently, allowing the operator to select from a range of welding parameters, it delivers a high-quality joint with minimal slag because inert gas is used for shielding.


Editorial Note: One of the most popular models is Kemppi Pulse TCS (Tandem Control System) which can be connected to any common robot brands. The TCS software solutions provide easy system set up and automatic arc regulation, thereby adjust both the arcs precisely and independently. It makes it more tolerant of welding parameter variations compared to traditional tandem welding processes The TIG arc continuously monitors the lead and adjusts itself accordingly, resulting in several performance benefits, such as, achieving significant speed increase and consistent quality. It is able to increase productivity between 40-60% over the single-wire process in a reliable way. Other benefits include: No system arc interference; four process options available; reduced heat input on thin sheet materials; Remote control by pendant etc.
Innovation in Mig - Tandem Arc Welding

INTRODUCTION
Welding is a manufacturing process used in a large diversity of industrial sectors. Developments in arc welding processes are strongly related with the need to increase productivity without losing quality of the welds performed. Only targeting these aspects are companies competitive in the worldwide markets. Reducing costs for competitive pricing is strongly related to advancements in technology. The way forward is thus innovation to produce better products at lower costs.

MIG-MAG variant - Tandem Welding
Welding with the use of two electrode wires (Tandem) was applied for the first time for submerged arc welding. In the beginning of the nineties this innovation was successfully transferred into gas shielded welding. The action of melted metal in two welding arcs, supplied from separate wire feeders, onto the common weld pool is applied in the Tandem method. Both welding current circuits are separated electrically, thus parameters can be set independently and individually for each welding wire. This results in the wide possibility to control melted weld pool and consequently the shape of the weld.

During the welding process with the Tandem method both welding electrodes are placed one after another towards welding direction. First electrode, called leading electrode, ensures required penetration depth, while second one, called following electrode, provides required filling up of the pool, prolongs the time of its degasification and provides proper face shape, free from porosity and undercutting. Usually, the leading electrode is of larger diameter as it ensures approximately 65% of the whole deposition efficiency obtained in the welding process. Second electrode, which is placed in the backside part of the weld pool, is usually loaded with lower current intensity and controls melted metal of weld pool.

A torch for tandem welding
Application of Tandem welding instead of conventional MIG/MAG welding, especially on automated and robotised welding stations, allows travel speed to be increased even up to several meters per minute, depending on the thickness of welded elements and joint configuration. Such welding speed is impossible to reach during semiautomatic welding, therefore Tandem welding is usually applied in mechanised or robotic processes. Tandem method is one of the most effective methods of improving welding productivity.

Launch of Thermal Spray Powders in Weld India 2017

The XII International Welding & Technology (IW-2017) along with “Weld India 2017” exhibition was held at Chennai between 7th to 9th December 2017. The theme of seminar was “Advances in Science, Technology & Skill Development in Welding” and around 200 high profile global exhibitors wherein 7000+ visitors participated.

On this occasion, Welswell Speciality Pvt. Ltd. and Sentes-Bir, of Turkey joined hands to launch a range of Thermal Spray Powders for the Indian Welding Industry. Welswell Speciality represents some of the most trusted international brands in welding consumables and equipment, Sentes-Bir is one of the top European manufacturers of thermal spray powders.

Welswell Speciality Pvt. Ltd., as the exclusive distributor, along with their international partner, Sentes-Bir, of this opportunity to launch Thermal Spray Powders for the Indian Welding Industry. Mr. Cagri Gurbuz – MD and Mr. Okudan Gunalan – Migj, MIG, from Sentes-Bir along with team of WelswellIndia by Mr. Sanjay Sahay, were in attendance for all the days.

Of particular interest to the visitors were the Cobalt – based and Nickel – based powders displayed in the fair. Fortica range was among Cobalt based powders have excellent mechanical wear resistance even at high temperatures and very good corrosion resistance, and Fortica Self-fluxing Nickel Based FuseWelding (Powder Welding) Powders with consistent coating properties were appreciated. Engineers from the Industrial Valve, Automobile Valves and Glass Mold Industry, were quite impressed with the high level of surface finish. All in all, the response was positive and few trial orders were booked.
Flush Cutting to Remove Attachments - A New Approach

Abstract

At the end of any fabrication, there is a need to remove attachments such as lifting lugs, pad eyes, and temporary weld supports. These are typically done by using oxyfuel, carbon arc gouging or traditional plasma cutting tools.

Attachment removal is a tricky task but essential to the successful completion of metal working projects. From large to small-scale projects, construction sites to workshops, the ability to produce a clean, flushed result requires the right tool and removal method. This is now made possible by horizontal flush plasma cutting.

A pristine finish, after the removal of an attachment, often comes at the cost of additional labor and resources. Traditional methods of removal such as plasma cutting, oxyfuel cutting, and carbon arc gouging (CAG) leave behind sizable metal remnants. Attempts to avoid this by cutting closer with traditional tools may result in scarring of the workpiece. The metal that remains must be meticulously ground away, resulting in additional labor costs and the potential of a workplace injury from the grinding wheel ergonomics and potential debris.

Without the ability to mechanically position the tool so that a closer cut can be achieved with less residual metal, workers were forced to deal with the drawbacks of traditional removal processes.

Development of a new variant

With this lack of closeness in mind, a team of plasma process engineers realized the answer required a modification to the tool that would allow the angle of the plasma arc to sit parallel to the workpiece. This seemingly simple solution presented a few technical hurdles.

The first, how to redirect the arc. Normally, in plasma cutting tool, a high velocity of air forces the plasma stream through the nozzle bore in a straight line. Changing the position of the nozzle bore would not itself influence the direction of the plasma stream. This would simply drive the plasma into the bore and shield, damaging them both. Hypertherm engineers found the key to guiding the plasma was controlling the swirl of air around it. In doing so, they could successfully design a new path for the plasma arc.

The second issue was developing a bore that would allow this new arc to cut closer to the base material, but also maintain a desirable thickness for cutting. Engineers from Hypertherm, through painstaking potential configurations, by developing a set of bore feature aspect ratios that could accommodate the flow of gas, they were able to create a plasma stream with enough arc density to compete with the thickness capabilities of cutting tools currently in the market.

Lastly, the shape of the shield and nozzle had to be sculpted in such a way that was ergonomic and would allow the plasma stream to sit parallel to the base material. This was achieved with an asymmetric shield and nozzle interface. With one flat side, angled to sit against the workpiece, the shield offers greater stability and control than its predecessors. In consideration of ergonomic requirements, engineers designed the nozzle and shield as a single interlocked piece where all parts would rotate in relation to each other. This provides flexibility to the user while maintaining proper alignment.

Continued from page no. 7

control. It is possible to trace any work stream, from any site, keeping an eye on how the welders or subcontractors are performing, and how the projects are progressing. Since WeldEye monitors compliance with international welding standards, it also functions as a quality controller; it creates value through increased efficiency. The solution collects, systemizes, and provides information about individual for repair work. More information allows the added transparency means that welders can systematically improve their welding by reviewing prior work. The added transparency also means a defect can be spotted earlier, and be fixed immediately, WeldEye provides a new level of traceability to your welding production. If a batch of welds is found to be faulty, WeldEye knows exactly which welds were done with that filler batch. At the end of the day, this boosts the efficiency by reducing the need for repair work. More information allows project managers to take both quicker and better decisions, and simplifies the documentation process.

Summary

For nearly four decades, the welding industry has been a low technology industry. Only on the advent of inverters, incorporating electronics innovation of the power sources are taking place. All the developments and technique have their own range of applications and advantages. Kemppi Wise products are smart welding software solutions that provide range of benefits. They influence either the efficiency or quality of welding. WeldEye is a universal solution to simplify and manage welding production, aiming to create value for everyone in production. A balanced combination of software, hardware and cloud service, that systemizes, analyzes and documenting, insight into WPS compliant welding quality, production progress, personnel qualifications and much more.

Courtesy: Kemppi India
Automating Processes of Welding

There has been a great increase in the number of automatic processes designed to speed up welding production. Automatic welding gives high rates of metal deposition because high currents from 400 to 2000 A can be used, compared with the limit of about 600 A with manual arc welding. Automatic arc control gives uniformly good weld quality and finish and the high heat input reduces distortion and the number of runs for a given plate thickness is reduced. Twin welding heads still further reduce welding time, and when used for example; one on each side of a plate being fillet welded, distortion is reduced. The welding head may be:

1. Fixed, with the work arranged to move beneath it.
2. Mounted on a boom and column which can either be of the position type in which the work moves or the boom can traverse at welding speed over the fixed work.
3. Gantry mounted so that it can traverse over the stationary work.

TIG, MIG and CO₂ (gas shielded metal arc) with their modifications are extensively used as fully automated systems. Heads are now available which, by changing simple components, enable one item of equipment to be used for MIG (inert gas), CO₂ and tubular wire, and submerged arc processes.

Submerged Arc Welding (sub-arc) - In this automatic process the arc is struck between bare or flux cored wire and the parent piece, the arc electrode and the molten pool are submerged or enveloped in an agglomerated or fused powder which turns into a slag in its lower layers under the heat of the arc and protects the weld from contamination. The wire electrode is fed continuously to the arc by a feed unit of motor-driven rollers which is voltage-controlled in the same way as the wire feed in other automatic processes and ensures an arc of constant length. The flux is fed from a hopper fixed to the welding head, and a tube from the hopper spreads the flux in a continuous band in front of the arc along the line of weld and of sufficient depth to completely submerge the arc, so that there is no spatter; the weld is shielded from the atmosphere and there are no radiation effects (UV and IR) in the vicinity. A latest development to increase spatter rate is to lay down a powder in front of flux feed and welding head; this is generally used with a tandem ac/dc head.

Welding Heads - Fully automated welding heads for this process can also be used with modification for gas shielded metal arc welding including CO₂, solid and flux cored, thus greatly increasing the usefulness of the equipment. The head can be stationary and the work moved below it, as for example in the welding of circumferential and longitudinal seams, or the head may be used with positioners or booms or incorporated into custom-built mass production welding units for fabricating.

The main components in the control box are welding voltage and arc current controls, and wire feed controlled by a thyristor regulator which maintains set values of the voltage. The head is accurately positioned by slide adjusters for horizontal and vertical movement and has angular adjustment also. The wire feed motor has an integral gearbox and wire straightening rolls give smooth wire feed. The gear ratio for the metal arc process is much higher than for submerged arc and each wire diameter usually requires its own feed rolls, which are easily interchanged. For fine wires less than 3 mm diameter a fine-wire-straightening unit can be fitted.

Power Unit - The power unit can be a motor or engine-driven, generator or transformer - rectifier with outputs in the 30–55 kVA range and with currents from 200 to 1600 A with the wire generally positive. In the case of multiple head units in which the leading electrode is D, C, and the trailing electrode is A, C, A transformer is also required. In general any power source designed for automatic welding is usually suitable when feeding a single head. Many factors affect the quality of the deposited weld: metal electrode wire, slag basicity, welding variables (process), cleanliness, cooling rate, etc. For hard-facing, alloy additions necessary to give the hard surface usually come from the welding wire and a neutral flux, and tubular wire with internal flux core is also used in conjunction with the external flux.

Various mountings for automatic welding equipment

The all new Flush Cut Consumables: After years of research and development, Hypertherm FlushCut consumables are entering the market and enabling a new flush cutting application that never existed before. As proposed, the FlushCut design offers an asymmetrical shield with a surface guiding flat, and an off-centered nozzle cone. Now, it is possible to minimize the cutting angle and the distance between the arc and the workpiece, the user can comfortably achieve a parallel cut, significantly reducing the residual material. The guiding flat increases stability and allows the user to easily drag the torch against the workpiece while achieving a straight, close cut. FlushCut consumables can be used with all plasma cutting torches of Powermax series equipment.

Tradition Meets Innovation: Not only does the flush cutting process serve as an improvement to current plasma cutting processes, it successfully competes against non-plasma methods as well. When tested against traditional cutting techniques the Powermax® FlushCut process outperformed both CAO and oxygen in the amount of time spent completing an attachment removal job.

Although the actual metal removal is quick, the primary drawback to CAO has been the amount of waste and labor it creates afterward. The process often causes scars in the workpiece which can require extensive costly repairs. The CAO process may also dig into the attachment being removed rendering it unsuitable for future projects.

By design, the FlushCut process avoids this extra repair cost by setting flat against the workpiece and guiding the arc through the attachment at a much smaller angle. This reduces the overall process time, from start to finish.

Like CAO, oxygen化进程 drawbacks which are costly and time-consuming. The intense heat involved in oxygen cutting creates a heat affected zone (HAZ) which could cause thermal damage to the workpiece. To prevent this, metal workers must avoid cutting too close to the base and instead cut into the attachment at least 1/4 inch from the workpiece. With this loss of material, the attachment is usually not suitable for reuse. Left with extra metal workers arduously grind away at the remaining costing extra labor hours and increasing the risk of a work-related injury.

As when compared to CAO, the FlushCut process can produce a quicker clearer result than oxygen cutting due to the nature of its design. Although oxygen and FlushCut process are nearly identical in the actual time it takes to cut through metal, it’s the reduced prep time, and lack of residual material left over that sets FlushCut process apart.

Conclusion

The new flush cutting process offers a more efficient way of cutting closer to base materials than ever before, reducing costly time-consuming operations and more important without piercing or damaging the workpiece. What might seem like a small alteration has made a huge impact on the attachment removal process. Metal workers familiar with standard cutting practices are finding the new asymmetrical shield and surface guiding flat increases efficiency and decreases time and resource waste by reducing grinding time.

Courtesy: Mr. Yasser Wajahat
Country Head, Hypertherm India

Editorial Comments:
1. hypertherm designs and manufactures Plasma Cutting Systems, They are trusted for performance and reliability that result in increased productivity.
2. Typical flush cutting applications: Removing lugs, and temporary weld supports.
   Material washing
   End cap and pad eye removal
   Hat hole cuts in T and I beams
   Bolt and rivet washing
   Casting source removal
   Post tension cable tie cuts
   Wearable part removal/replacement
Panasonic Robot & Welding presents a New Solution for High-speed Welding at Schweissen & Schneiden Trade Fair - 2017

Since 1957, a total of 60 years, Panasonic has been developing innovative products and processes for welding technology. Areas of application include Laser Welding, Metal Inert Gas (MIG), Metal Active Gas (MAG), and Tungsten Inert Gas (TIG) Welding for Robot as well as Manual Welding. One such new form of high-speed welding was demonstrated at this years Schweissen & Schneiden in Dusseldorf.

This new process is characterized by the fact that almost no welding spatter is generated. This is achieved with minimized heat input and increased wire deposition during the welding process. The number of short circuits for material transfer during welding have been increased significantly. This greatly reduces both the transfer droplet size and the arc length. In addition, the disturbances caused by post-vibrations in the weld pool are almost completely eliminated. Considering the need to optimize welding quality and throughput times, the active wire welding process has been further developed, to Active Wire-feeding Process (AWP).

Active Wire Feed Process (AWP) Principle

Flying Arc Start
Wire feeding starts before torch touches welding start point. Immediately on reaching welding start point the arc starts and welding is carried out.

Quick start and lifting of the welding torch at the start and end of AWP welding.

Restart Function for Arc Ignition
When the robot moves to the next welding start point, the welding wire is automatically retracted, thereby improving the ignition.

Summary
The result is a significantly improved and worldwide unique welding process that allows the user to achieve an unusually high weld with an extremely low percentage of spatter, all at high speed. Trade visitors, including team from Weldwell, had the opportunity to experience first live demonstrations of the newly developed welding solution.

Normal Arc Start
Wire feeding starts on torch reaches the welding start point. Subsequently, arc starts and welding progresses (Refer Fig.1).

Welding Power Source Technology Transformation

In the early 1990s, it was discovered that transformers could be used in the arc welding process, which was in its beginning at that time. It took several years to work through various electrical designs to be able to control the arc. The inverter based welding power source is one of the welding industry’s most important technology advances of the last two decades. In the world of welding, innovation is guided by the needs of both the industries using welding systems, and the individual welders who work with them from day to day.

Equipment, based on usability and applications, are designed and manufactured in every aspect of the power source, wire feeder, welding guns, user interface, and other components. Although, mechanized welding increases speed and creates more uniform quality, the growth of electronics and software industry, engineers realized that software-controlled inverter would be the basis of innovation. Kemppi, one of the pioneers in the welding industry have developed many new technologies and techniques that produce spatter-free welds, allowing for faster finishing. Some of these are described below:

Reduced Gap Technology™ (RGT) Solution - a technology that allows reliable and efficient narrow gap welding with no need for special equipment or accessories for material thickness of up to 30 mm. The RGT combines intelligent arc control with Kemppi’s high-tech power source, wire feeder and mechanization equipment.

WiseFusion™ - an optimized welding function designed to keep current and thus penetration invariant regardless of the changes in stick-out length in manual welding. The function prevents the current from dropping down by actively adjusting wire feeding. This helps keep the weld mechanical properties on a desired level and prevents welding defects.

WiseSteel™ - by optimizing arc characteristics for different transfer modes makes MIG welding of carbon steels easy and efficient. The intelligent control system alternates short arc transfer with spray transfer, reducing spatter by up to 30%, increase travel speed, and producing high-quality welds.

To be continued on page no. 9