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SAIW
Southern African Institute of Welding

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One of our board members commented recently that, outside a World War, the COVID-19 pandemic must be the most cataclysmic event in any of our lives. It is affecting all of us, our way of life, our economic and physical survival and, inextricably, the economic health of our companies and our country. The SAIW is no exception.

We began the year invigorated and determined, with a focus on building our membership, increasing engagement and ensuring we add value to our members' lives. And then COVID-19 and the resultant lockdown struck.

This has meant that fabricators are experiencing severe cash flow problems as they reopen and get back to work. It is going to take time to get money flowing in our economy again. And, of course, when money is tight, companies cut back on the 'nice-to-haves' such as training and marketing.

Times are tough and the future is uncertain but the SAIW management team used the lockdown well. We have tried to remain calm and maintain a long-term mindset. It has been a time of reflection, to look at our purpose, what we offer, where we are delivering a great service and, even more importantly, where we can improve.

We believe that our NDT team offers the gold standard of training in South Africa with all lecturers being qualified to Level 3. We have now also started offering an NDT Consultancy service, such as Level 3 supervision during shutdowns.

Our Practical Welding school utilises the latest simulation welding equipment that combines virtual reality with live welding for training and testing of welders. This has the potential to save our client's money by minimising training time, reducing consumable costs and ensuring the best quality welders.

Our Welding Technology department offers the renowned SAIW Level 1 and Level 2 Inspectors Course, while our new Robotic Welding Course brings the Fourth Industrial Revolution to the world of welding training.

We also have a fully equipped ISO 17025 certified materials testing laboratory and metallurgical consulting service that offers professional advice at a competitive price.

Going forward, our main focus has been on improving the quality of our customer service from reception, to lecturing, consulting and auditing. Although there is a lot of work still to be done, I am pleased to report that in our latest survey, SAIW Certification achieved a Net Promoter Score® of 68 from the ISO 3834 companies they certified, versus a global benchmark of 43, and with customer satisfaction exceeding 95%.

We need to work more closely with industry to make sure our products and services are 'of the industry, by the industry, for the industry', to paraphrase Abraham Lincoln's Gettysburg Address. We have thus reconstituted the Technology and Training Committee to guide us in our training and technical events such as webinars and seminars.

We are reaching out to all our present and past members as well as our auditing and technical services clients to reconnect and work with us in all welding and related technologies.

Together, we can get through this pandemic, build our businesses and grow the economy.

John Tarboton

SAIW webinars offer new learning opportunities

To maintain contact with its members during the COVID-19 lockdown, the SAIW has produced a series of webinars delivered by SAIW welding and NDT specialists. According to executive director, John Tarboton, these could become part of the Institute's 'new normal' for effective communication and training.

In response to the lock down imposed because of COVID-19, the SAIW has embarked on a ground-breaking series of webinars that are being presented by members of SAIW, each an expert in their respective fields.

"By utilising the highly popular and free Zoom App, which is easily downloadable on both desktop and mobile devices, our brand new webinar series represents a change in approach to training and communication, one demanded of us by the pandemic, but we see its long term potential too," says SAIW executive director John Tarboton.

With the launch of the new webinar series, the SAIW has proved that it is possible to provide online engagement and learning opportunities while the country is in lockdown. Each short webinar is designed to educate and inform attendees in an easy to understand, useful and entertaining manner. Unlike a live lecture, the sessions are also recorded and made available online for use after the live event, so anyone who could not make it at the time can catch up at their leisure.

SAIW has routinely held monthly evening meetings for members, which from part of the Institute's personnel certification programmes, most notably for those requiring continuous professional development (CPD) points to maintain the certified status of their SAQCC CP/IPE/NDT qualifications. "In the future, we envisage these sessions as easily deliverable via webinars, and there are many other training and practical demonstration opportunities that could benefit," Tarboton adds.

"Despite COVID-19 having a severe impact on our economy, it has offered us a golden opportunity to develop virtual learning opportunities for our members and students; cost-effective opportunities that bring SAIW knowledge and insight into people's home offices across the country and continent," he says.

All of the SAIW's online Webinars delivered to date are still available online. A summary of these is listed below, and can be accessed via the QR code associated with this article.

By using the virtual capability of the SAIW's augmented, virtual and real welding systems, students receive quicker and cheaper training while they practice, troubleshoot and master welding techniques.

1 ISO 3834 Company Certification: How to ensure quality control through proven certification procedures.
Delivered by Herman Potgieter, this webinar outlines the value of ISO 3834 Company Certification.

"For products to be free from serious problems in production and in service, it is necessary to provide controls; from the design phase, through to material selection, into manufacture and on to subsequent inspection. Poor design may create serious and costly difficulties in the workshop, on site or in-service, and incorrect material selection may result in problems, such as cracking in welded joints," says Potgieter.

"To ensure sound and effective manufacturing using welding, managers need to understand and appreciate the sources of potential trouble and to implement appropriate procedures for their control," he adds

The Introduction to ISO 3834 Company Certification webinar provides an overview of how weld quality can be manufactured into a product, and why ISO 3834 Company Certification, while also a standalone system, is a necessary complement to ISO 9001 for those who manufacture welded products.

2 Augmented, virtual and live weld computer assessed training for students: Augmented reality can take your welding training to the next level
On Wednesday April 22, SAIW Business Development manager, Etienne Nell, gave students a glimpse of the future of welder training. Via virtual reality, he introduced students to the idea of virtual welder training.

"By using the virtual capability of the SAIW's augmented, virtual and real welding systems, students receive quicker and cheaper training while they practice, troubleshoot and master welding techniques. On this system, trainees can practice welding plate using stick electrodes or wire-based GMAW/FCAW processes with shielding gas," says Nell.

With audio coaching and instructor reviews based on five welding parameters, students can speed up their comprehension and training time and acquire a greater understanding and mastery of techniques, which results in higher certification rates.

"All the more reason to utilise welding simulators through SAIW and maximise your chances of qualifying in the shortest time at the lowest cost!" Nell suggests

SAIW's training offering includes courses on how to be a practical welder as well as career progression pathways via the Institute's welding coordination courses.

3 Augmented, virtual and live weld computer assessed training for fabricators: Screen employee proficiency at a fraction of the cost

In a second simulated/virtual welding related seminar, Etienne Nell introduced the system's value for fabricators seeking to employ skilled welders for particular projects and processes. The webinar describes how contract welders can be prescreened for employment at a fraction of the cost of having to do actual weld tests.

Based on five welding-skills parameters, the audio coaching and instructor review features of the simulated system produce objective scores for each candidate's welding skills. While this helps students and candidates to quickly improve their understanding and mastery of the required techniques, at the end of the day it can also be used as a quick and easy way of selecting the candidates most likely to successfully pass a welding process qualification test.

4 A career in welding: The profession with meaningful advancement opportunities

SAIW Training manager, Shelton Zichawo, talks about a welding career as an immediate opportunity for employment and one with multiple opportunities for promotion and meaningful professional progression.

"In recent decades welding has become a dominant process in the fabrication of industrial products and in the building of structures from steel. It is used in all phases of production and is needed not only nationally but also internationally in almost every industry," says Zichawo.

He goes on to argue that completing a trade course in welding can virtually assure every candidate of gainful employment and a long career with multiple opportunities for advancement.

In his webinar, Shelton Zichawo talks about the SAIW's training offering, how to be a practical welder, and potential career progression pathways via the Institute's welding coordination courses.

As well as those exploring opportunities in practical welding, this webinar will also benefit those seeking to lead welding teams and manage the day-to-day operations of a fabrication shop: welding specialists, welding technologists and welding engineers, for example.

5 A career in non-destructive testing (NDT): An integral career in the engineering and manufacturing process

SAIW NDT Training manager, Mark Digby, talks about the NDT profession as essential to the production, overhaul and maintenance of welded plant and equipment: a career that is integral to engineering and manufacturing processes.

"NDT personnel test materials or products for any imperfections – without destroying these products or materials – and the process is not only limited to testing welds, but can be extended to various product sectors such as castings, forgings and tubes. NDT can be applied in most industrial sectors such as pre-and in-service testing, power generation and in the petrochemical and oil and gas industries, to name but a few," says Digby.

NDT personnel form part of the chain of expertise used to ensure the world uses high quality products that pose lowest possible safety risks to end users. This webinar covers the benefits of a career in NDT as well as the courses that the SAIW offers in six different NDT testing methods.

Scan QR code to learn more about SAIW's webinars.

A weld on a steel pipe being inspected using the non-destructive ultrasonic testing technique.

The Cutmaster 60i: ESAB's cutting marvel

With the introduction of the new Cutmaster® 60i, ESAB is offering the most powerful air plasma cutting machine on the market today. The unit can cut through 20 mm (¾-inch) mild and stainless steels, or aluminium of up to 32 mm (1¼-inch) thick. Eugene van Dyk of ESAB South Africa talks about this and other cutting 'wonders'.

"The new ESAB Cutmaster 60i is extremely powerful, can cut through a multitude of metals and never backs down, from first cut to clean up. It really does take plasma cutting to the next level," begins Van Dyk.

Compared to its predecessor, the Cutmaster 60i now has 16.6% more cutting and piercing capacity, enabling it to get jobs done faster with cleaner cuts. With a mass of only 16.8 kg, this is a compact and lightweight air plasma unit designed with portability in mind. "But neither power nor performance is sacrificed to achieve this. With a wide range of available cutting and gouging nozzles, fabricators can harness the Cutmaster 60i's power like never before," he continues.

Key improvements include:

- Increased cut capacity and cut speed: The Cutmaster 60i's recommended quality cut capacity is 20 mm, with a maximum sever capacity of 38 mm and a 20 mm pierce capability.
- Superior duty cycle: The machine's duty cycle of 50% at 60 A while cutting mild steel equates to a 7.6 kW power supply rating, the highest output in its class. This enables more and faster cutting for longer periods of time.
- Rugged roll cage: With multiple lift points, the sturdy four-handle roll cage makes it easy to transport the Cutmaster 60i to where it is needed – including outdoors. The machine's IP23S protection rating makes it is ready to face the most rugged of African environments.
- Generator reliable: Power factor correction embedded in the 60i ensures no disruptions in cutting performance emerge due to power spikes when connected to a generator.

ESAB's latest Cutmaster 60i air plasma cutting machine has 16.6% more cutting and piercing capacity, enabling it to get jobs done faster with cleaner cuts.

"The Cutmaster 60i comes alive when cut capacity or cut speed are imperatives. It slices cleanly through mild steel, aluminium and stainless steel with ease and creates a perfect groove when gouging. The improved SL60QD™ 1Torch® with ESAB's innovative Cutmaster Black Series extended life consumables also help fabricators to achieve the best cuts currently possible from any machine in this class," says Van Dyk.

The extended life consumables in the Cutmaster Black Series include Cutmaster Black Series electrodes designed to operate for 60% longer than standard consumables before needing to be replaced. "So operators get maximum productivity and excellent performance from consumables that really do last longer," he adds.

In addition, the Series carries only three consumable parts so fewer replacement parts need to be held in stock and torch changes are quicker, which keeps cutting downtime to a minimum.

Other enhancements include:

- Long arc stretch: When in an odd position or trying to hit a corner, Cutmaster 60i's extra-long arc will stretch to keep constant contact with the workpiece.
- Additional modes of operation: The machine now has four modes of operation – twice as many as competitors – ie, cutting mode; expanded metal cutting mode; gouging mode; and latch mode, which allows the torch trigger to be locked so an

ESAB can offer many more cutting options, both small and large, including a full range of green Thermal Dynamics (TD) cutting machines.

The extended life consumables in the Cutmaster Black Series are designed to operate for 60% longer than standard.

operator can better focus on cutting accuracy.

- ESAB's SL60QD 1Torch: This torch has a lot to offer. First, it is compatible with the entire Cutmaster family – as well as with other cutting systems in the industry. Second, 'QD' stands for quick disconnect, which gives the option of replacing only what is needed to be replaced, the torch or the lead, for example, which saves money in the long run.

The system's large and durable LED display offers high-visibility for easy viewing of all machine settings from a distance. Intuitive and easy-to-use, the display instantly provides the necessary feedback for keeping settings and cut quality optimised.

The Cutmaster 60i also incorporates a gas optimiser to precisely regulate air pressure, ensuring premium cut quality and performance. When amperage is set and the torch type, torch lead length and mode of operation selected, a visual prompt tells the operator to adjust the gas pressure required, while still offering the flexibility to tweak the settings to suit individual preferences.

Cutmaster 60i's end-of-life indicator continuously monitors the remaining life of the consumable parts and sends out an alert when it is time for replacements, so maintaining optimal performance and cut quality. In addition, a consumables configuration guide is displayed on top of the power source, giving easy-to-follow instructions on how the consumables work together. There is also a quick-start guide in the box that helps customers to be up and running in no time.

"Every Cutmaster 60i delivery includes a full range of consumables with several amperage sizes of cutting and gouging nozzles. Whether drag cutting, gouging, shield cap cutting, or working on another application, the Cutmaster 60i comes ready to rumble," says Van Dyk.

As with all Cutmaster plasma cutters, ESAB's MechPak mechanised package is also available for the Cutmaster 60i, making it easy to hook up to a cutting table for semi-automatic cutting processes. MechPak comes with everything needed to get started, including an SL100 mechanised torch (7.6 m or 15.2 m), a remote pendant, a lead with its ATC connection, and all torch consumables.

Complementing the package is the SentinelTM A50, an excellently balanced auto-darkening helmet with a full range of shades, including matched plasma cutting shades 6 to 7.

"And if both cutting and welding are required, the RebelTM 215 multi-process welding machine offers the most innovative welding technology available. Combined with the Cutmaster 60i, onsite maintenance teams and workshop fabricators gain the ability to cut or weld almost anything, anywhere," Van Dyk says.

"The Cutmaster 60i, like every ESAB machine, is backed by our commitment to superior customer service and support. Our skilled customer service department is prepared to answer any questions, address problems and help with maintenance and upgrading of machines.

"And if this is not exactly what you need, we at ESAB can offer many more cutting options, small and large. These include the Cutmaster 40, Cutmaster 80, Cutmaster 100, or Cutmaster 120," Van Dyk concludes.

With a mass of only 16.8 kg, this is a compact and lightweight air plasma unit designed with portability in mind.

Use the QR code to watch a video clip of the Cutmaster 60i in action.
Or to find out how more and take control of the latest plasma technology yourself, visit esab.com/marvel.

ESAB Cutmaster 60i specifications table	
Amperage output:	10–60 A, continuously adjustable
Open-circuit voltage (OCV):	300 V
Input voltage	400 Vac
Number of phases	3
Supply frequency	50/60 Hz
Rated duty cycle	50% @ 60 A; 60% @ 50 A; 100% @ 40 A
Amperage draw	13.2 A @ 400 V
Enclosure rating	IP23S
Input power cable and plug	2.7 m three phase 14 AWG 4/C
Work lead with ground clamp	6 m work cable with 50 mm connection
Gas requirements	compressed air
Operating temperature range	0 °C to 50 °C
Input pressure	8.6 bar (max)
Air flow requirements	142–235 ℓ/s
Power supply gas filtering ability	particulates to 5.0 µm
Maximum recommended cut	up to 20 mm
Maximum sever	38 mm
Pierce rating	20 mm

Welding apprenticeship programme to boost SA skills base

SAIW Business Development Manager, Etienne Nell, describes and champions SAIW's new work-based apprenticeship learning programme for the welding industry, which is now available through the SAIW Foundation and the Quality Council for Trade and Occupation (QCTO).

A lack of apprenticeship opportunities is seen as one of the main obstacles facing artisan learners in South Africa. The issue is that while students may achieve a suitable qualification at a TVET college, they subsequently discover that they cannot obtain the necessary work experience to enable them to acquire a job.

Realising this, the Southern African Institute of Welding (SAIW) is championing work-based apprenticeship learning for the welding industry through the SAIW Foundation and the Quality Council for Trade and Occupation (QCTO). The programme provides aligned, professional training and service standards, with the aim of supporting the overall economic growth of the industry through skills delivery and international standard qualifications.

SAIW Business Development Manager Etienne Nell comments: "Welding industry apprenticeship training has been plagued with profit-only focused training centres, outdated curricula and poor skills standards with no workplace service delivery.

"Many welding apprentices were therefore failing to secure work and employment opportunities were lost owing to non-aligned skills training or occupational competency."

Dual System Learning for welding apprenticeships combines industry designed curricula with technical and simulated practical training at the SAIW, backed by authentic workplace experience overseen by qualified and experienced employed welders.

Through the new single, integrated learning programme, all traineeships will be facilitated through the employee according to the QCTO curriculum and based on targeted skills training standards at the SAIW. The new Dual System Learning for apprenticeships will combine industry designed curricula with technical and simulated practical training at the SAIW, backed by authentic workplace experience overseen by qualified and experienced, employed welders.

Nell elaborates: "This means fabricators select and manage their own employees, register them for the desired training standards for the services they require and the employee is able to complete his or her apprenticeship on the job and according to industry requirements of the recognised standards of welding expertise required at their workplace."

Economic productivity and higher employment

The new, industry-designed curricula programme will ensure an apprentice of 1 310 hours theoretical training, 1 960 hours of simulated welding training and 2 200 hours of workplace experience, resulting in a new qualification which reflects occupational competence, trade theory, simulated practice and workplace capability. Qualifications such as these will assist apprentices in achieving economic productivity and higher employment returns in their chosen speciality.

Benefits for industry employers include the resulting productive value of the apprentice's work, SETA grant support towards apprentice training costs, a tax-break from SARS and B-BBEE scorecard points for skills development for the welding industry.

Showing full commitment to the QCTO curriculum and the new Dual System Learning for Apprentice's programme, the SAIW will also assist in maintaining the required training results for external assessment, as required by QCTO.

Nell explains: "Working together with the SAIW, the QCTO and the International Institute of Welding, the welding industry as a whole is ensured of the best possible outcomes when supporting quality assured workplace learning to national qualification standards. They will have skilled employees, trained to industry standards and acculturated to the company, meaning there is reduced risk to quality and service, lower-cost recruitment and better employee retention."

Employer support is vital

In support of the internationally recognised Dual System national diploma, the SAIW is calling on the welding industry to step forward and show its support through providing Apprentice Contracts for employees and agreement towards a Memorandum of Understanding (MOU) concerning quality assurance with the SAIW.

SAIW Executive Director John Tarboton describes it as a win-win situation of economic benefit to the industry, which couldn't have come at a better time given the current economic crisis the country finds itself in. He stresses however: "The reality is we can't do it alone. We need industry commitment and financial support to drive this programme, which makes perfect business sense given that it will ultimately lead to the delivery of highly skilled welding artisans of international standard and an overall deepening of South Africa's skills base.

"The SAIW is a non-profit technical organisation dedicated to promoting world-class excellence in welding, NDT and allied technologies. We provide training programmes, consultancy and industry support services, as well as certification of companies and personnel to international standards and specifications. And although based in Johannesburg, South Africa, we are now active throughout Southern African and also have experience further afield – predominantly in Central Africa, the Indian Ocean Islands and the United Arab Emirates," Tarboton concludes.

Develop appreciation for the benefits of welding

Welding has a crucial role to play in the rebuilding of our economy post the COVID-19 lockdown with this specialist skill being required to build strength into key fabrication, supply chain and infrastructure projects, to name a few.

Realising the need for a wider understanding of the benefits of welding in the workplace, SAIW will be re-launching its Five Day Appreciation of Welding for Engineers course which is designed to introduce students to the field of welding.

SAIW Training Manager Shelton Zichawo explains: "The course is not only for engineers but can be attended by personnel who are not necessarily engineers but have an interest in learning more about welding: engineers new to welding, QA personnel, workshop managers, storeman, entrepreneurs or any person whose new role involves welding."

He explains that the course sets out to give information on the various requirements that need to be taken into consideration to produce good quality welds. "One of the key things with welding is that once a product has been manufactured, it cannot be fully tested to check for that mechanical quality requirements have been met: we can only do non-destructive testing.

"The implication of this on a completed product is that the weld quality needs to be managed before welding commences so as to build the quality into the product," he stresses.

SAIW is re-launching its Five Day Appreciation of Welding for Engineers course which is designed to introduce students to the field of welding.

In terms of the Appreciation of Welding course content, various topics from welding processes to the nature of materials that are welded and how these alter during the welding process are covered. Other aspects such as how to manage the quality of deposited weld metal through the use of qualified personnel and procedures and the different types of testing that is required are also taught in this course.

The course is delivered at the Southern African Institute of Welding (SAIW) in Johannesburg as well as satellite classrooms in Durban and Cape Town – and it can also be presented at a client's premises if required.

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A new era in SA for welding skills development

The SAIW is set to launch a pioneering new welding hub in Middelburg that will form the core of its presence in South Africa's industrially-focused Mpumalanga Province.

SAIW Executive Director John Tarboton says: "The formation of this welding hub is vital for the local welding sector. "30% of SAIW's students are from Mpumalanga and the SAIW has always wanted to open a branch in Middelburg, which is an engineering hub for the mines and power stations of the surrounding areas, so it makes perfect sense to locate a branch there.

The SAIW is partnering with the Department of Economic Development and Tourism of the Mpumalanga Provincial government as well as with the Steve Tshwete Local Municipality (STLM), which Tarboton describes as a business friendly municipality with the second most sound municipal finances in the country, this according to Business Insider article on the most financially sound cities in South Africa (www.businessinsider.co.za/most-financially-sound-cities-in-south-africa-drakenstein-paarl-middelburg-national-treasury-stat-e-of-local-government-finances-2019-8).

Tarboton explains that currently, prospective students have to travel to Johannesburg for training. "The opening of this branch will significantly reduce costs and improve accessibility to the courses. It represents a great opportunity for continued economic growth in this area, particularly in engineering and metals fabrication."

The initial Middelburg Branch will be located at the Mpumalanga Stainless Initiative (MSI) until the Centre of Excellence has been built of which the SAIW will become an anchor tenant.

The facility will offer students 15 welding bays with a fully equipped classroom and on-site office to handle any of the courses that are offered by SAIW, provided there is the minimum number of students.

The Middelburg hub will offer Practical Welding Training, accredited by the International Institute of Welding (IIW) as well as courses in Non-Destructive Testing (NDT) and other welding related courses, such as Welding Inspectors.

The SAIW is set to launch a new welding hub in Middelburg that will form the core of its presence in Mpumalanga.

Tarboton says this model is a useful template for similar initiatives going forward, such as public private partnerships. "Having the SAIW as an anchor tenant at the Centre of Excellence will enhance the viability of the Centre of Excellence and will act as a draw card for new and emerging entrepreneurs to set up metal fabrication businesses. At the same time, it will assist with our regional development strategy and expand our footprint.

Thermal spray protective coatings for drinking water reservoirs

In this paper, T Wessler and A Wank from German thermal spray specialist, GTV Verschleiss-Schutz; and H Morgenstern of RWTH Aachen University Institute for building research (IBAC) describe their work on the use of thermal spray coating processes to improve the lining quality of concrete-based drinking water reservoirs.

More than 10 000 water reservoirs made of armoured concrete secure drinking water supplies in Germany. Leaching effects of the concrete and chemical pollution from regular cleaning processes raise reservoirs' stress levels and cause erosion. In the past, repair was based on polymer mortar composites or chlorinated rubber coatings with solvents that are now classified as toxic.

These days, there are three alternative state-of-the-art coating possibilities: low polymer content mortar coatings; solvent-free two-component polymer coatings; or linings based on sheets, foils and glass plates. But specific disadvantages of all these techniques, such as low bond strength or gap problems, still require alternative solutions to be developed.

Combinations of special heat resistant mortars with fused or sealed thermal spray coatings are considered to be economical, long-life and hygienic solutions for reconditioning concrete water reservoirs. Plasma spraying with high power torches permits high coverage rates and might be capable of in-situ fusion of glass ceramics for the production of watertight coatings. However, strong heat transfer during the fusion process results in severe thermal loads on mortars.

On the other hand, conventional thermal spray coatings can be deposited with low heat input, but are not watertight and require sealing. In a first series of tests, specially sealed conventional ceramic coatings have proved to provide high bond strength, hydrophobicity and resistance against water penetration.

Introduction

Protective coatings have become interesting in more and more applications. Besides economic advantages, environmental sustainability and resource protection considerations have become major driving forces for this trend.

Recently, new applications beyond corrosion protection of steel structures such as bridges or armouring steel [1] are being considered in civil engineering. For example, there is need to improve lifetime and tightness of potable water storage vessels and wastewater ductwork. The lifetime of these products is limited, first due to leaching by water, which is particularly severe in the case of lime deficient water and in zones of fluctuating water levels. This leaching results in pollution of water and in loss of basicity followed by a loss of the protective function of steel reinforcements. Second, cleaning agents applied for sanitation or acids contained in wastewater cause additional corrosive attack.

These days restoration is done either by polymer modified mortars, two-component varnishes or lining the concrete with glass or polymer sheets. Polymer modified mortars are not highly resistant to leaching or corrosive attack by cleaning agents and therefore cause lower levels of water pollution.

Two-component varnishes can generally create hygienic and long-lasting protective surfaces. However, application of only slightly incorrect ratios of components can cause severe contamination of drinking water. Lining using glass or polymer sheets also results in the creation of hygienic and long-lasting protective surfaces. But this method is relatively time consuming and costly, especially when covering complex shaped surfaces such as steps. In addition, the gaps between sheets result in unprotected areas.

Thermal spray processes show high potential to create long-lasting protective coatings as an alternative to the presently applied technologies, because they permit deposition of relatively thin coatings with homogeneous thickness even on complex shaped, large surface areas and in a short time – and thermal spay processes do not require the use of solvents.

One thermal spray technology based approach that has been studied is the in-situ fusion of powder flame-sprayed glass coatings [2-3]. However, powder flame spraying only permits relatively low deposi-

Figure 1: Bond strength test bodies and Karsten tubes glued on plasma spray coated concrete samples and the reference tiles.

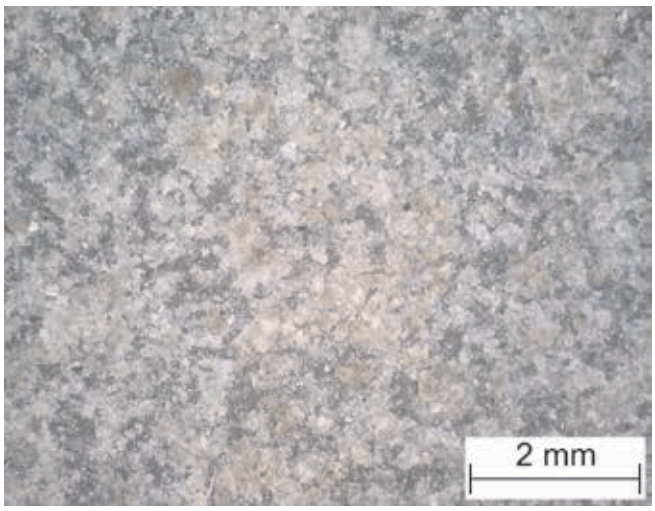

Figure 2: Optical microscopy image of an alkali resistant glass coating deposited on mild steel.

tion rates and, despite complex heat management, it has not yet been possible to create crack-free coatings on large surface areas.

In a joint project, the Institute of Building Materials Research of RWTH Aachen university and GTV Verschleiss-Schutz GmbH is investigating different approaches to overcome the remaining shortcomings of thermally sprayed protective coatings for concrete substrates. The investigations include the use of particularly heat resistant, polymer free basalt mortars [4] as an intermediate layer between a concrete substrate and the thermal spray coating; the use of different plasma spray torches in order to increase deposition rates; and the comparison of sealed conventional thermal spray coatings with in-situ fused thermal spray coatings.

Experimental procedure

For these experiments, basalt mortar substrates (Table 1) with dimensions of 200x200x30 mm^3 were prepared by casting into formworks, densification for 120 seconds, storage for 7 days under foil, and after stripping from the formwork, drying for 21 days at 23 °C and 50% humidity.

Various glass powders were tested at an early stage to identify feedstock that could be fed using a conventional disk type powder feeder type GTV PF (GTV Verschleiss-Schutz GmbH, Luckenbach, Germany). Besides crushed float glass with particle sizes of between 90 and 125 µm and a specially designed alkali resistant glass [5] with particle sizes between 300 and 500 µm, an Al2O3 99.7% powder with a nominal size range of +20 -45 µm (GTV 40.05.1W) was used as powder feedstock.

Table 2 lists particle size distribution results from optical analyses equipment (Retsch Camsizer X2, Retsch GmbH, Haan, Germany). For sealing not in-situ fused coatings water glass and methyl methacrylate based sealer GTV 92.00.7 approved for tap water applications were tested. The latter was applied in four steps at room temperature using a brush.

Plasma spray and fusion tests were carried out using both a conventional single cathode-single anode dc plasma spray torch type GTV F6, and a high-power single cathode-quintuple anode dc plasma spray torch type GTV Penta. F6 tests were carried out at a power level of 42 kW using an argon-hydrogen 77/23 plasma gas mixture at a total flow rate of 53 ℓ/min. Powder feed rate was kept constant at 15 g/min and 50 g/min for spraying of glass and alumina powders respectively, while spray distance and surface speeds were varied between 100 to 150 mm and 0.23 to 1.13 m/s respectively.

For spraying of alumina powder, the Penta torch was operated at

w/c-value (water to cement ratio)	0.47
Cement type	CEM I 42,5 R
Grading curve	A/B 8
Water	189 kg/m^3
Cement	400 kg/m^3
Flue ash	50 kg/m^3
Superplasticiser	3.2 kg/m^3
Basalt, < 1 mm	719 kg/m^3
Basalt, 2-5 mm	1 078 kg/m^3
Average raw density	2 510 kg/m^3
Avg. cube compressive strength after 28 days	66.5 N/mm^2
Avg. bending tensile strength after 28 days	9.6 N/mm^2

Table 1: Basalt mortar composition and properties.

Powder	Al_2O_3 99.7%	Float glass, +90 -125 µm	Alkali res. glass, +300 -500 µm
d10 [µm]	21.5	74.6	180.3
d50 [µm]	30.6	112.2	282.7
d90 [µm]	41.2	144.5	488.8

Table 2: Particle size distribution of applied powder feedstock.

a power level of 106 kW using an argon - hydrogen 75/25 plasma gas mixture at a total flow rate of 67 ℓ/min. Powder feed rate was kept constant at 300 g/min, while spray distance and surface speed were varied between 150 to 250 mm and 0.75 to 1.13 m/s respectively.

Track offset ranges between 10 to 30 mm, substrates were coated without and after pre-heating to 80 °C, and coatings were deposited in one pass and two passes.

Coatings on concrete samples were evaluated with respect to defects, coating thickness distribution and microstructure using optical microscopy. Additionally, protective coatings were tested for their bond strength using standard DIN EN 1542 tests; and their tightness against water penetration was evaluated according to Karsten, with a tile used as the reference representing a completely tight specimen surface (Figure 1).

Results

In pre-tests, glass powders were sprayed on grit-blasted mild steel substrates using the GTV F6 torch. Generally, both glass powders permit spraying of coatings. However, deposition efficiency is very low, < 20%, and especially big spray particles do not form flattened splats but rather get rounded due to local evaporation or melting of some surface areas. These splats do not get fully incorporated into a consistent coating (Figure 2). Even at surface speeds as slow as 0.23 m/s only a small fraction of the coating gets fused and not even four passes resulted in full coverage of the substrates.

Trials to transfer the process parameters for coating concrete samples were not successful, either. There was no deposition of spray particles at all. Instead, there was local damage of the concrete surface due to overheating at the low surface speeds required. Since there was no evidence that a fused glass coating could be deposited on the concrete samples without thermal overload, this approach to protect concrete surfaces using in-situ fusion of plasma sprayed glass coatings was discarded.

Contrary to spraying of glass powder feedstock, spraying of alumina powder readily enabled the deposition of consistent coatings. In order to maximise the coverage rate, spray tests focused on the use of high-power GTV Penta plasma spray torches.

Using a powder feed rate of 300 g/min, coatings that fully cover concrete sample surfaces could be deposited in a single

Figure 3: Alumina coating deposited on concrete in a single pass using plasma spray torch GTV Penta.

Figure 4: Local damage of an alumina coating on concrete because of excessive heat transfer.

layer (Figure 3). For the production of coatings with an average thickness of 50 µm, 70 to 80% deposition efficiency and a coverage rate of 1.36 m^2/min was achieved.

In extensive investigations on the influence of spray distance, surface speed, track offset, number of passes and pre-heating temperature, it was found that the formation of defects such as cracks, local coating delamination or concrete spallation (Figure 4) clearly increases with the heat transferred to the concrete substrate and with increasing coating thickness. So high surface velocities and long spray distances are beneficial, while large numbers of passes and pre-heating are disadvantageous.

Relatively smooth surfaces of concrete samples formed on formworks permited deposition of consistent alumina coatings that showed a comparable microstructure to the coatings deposited on metallic substrates (Figure 5), with low porosity and a network of fine microcracks. On the other hand, large surface pores and roughness peaks prevented complete coverage of the concrete sample surfaces. Heat affected zones were not observed in basalt mortar substrates.

Coated concrete samples that did not show obvious defects

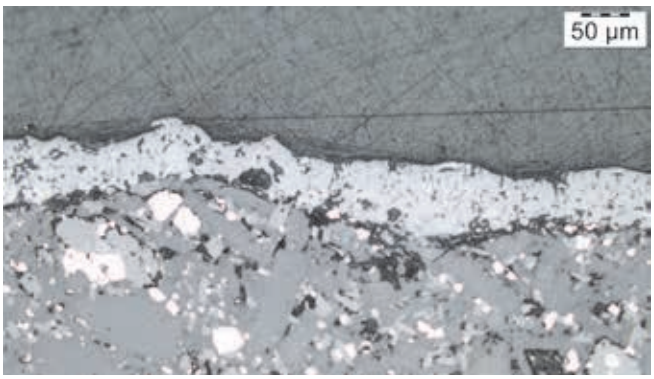

Figure 5: Microstructure of a plasma sprayed alumina coating with 50 µm average thickness after sealing with a methyl methacrylate based sealer on concrete, torch: GTV Penta, powder feed rate: 300 g/min, surface velocity: 1.13 m/s, passes: 1, coverage rate: 1.36 m2/min, deposition efficiency: 78%.

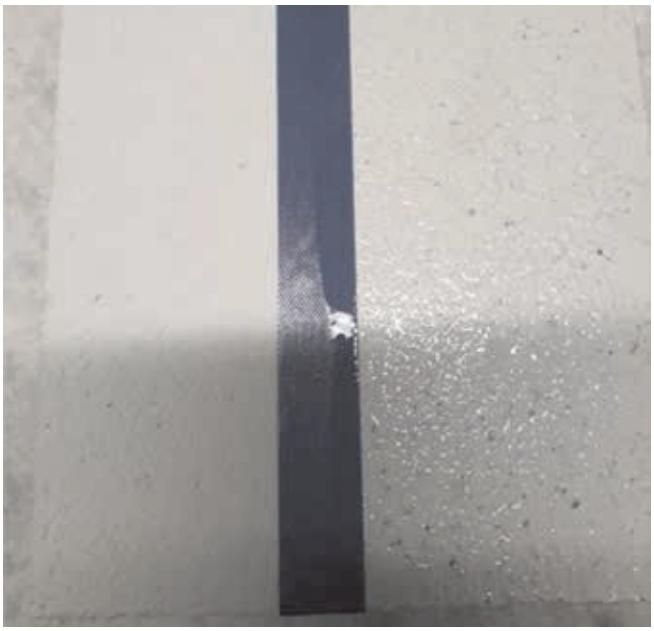

Figure 6: Alumina coating on a concrete sample after partial (right side) sealing with a polymer sealer.

on visual inspection were evaluated with respect to coating bond strength and their capacity to avoid water absorption both in as-sprayed and sealed states. Sealing with water glass is clearly less effective compared to the use of the methyl methacrylate based sealer. Water glass forms a thin layer on top of the plasma sprayed alumina coating, while the polymer sealer penetrates the defect network of these coatings, right down to the concrete substrate.

After sealing with the polymer sealer, a segmentation crack network in the plasma sprayed alumina coatings becomes clearly visible (Figure 6). Also, polymer sealed surfaces show strong hydrophobicity (Figure 7). Due to the superior penetration behaviour, only polymer sealed alumina coatings were evaluated in tightness tests.

Tightness tests were carried out by filling Karsten tubes with 4.0 mℓ of tap water. Sample surfaces were exposed to tap water for 72 hours. In this time, evaporation of 0.15 mℓ water was measured on the reference tile and the Karsten tubes on all polymer sealed alumina coatings showed exactly the same loss of water, which means that the surfaces are perfectly watertight.

On the contrary, concrete samples covered with unsealed alumina coatings lost from 3.3 mℓ up to the full volume of 4.0 mℓ, which indicated that the plasma spray coatings alone could not act as an effective barrier between tap water and concrete substrates.

Bond strength tests showed an excellent bond strength of

Figure 7: Water repellent function of a polymer sealed alumina plasma spray coating.

plasma sprayed alumina coatings. Only two out of sixteen coatings that were sprayed with the GTV Penta torch at 300 g/min powder feed rate showed an average bond strength of less than 2.4 N/mm^2 and failed in the interface between the plasma sprayed coating and concrete substrate (Figure 8). These coatings show a thickness of about 200 µm and were deposited with a maximum spray distance of 200 mm and, therefore, with relatively high heat input to the concrete substrate. All the other coatings showed higher bond strength to the concrete substrate compared to the substrate´s cohesive strength and failure occurred at tensile stresses of between 2.4 and 3.3 N/mm^2.

Summary and conclusions

In-situ fusion during plasma spraying of glass coatings on basalt mortar could not be achieved within the limits of the performed tests. Basalt mortar substrates were thermally damaged before any relevant coating formation could be realised.

However, well adhering alumina coatings can be deposited on the concrete substrates at a powder feed rate of 300 g/min and 70-80% deposition efficiency by use of high-power plasma spray torch type GTV Penta. If a coating thickness of 100 µm is not exceeded, bond strength between plasma sprayed coatings and basalt mortar substrates exceeds the cohesive strength of the basalt mortar.

Due to their pore and crack network, however, the plasma sprayed alumina coatings are not an effective barrier between concrete substrates and drinking water. But sealing with a conventional polymer sealer that is approved for tap water applications enables perfect water tightness to be achieved. Accordingly, sealed plasma sprayed alumina coatings represent a promising solution for the long term protection of tap water reservoirs – and these coating can also be deposited as restoration measures.

Further investigations will be carried out on the resistance of sealed plasma sprayed alumina coatings against wastewater containing chlorides and sulphates. Also, complex shaped geometries such as stairs and bends will be coated to prove the full applicability of this technology for the restoration of tap water reservoirs and sewage ductwork.

Besides fairly temperature resistant basalt mortars, different qualities of conventional quartzite-based concrete and clay bricks will also be coated to explore the spectrum of applicable base materials and the need to apply basalt mortars as intermediate layers.

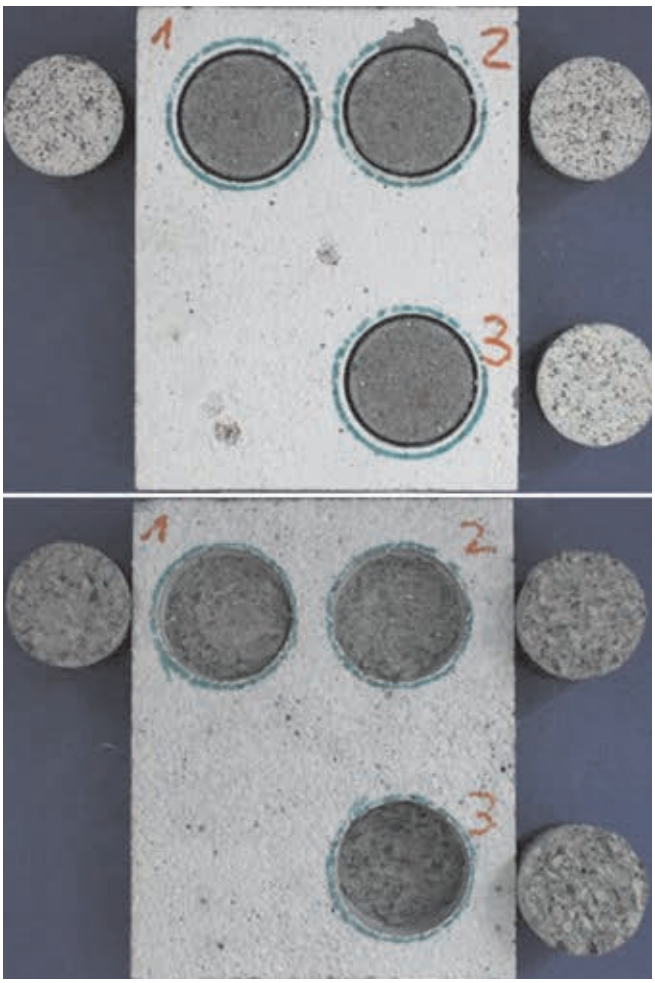

Figure 8: Bond strength test failures of the alumina coating/concrete substrate interface (top); and the concrete substrate (bottom).

Acknowledgement

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Air Liquide gas and Harris Products cutting and welding solutions:

A collaboration synonymous with quality

Michael Ashley, product manager for Hardgoods at Air Liquide in South Africa, talks about the relationship between Air Liquide and Harris Products, which is built around providing fabricators with the highest possible safety and quality levels.

"The Harris Products Group is a world leader in metal working products used in the brazing, soldering, welding, cutting and gas distribution industries. It was formed in 2006 as a result of a merger between Harris Calorific, the manufacturer of gas welding and cutting equipment and gas regulation and distribution systems, and the J.W. Harris Co, the manufacturer of brazing and soldering alloys and welding consumables," explains Ashley.

The Harris Products Group currently operates manufacturing facilities in Mason in Ohio and Gainesville in Georgia, USA, as well as in Dzierzonow, Poland and Sao Paulo, Brazil – and all of the company's facilities are ISO 9001 certified for quality management. "In addition, these sites are also ISO 14001 certified for environmental management systems, demonstrating commitment to the stewardship of the global environment," he adds.

"We couple Harris' application specific equipment with Air Liquide packaged gases, with every combination chosen to best meet the quality required, while delivering the productivity, safety and cost effectiveness demanded from fabricators operating in these lean times. We supply an array of items predominantly to end users, catering for all their requirements, and a comprehensive range of products is available for every conceivable applications," Ashley notes.

"When people think of gas equipment, they think predominantly about regulators, but Air Liquide stocks a full range of Harris products that also includes cutting torches, flash back arrestors, cutting nozzles, hoses, flowmeters, gas savers and a host of the other items required for our customer's gas cutting, welding, purging and brazing needs," he tells *African Fusion*.

With respect to oxy-acetylene hand cutting, for example, Ashley points out that Harris' 896-1.5-AC acetylene pressure regulator and the associated 896D-10-OX oxygen pressure regulator are designed to offer safe and efficient delivery of the two cutting gases needed at the precise pressure needed to cut carbon based steels. "Coupled with a model 28 heavy duty cutting torch; a 188-1-L8 flash back arrestor with a check valve and a flame-extinguishing sintered metal filter; a Model 2890-F cutting nozzle for acetylene; and all of the hoses and other accessories needed, Harris has developed the complete package. All that is then needed are the two cutting gases, Air Liquide Acetylene and Industrial Oxygen, which are readily available in cylinders," he says.

All Harris regulators are designed and manufactured according to the most recent international standards, namely ISO 2503 (cylinder pressure and flow control regulators) and ISO 5171 (pressure and flow gauges) – and all carry a seven-year warranty. "The Harris products supplied by Air Liquide can withstand industrial applications in the toughest working conditions, while on the other end of the spectrum, high accuracy, high quality specialty gas regulators are also available for precision laboratory type work," he adds.

Harris' 896-1.5-AC acetylene pressure regulator and the associated 896D-10-OX oxygen pressure regulator are designed to offer safe and efficient delivery of the gases needed for oxy-acetylene cutting at the precise pressures needed.

Above: Harris Product' Model 28 hand cutting torch is purpose designed for heavy duty oxy-acetylene cutting, but can also be used with alternative fuels such as propane.

Right: Harris 188-1L8 flash back arrestors have a built-in check valve to prevent reverse flow of gases and a sintered metal filter to extinguish any flashback flame.

An acetylene cutting nozzle and a mix fuel nozzle.

As well as cutting, though, the range includes solutions for all gas welding processes, including gas tungsten arc welding (GTAW); gas metal arc welding (GMAW); metal-cored arc welding (MCAW) and flux-cored arc welding (FCAW) as well as for brazing and other traditional fuel-gas based gas welding processes.

"Our ARCAL™ Prime argon gas with Harris regulators, flowmeters and gas savers make an ideal combination for gas shielding and purging in critical applications such as the GTAW welding of stainless steel tubing used for hygienic applications in the food and beverage industries.

"We have also seen an increasing need for laser cutting gases. We have, therefore, developed a custom range of high purity gases that, with Harris' high-flow pressure and pipeline regulators, we can offer to the local laser cutting industry to best suit the machines, processes and materials they are dealing with," says Ashley.

An industry leader in the supply of packaged gases, Air Liquide's gases coupled with the robust, competitively priced range of Harris gas equipment feature throughout industry. The recent introduction of Harris' specialty gas regulator range further enhances this coupling and an easy reference table for welding or cutting process is available that recommends the ideal match between the gas equipment, gas type and gas supply modes required.

Harris Product's gas cutting equipment has featured in the Air Liquide sales portfolio since 2012. Previously sold through Weld-Cut, the wholly-owned Air Liquide subsidiary, Harris products are now available directly from Air Liquide branches throughout South Africa.

"The relationship is certainly synonymous with quality," assures Ashley.

Process	Base material	Harris equipment	Air Liquide gas	Gas supply mode	
				Cyl	Bulk
Oxy-fuel gas cutting	C-Mn steel & Low alloy steel	Pressure regulator	Acetylene	✓	
			Propane	✓	
			Industrial Oxygen	✓	
		Pipeline regulator	Acetylene		✓
			Propane		✓
			Industrial Oxygen		✓
		Cutting torch	Oxy-fuel	✓	
GTAW (TIG)	Al alloys C-Mn Cu alloys Low alloy Ni alloys Stainless Titanium	Flowmeter regulator	ARCAL™ Prime	✓	
GMAW (MIG)	Al alloys Cu alloys Ni alloys Titanium			✓	
GMAW (MAG)	Stainless steel		ARCAL™ Chrome	✓	
	C-Mn & Low alloy		ARCAL™ Speed ARCAL™ Force	✓	
MCAW	Stainless steel		ARCAL™ Prime ARCAL™ Chrome	✓	
	C-Mn & Low alloy		Inarc 25 Carbon Dioxide	✓	
FCAW	C-Mn Low alloy Stainless		ARCAL™ Force Inarc 25 Carbon Dioxide	✓	
Gas welding processes	Al alloys C-Mn & Low alloy Cu alloys Ni alloys Stainless Titanium	Pipeline regulator	All gases		✓
		Flowmeter + Gas saver			✓
		Shielding Gas Saver		✓	

A summary of Harris Products and Air Liquide's easy reference table for welding and cutting equipment and gas combinations.

A flexible approach to eddy current weld inspections

Bill Ziegenhagen, product manager at global NDT equipment specialist, Zetec, talks about eddy current testing (ET) and the use of ergonomic, powerful and light weight modern instruments such as Zetec's MIZ-21C.

Eddy current testing (ET) is a fast, accurate, chemical-free way to detect surface and sub-surface defects, including cracks, corrosion and heat damage. It's a proven technology for inspections of welds, rivet holes, tubing and other ferrous and non-ferrous components in aviation, aerospace, oil and gas and other industries.

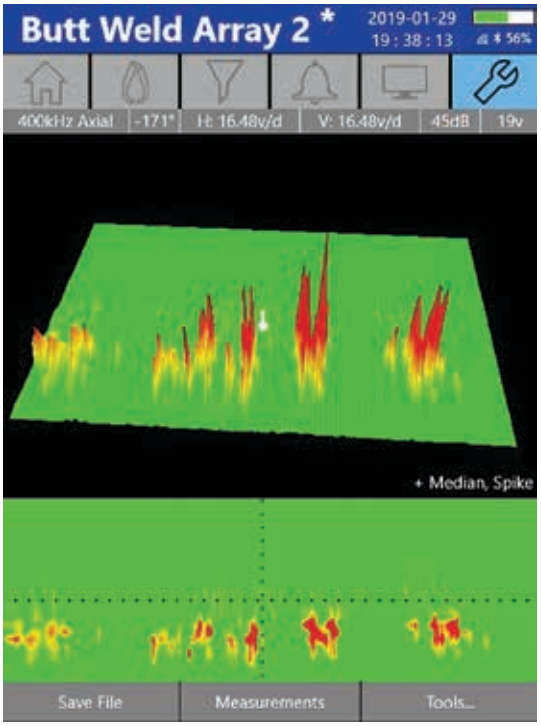
ET has the added benefit of producing an electronic inspection record, a big advantage over dye penetrant testing (PT) and magnetic particle testing (MT). These digital test results can be analysed, saved, shared, stored and compared at any time.

Eddy current testers can also 'see' through non-conductive coatings such as paint, without technicians having to pre-treat the surface.

Modern ET insights

ET involves using a portable instrument and a probe with a coil in it that fires electronic currents into the material. Eddy current array (ECA) probes have multiple coils that fire at coordinated times and can capture more information in a single pass, transforming a process that might last several minutes per weld or joint to one that takes seconds.

One practical limitation of eddy current technology is that the coils in the probe need to be close to the material under test, which is a challenge when the inspection involves complex shapes or rough surfaces like a positive curvature of the circumferential weld crown bead or the non-uniform surface of the weld itself.



ET surface array indications for the butt weld of a mining drum. Zetec's MIZ-21C has a large, colourful, sunlight-readable C-scan display that allows the technician to rotate, zoom and manipulate the data with his fingers.

Because inspection points can be physically hard to reach, most technicians prefer instruments and probes that are battery powered and easy to handle yet don't compromise data-acquisition speed, performance or probability of detection.

Fortunately, eddy current tools and probes are evolving in several important ways.

Portable Instruments

Taking their cue from consumer electronics, the latest instruments feature ergonomic designs with small form factor, powerful software, light weight, long battery life and colourful multi-touch displays.

For example, Zetec's MIZ-21C handheld eddy current instrument weighs just 1.2 kg. It has a large, colourful, sunlight-readable C-scan display that allows the technician to rotate, zoom and manipulate the data with his or her fingers. The 5.7-inch (480x640 pixels) screen is large enough to handle a range of modes, including two signals side by side; or a reference signal and a live test signal simultaneously.

Software that supports single- and dual-frequency eddy current, rotating scanners and conductivity, with viewing tools for impedance, sweep, waterfall, and C-scans, enables inspectors to maximise the instrument's ability to manage signal-to-noise ratios and deliver accurate, detailed inspection results.

Advanced software, however, requires maximum storage and increased processing power. The MIZ-21C has the capacity to store inspection configurations within the instrument, manipulate signals and views for each test application, and use automation to remove steps or remove certain tasks, which is key to a fast, efficient inspection. One example is the MIZ-21C's

Zetec's MIZ-21C handheld eddy current instrument weighs just 1.2 kg and features an ergonomic design with a small form factor, powerful software, light weight, long battery life and colourful multi-touch displays.

'auto lift-off/rotate' button. By automating this task, the technician can repeat the test more consistently while using fewer steps.

Finally, long battery life is important, but so is convenience to maximise user productivity. The MIZ-21C offers both. With up to 10 hours of battery life, users can operate the unit for an entire shift without recharging, while replaceable batteries support 24-hour operation. Even something as simple as the MIZ-21C battery cover design, where no separate tool is required to open it, can be a significant productivity factor.

Flexible probes

During an inspection, one way to ensure that the probe coils are aligned with the surface is to build a surface array probe that is shaped for one specific application or component, such as gear teeth, rivets, bolt holes or something that has to be subjected to repeated non-destructive testing.

Using CAD drawings and 3D printing technology, it is possible to manufacture an eddy current probe that's precisely formed to fit an exact shape or surface. Though designed to do only one job, a custom-made probe can be extremely effective at producing consistent data acquisition conditions over and over again.

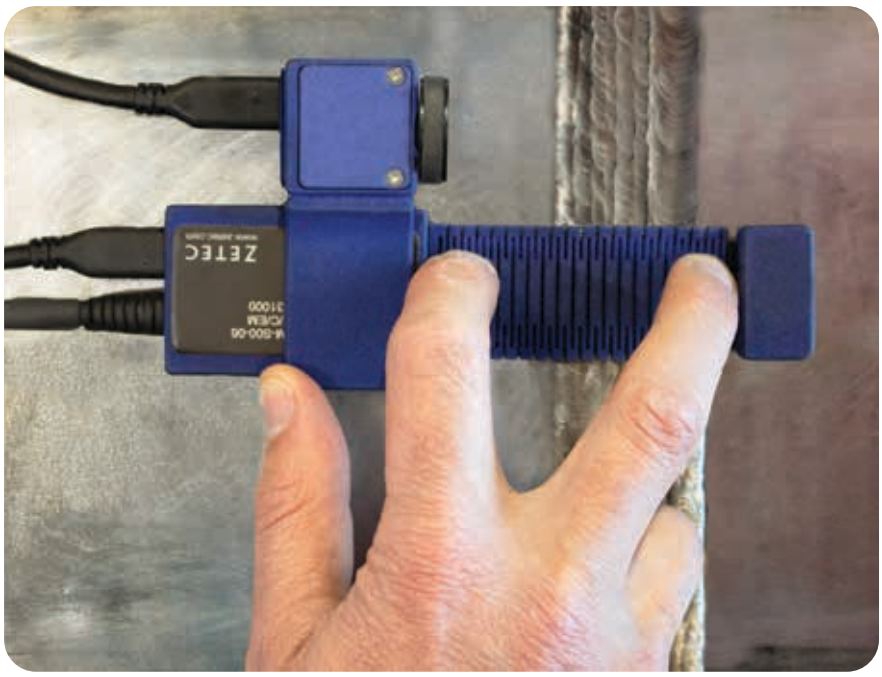
Another approach is to use an ECA probe with a flexible, durable wear surface that allows the coils to bend and remain nominally perpendicular to the surface when that surface is rough, irregular, or complex. In the case of a weld, for example, a flexible surface array probe with just two inches of coverage can encapsulate the weld bead, transition zone and heat-affected zones in a single pass.

Because this type of flexible probe can conform and adapt to different surfaces and contours, it can handle a range of ECA inspections on the same job ticket: for example, a technician can inspect welds on a curved tower and weld joints on turbine rotors with the same flexible surface array probe.

For very high weld crowns, some surface array probes have '+point' coils at the tip of the probe. These types of coils can be especially effective when examining the top of a weld.

One important consideration is the material on the probe's wear surface. The thickness of the wear surface will affect the proximity of the coils to the material as well as the probe's overall flexibility and eddy current signal quality.

In some cases, the flex circuit may not be durable enough to withstand repeated abrasion against rough metal surfaces. Probe manufacturers offer a variety of materials as a wear surface, including plastic films and abrasion-resistant fabrics such as SuperFabric™.



The Surf-X Array Probe can handle a range of inspection applications, from inspecting corrosion or cracking in pipes, pressure vessels, or tanks, to assessing and sizing cracks in raised welds and friction stir welds.

Modular approach

Customised and flexible surface array probes can quickly and accurately test a wide range of materials and geometries, but the entire assembly must be replaced if one element of the probe wears out or fails.

One new approach to improving the versatility and service life of ECA probes is a modular one. Last year, Zetec introduced Surf-X, a flexible ECA probe with swappable coil sets for specific applications. Each probe is comprised of an electronics module and detachable encoder that can be used interchangeably with different array probe coil sets. Users in the field can switch out a coil set in less than a minute.

Currently, Zetec offers five coil sets, including one set for welds, which uses a mix of 32 array coils and two +point coils for complete inspection coverage of butt and T-weld joints; two versions of very flexible tape probes for inspecting small surface flaws on complex geometries such as turbine dovetails; and another set for a range of surface array testing applications where PT or pencil probes might be used today. The encoder can connect in multiple locations on both the handle and electronics module – and the module, encoder and cables can be re-used, saving time and money.

The coil sets have four wear-surface options: no wear surface on the tape probes for inspecting small indications on smooth materials; a thin UHMW plastic wear surface to protect coils and reduce lift-off; a cloth wear surface for protecting the array coils on smooth or polished surfaces such as gear teeth; and SuperFabric for protecting array coils on rough surfaces such as butt and T-welds.

The Surf-X line of probes is fully compatible with the MIZ-21C family, delivering a complete platform for eddy current inspections: making this a cost-effective handheld instrument with surface array capabilities, powerful embedded software and compatibility with new and legacy probes and scanners.

More coverage and versatility

Regardless of whether a custom probe shape, a flexible surface array probe or a modular approach is being used, today's ECA probes provide greater inspection coverage in a fraction of the time compared to PT, MT or pencil probes.

The key is to focus the probe's flexibility – literally, in terms of the surfaces and geometries it can handle; and figuratively in its ability to help technicians be more productive. With a focus on portability, ease of use, connectivity and high probability of detection, Zetec's MIZ-21C and Surf-X probes deliver every inspection advantage available today, while also setting up for the future.

Zetec NDT instruments are available in South Africa through GammaTec.

gammatecsa.com

Managing welding costs by optimising shielding gas mixtures

Air Products Welding Specialist, Sean Young, offers expert advice on optimising the selection of shielding gases for welding and the effect this choice has on arc stability, weld quality, spatter and clean up requirements and, ultimately, total welding costs.

Manufacturing costs have increased significantly in the past few years because of a number of external factors. The current challenge for manufacturers is to manage the costs involved in welding processes without compromising quality, output volumes or production rates. One way to manage these costs is to ensure that the correct materials, processes and consumables are used from the onset, to avoid unnecessary costs as a result of unsuccessful welds that require rework.

For a fusion weld to be successful, the molten welding consumable and the metal components being joined all need to be protected from oxidation and atmospheric contamination. This can be achieved by means of a flux – when a stick electrode of self-shielded wire consumable is being used, for example – or by using a shielding gas. In the case of shielding metal arc (SMA) electrodes or submerged arc processes, a flux is used, whereas a gas shield is used with gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and most flux-cored processes.

In weld trials conducted at Air Products to compare a two part argon/CO_2 mix and Air Products' MagMix3 three-part mix with CO_2 in the 5% range, the welding time for a 30 cm weld was reduced from 58 to 48 seconds when using MagMix3, while producing a cleaner weld with less spatter that required less post-weld grinding.

Selecting optimised shielding gas mixtures for gas metal arc welding (GMAW) of carbon steel is one way in which costs can be evaluated and minimised. For Air Products, it is important to provide customers with different solutions that suit their specific needs, and assist with cost savings where possible.

"Air Products offers specialist services and advice to customers on various components of the process, one of which is the selection of shielding gas," says Young, adding that it is important to look at the welding process, the material, its thickness and the metal transfer mode before selecting the combination of associated consumables that will produce a quality weld that is also cost effective in terms of the project.

"Resulting weld properties are significantly affected by the shielding gas used and in order to optimise the choice of shielding gas, it is important to take all the elements into account that can affect the quality of the weld, such as spatter, bead profile, fusion and penetration," Young notes.

Air Products offers a wide variety of shielding gases and mixtures and a number of commonly used ones for welding are:

- CO_2, which is largely used for GMAW of carbon steels in dip transfer mode.
- Argon: suitable for GMAW of non-ferrous materials and all GTAW applications.
- Argon/CO_2, Argon/O_2, Argon/CO_2/O_2 mixes are used for GMAW of carbon steels as well as stainless steels.
- In the case of more advanced GTAW applications, mostly for more exotic materials and critical applications, argon/helium and argon/hydrogen mixes are available.
- With more advanced and specialised GMAW applications, Argon/He/CO_2 and Argon/H_2/CO_2 mixes are available

Elaborating on the use of argon and CO_2 gases, Young says: "In any mixed shielding gas cylinder, argon is generally the dominant gas. In its pure form, it is an inert gas that is used to keep other gases out and has no chemical effect on the deposited metal weld. On its own, argon is used for all tungsten inert gas welding (GTAW/TIG) and GMAW aluminium and copper and its alloys."

He further explains that pure CO_2 is perceived as the original shielding gas for GMAW and is still commonly used for general purpose welding of steels today. It is widely regarded as a least-cost shielding gas. However, because CO_2 violently dissociates into carbon monoxide and oxygen in the arc, it can destabilise the arc and cause spatter. The dissociation leads to a hotter arc with deep penetration, but it also causes large droplet formation and unstable metal transfer, which is known to restrict the use of the CO_2 to the dip-transfer mode.

Improving welds with active gas additions

Minority percentages of active gases such as oxygen and carbon dioxide can make significant improvements to an argon-based shielding gas for GMAW of carbon steels and stainless steels. "Adding small percentages of oxygen leads to a shielding gas with improved wetting action and it also decreases the surface tension of the molten metal, producing a flatter weld. Furthermore, the pinch-off effect is ac-

Air Products SA manufactures, supplies and distributes a diverse portfolio of atmospheric gases, specialty gases, equipment and services to the Southern African region.

celerated, creating smaller sized droplets. The result is more stable metal transfer, a softer arc and reduced spatter," says Young.

Improved transfer stability ensures that the GMAW welding process is less sensitive to welding parameters and more tolerant to voltage and current variation. Ultimately, this leads to reduced time for machine set-up, which improves overall productivity. He adds that an argon/oxygen mixture with up to 2% oxygen is ideal for stainless steel applications.

In instances where CO_2 is added to argon in a two-part mix, there is an improvement in the penetration of carbon steel joints. A limit in the percentage CO_2 plays a role in obtaining smooth metal transfer in the spray transfer mode and to overcome instability issues.

According to Young, improved penetration and welding speed is obtained when increasing the CO_2 as a result of the increase in temperature in the welding arc. He warns, however, that more than 15% CO_2 in an argon-based mixture causes spatter and instability to re-emerge. "A mix of about 15% CO_2 in argon is optimal but, in the case of thinner materials where penetration is not required, 3% CO_2 and 97% Ar is sufficient," he suggests.

The benefits of three part mixes

GMAW shielding gas mixtures can be further optimised to provide the best welding properties for particular applications by combining the benefits of CO_2, O_2 and argon.

Elaborating on three part mixtures, Young says: "Such mixtures generally consist of argon with CO_2 of up to 15% and O_2 of up to 3%. By using all three gases, it becomes possible to further improve arc stability, while optimising metal transfer characteristics, minimising spatter generation and improving penetration and the bead profiles".

He explains that there is a vast difference between two part and three part mixtures, in particular when you look at the spatter generated during the welding process – three part mixtures tend to generate far less spatter. "In the long run, welding costs accumulate when the time and costs of post-weld activities and cleaning up are taken into consideration. A slightly more expensive gas mixture might make a switch worthwhile if an accurate cost comparison is done," he argues.

There are numerous other benefits of using three part mixtures: increased quality, ease of use and better welding stability, which becomes more tolerant to variations in parameter settings. All of these factors can result in improved profitability, productivity and efficiency.

"Improving welding stability plays a major role in total welding costs. For example, when drawing a direct comparison between a two part argon/CO_2 mix and Air Products' MagMix3 three part mix with CO_2 in the 5% range, the welding time for a 30 cm weld was reduced from 58 to 48 seconds. This translates into a 20% increase in welding speed, with reduced post-weld grinding, less spatter and a cleaner look as bonuses," Young notes.

Air Products SA manufactures, supplies and distributes a diverse portfolio of atmospheric gases, specialty gases, equipment and services to the Southern African region. The company touches the lives of consumers in positive ways every day, and serves customers across a wide range of industries from food and beverage, mining and petrochemicals, primary metal and steel manufacturers, welding and cutting applications to laboratory applications.

Founded in 1969, Air Products South Africa has built a reputation for its innovative culture, operational excellence and commitment to safety, quality and the environment. In addition the company aims to continue its growth and market position in the Southern African region.

Air Products strives to assist customers in streamlining processes with solutions to increase production and productivity. As the welding specialist, Sean Young is able to do this by providing expert advice on all of the alternative options available to customers when selecting gases for particular welding applications and processes.

Shane Pereira, business development executive for Lesedi.

Lesedi demonstrates confidence in EPC business

At the Africa Energy Indaba in Cape Town earlier this year, Lesedi, a leading South African EPC company and nuclear services specialist, expressed confidence for future business opportunities, while urging South Africa to take note of renewed global interest in small and medium nuclear power reactors.

Lesedi Nuclear Services evolved from Intens Engineering, which was founded in the mid-1980s. The company has been involved with maintenance and services at the Koeberg Nuclear Power Station from the synchronisation of the first unit to the Eskom grid in 1984.

Since 2001, Lesedi has executed over 150 modifications at Koeberg and remains engaged with the plant's life extension (+20 years) programme through the replacement of steam generators, the water storage tanks (PTRs) as well as other modifications.

Lesedi has since diversified into a major engineering, procurement and construction (EPC) company, having successfully completed numerous key projects in nuclear, industrial power, mining and oil and gas environments.

For the 7th consecutive year, Lesedi exhibited at the Africa Energy Indaba during March 2020 at the Cape Town International Convention Centre. This is the largest and most influential energy event in sub-Saharan Africa. The company also sponsored and participated in the CEO Roundtable on Energy Efficiency Measures in the production sector, with CEO Francis Carruthers.

Lesedi also took part in the Africa Gas Forum, where Lesedi's manager of project development, Greg Nichollas is spearheading Lesedi's entry and growth in the oil and gas sector. Nichollas was a lead speaker at the Africa Gas Forum on the topic 'The Gas City of Mozambique and the investment opportunities'. The participation at the Energy Theatre Workshop also included Lesedi with insights on solar tracking technology.

Lesedi's diversified business now includes active engagement in multiple energy generation segments; in the mining industry; and with products and projects in oil and gas industries. Shane Pereira, business development executive for Lesedi comments: "Lesedi is one of South Africa's best kept secrets. We have the expertise and knowledge necessary to provide solutions for South Africa's Energy crisis and we also offer solutions for emissions control in existing coal power plants, as well as solutions for the mining industry.

Most recently, Lesedi has now completed a compressed air plant expansion project in Mozambique for the South32 Mozal Aluminium Smelter plant.

"We are particularly proud of our long history at Koeberg Nuclear Power Station. The future of Koeberg itself is critical for energy stability in the country and particularly for the Western Cape. We believe Nuclear Power is a stable, cost-effective and clean source of power and that it should play a role in the future energy mix for South Africa," he says.

For new Nuclear to come online after 2030, Pereira says that South Africa should start the process as soon as possible, to retain critical nuclear skills and to contribute to energy stability, industrialisation and economic growth in South Africa. We have a strong nuclear industry in the country, as is evidenced by the successful operation of Koeberg for over 30 years and the 20 MW tank-in-pool-type nuclear research reactor Safari 1 at Pelindaba, West of Pretoria, which has been operating for over 50 years," Pereira adds.

In order to retain critical Nuclear Skills, Lesedi continues to pursue international nuclear opportunities. The company highlights the emergence and advancement of new technologies such as Small Modular Reactors (SMRs), which are under development in several countries and are reshaping the future nuclear energy landscape.

He further notes: "The World Nuclear Organization recently reported that 'the interest in small and medium nuclear power reactors is driven by a desire to reduce the impact of capital costs and to isolate power from large grid systems. The technologies involved are numerous and very diverse, but it is worth taking note of these developments in South Africa."

He adds that South Africa could become a regional hub of Nuclear Expertise and Training, as several African countries such as Ghana and Kenya have indicated that they are pursuing nuclear power. Lesedi is already involved with the development of nuclear skills at several South African Universities. In 2017, Lesedi, together with the International Atomic Energy Agency

(IAEA), took part in a peer review at the University of the Witwatersrand and at North-West University's Post-graduate School of Nuclear Science and Engineering.

During the African Energy Indaba, Lesedi showcased its diversified business capabilities and current projects and products. Most notably:

- Lesedi is a well-established engineering, project management and maintenance solutions house that conceptualises, manages and implements complex bespoke engineering projects.
- It covers the full suite of engineering from mechanical, electrical, process, civil, control and instrumentation to structural designs.
- The company has vast experience in collaborating with original equipment manufacturers (OEMs) in a variety of contractual arrangements including consortiums, joint ventures, and sub-contracting.

Highlighting some of Lesedi's recently completed and current project successes, Pereira includes:

- Involvement in the construction of Eskom's open-cycle gas turbines, completed in 2009.
- Ongoing maintenance and project work at Koeberg and the Medupi (balance of plant) and Kusile power stations.
- Emissions' control and plant upgrades and modifications at various Eskom Coal Power Stations.

Lesedi now has a global footprint, having exported skilled maintenance at more than 15 nuclear plants across the world for over 15 years. The company is also looking to expand its focus outside of Africa to Saudi Arabia, which has its own nuclear aspirations, as well as Abu Dhabi, where approximately 150 South Africans with nuclear experience are currently working.

"Most recently, we have now completed an expansion project in Mozambique for the South32 Mozal Aluminium Smelter plant. We were awarded the contract to assist South32 with the expansion of its compressed air plant for the smelter," Pereira tells *African Fusion*.

The Mozal Aluminium Smelter is one of the largest industrial employers in Mozambique and is made up of an aluminium smelter and logistics infrastructure, just west of Maputo. Lesedi was tasked with upgrading the compressed air installation plant through the addition of an additional compressor with its own heat of compression dryer. A new evaporative cooling tower was integrated into the existing compressed air system, while the compressed air system had to be integrated into the overall Mozal ring supplies.

For the Mozal AP3XLE compressed air expansion project, Lesedi was tasked with upgrading the compressed air installation plant through the addition of an additional compressor with its own heat of compression dryer.

Lesedi has also recently completed the design and installation of a 142 kW solar electric installation for its head office in Century City, Cape Town.

"Although projects such as these are prone to challenges, the commissioning went smoothly with no major setbacks. Beneficial use of the system was obtained by the end of January 2020 and hand-over took place in late February.

According to Leon van Wyk, Lesedi's project manager for the Mozal AP3XLE compressed air expansion project, the system is currently functioning as anticipated and "we are proud of the fact that we continue our legacy at the Mozal Plant. Through this project we supported well over a 100 local jobs at the peak of construction."

Lesedi is also looking to expand its footprint in Mozambique, most notably in the gas sector. "We are strategically aligning ourselves with local partners that will enable us to support the local market in Mozambique timeously and professionally," Pereira concludes.

Back in South Africa, Lesedi has also recently completed the design and installation of a 142 kW solar electric installation for its head office in Century City, Cape Town. The completed system is expected to generate approximately 177 507 kWh hours of energy every year.

Operating in the power generation, mining, oil and gas and renewable energy environments, Lesedi is a Level 4, 51% black-owned B-BBEE enterprise with its head office in Cape Town and regional office in Gauteng.

It employs more than 330 people, including qualified engineers and highly experienced project management professionals and technicians, all with extensive nuclear and industrial expertise as well as project support services capabilities in planning, cost control, administration, SHEQ, procurement, contracts, construction management and commissioning of personnel. ***www.lesedins.co.za***

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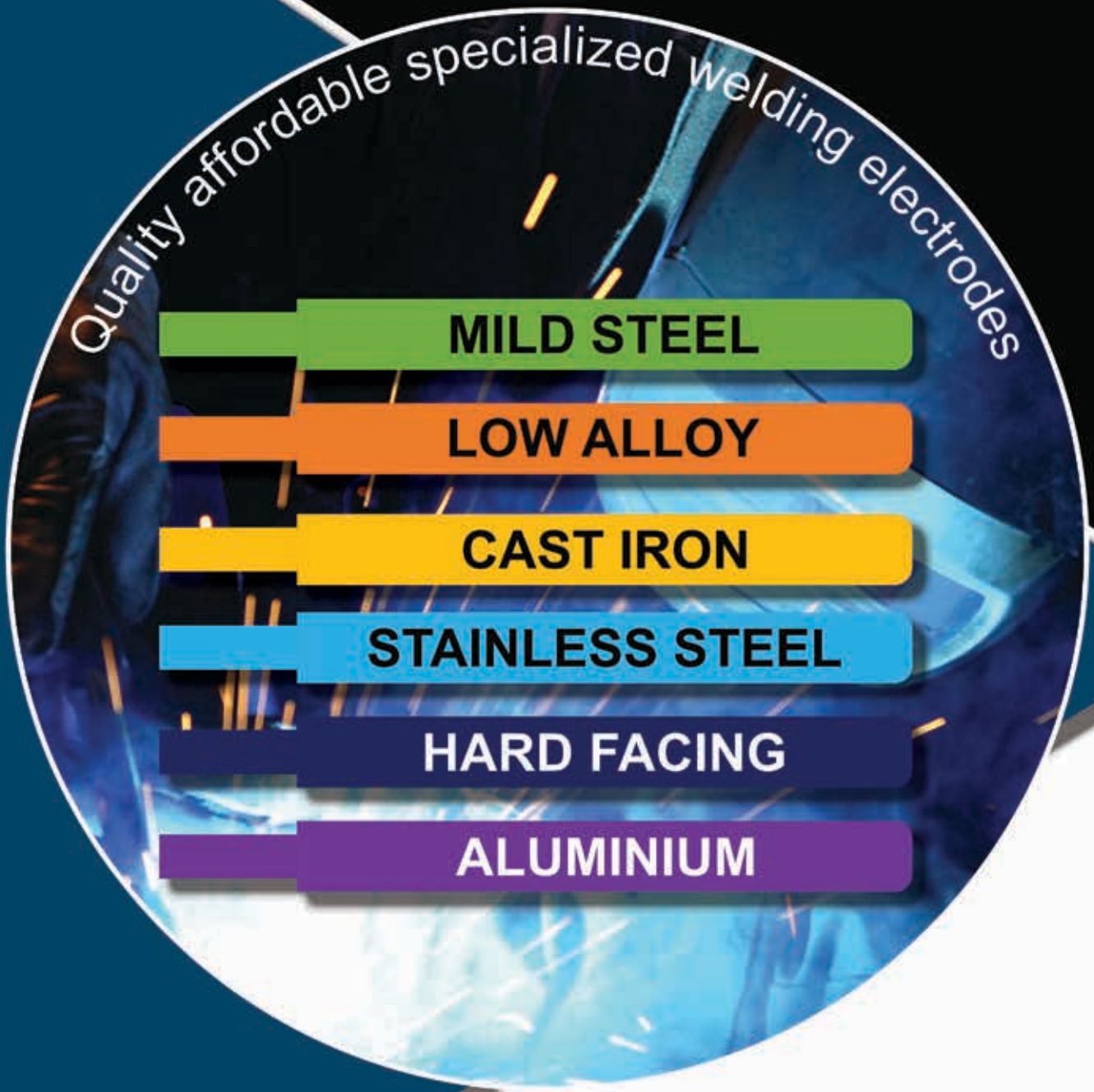

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Björn Kemper, CEO of KEMPER GmbH.

KEMPERbeats takes welding fume extraction to a personal level

During Blechexpo towards the end of 2019, KEMPER unveiled several new solutions, most notably its new extraction hood with integrated Bluetooth speaker sets, KEMPERbeats. This fume extraction system not only sets new standards in terms of fume capture rates, it also enables welders to personalise their workspace to improve motivation while better protecting their health.

KEMPER has developed an extraction hood, KEMPERbeats, that sets new standards in welding fume extraction. It not only makes it possible to listen to music, it also increases the capture rates and the degree of detection of hazardous substances during welding. By enabling welders to personalise their playlists and listen to their own music, their working environment is made more calming and comfortable.

Unsurprisingly, KEMPERbeats met with great visitor interest at Blechexpo 2019 in Stuttgart.

Extraction hoods are the most frequently used technology worldwide for extracting harmful fumes, particles and vapours directly at their point of origin during welding. KEMPER has gone one step further with its new extraction hood: "With our new development, we are thinking beyond pure extraction," explains Björn Kemper, CEO of KEMPER GmbH.

"KEMPERbeats creates a pleasant working atmosphere for welders, increases employee motivation and, ultimately, productivity," says Kemper. At the same time, the solution encourages the use of extraction technology, enabling employers to send positive messages to their employees regarding the friendlier workplace design of the future.

KEMPERbeats is an additional feature of the new KEMPER extraction hood. Behind it lie carefully mounted Bluetooth loudspeakers. These allow employees to network the hood with any mobile device while working, so they can listen to their own music while the extraction system is running. By giving individual welders the tools to choose their own music, welders are able to personalise their working environment according to their preferences. The loudspeakers are also designed so that employees at surrounding workplaces are not disturbed.

Higher capture rate thanks to new dimensioning

KEMPERbeats offers a further safety advantages: To ensure that the music always plays directly above the weld seam, welders need to reposition the extraction hood to align with the point where the welding fume originates. The solution thus ensures optimum hood positioning, which increases the fume capture rate, ensuring that hazardous substances are always extracted and filtered.

The dimensioning of the new extraction hood also results in a higher capture rate and easier handling for welders. By increasing the hose diameter to 180 mm, extraction performance is improved by 30% and the capture rate by a further 20% compared to previous generation KEMPER extraction hoods. And, owing to its flange-shaped design, this hood has already achieved capture rates up to 40% higher than conventional solutions.

KEMPERbeats is an additional feature of the new KEMPER extraction hood that allows employees to network the hood with any mobile device while working, so they can listen to their own music while the extraction system is running.

Welders also need to reposition the new extraction hood less frequently. "Twenty years after developing our extraction hood – which is still unique today – we are setting new standards in welding fume extraction with our developments," notes Kemper.

The new extraction hood can be rotated through 360° and is easy to operate by hand, even with welding gloves on. Integrated above the extraction area rather than in the air flow, an energy-saving LED strip provides welders with an optimum view of the workpiece. The new bayonet lock for connecting the extraction hose ensures an effective seal and quick fitting. A new extraction volume measurement feature is also included in the hood, directly at the point of origin, which can be used to safeguard companies against future legal standards disputes. This new development will be available from the end of the first quarter of 2020.

In conjunction with KEMPERbeats, visitors saw the new KEMPER hood as a pioneering development. At the same time, KEMPER presented other product solutions, especially in the field of spot extraction. In the case of the torch-integrated extraction system of the new VacuFil family, the automatic adjustment of the extraction capacity on the basis of various torch features attracted attention.

With regard to mobile extraction units, the new SmartFil with a 25 m^2 storage filter provides effective occupational safety at favourable conditions, while the new WallMaster offers an easy-to-retrofit, wall-mounted filter solution for existing exhaust air systems. ***www.kemper.eu***

Afrox-sponsored LIV Welding Academy receives QCTO Accreditation

Following a visit from the Quality Council for Trades and Occupations (QCTO) conducted on March 3, 2020, LIV's Culinary school and the LIV Welding Academy – sponsored by Afrox – have been awarded QCTO accreditation as occupational development providers for chefs and welders, respectively. *African Fusion* talks to Afrox's Johann Pieterse and Anne Meyer, campus and training manager for LIV Durban in Verulam, KZN.

Lungisisa Indlela Village (LIV) was founded in 1997 by Tich Smith as a village-styled home with cluster foster care, where orphans and vulnerable children could live, be loved and educated, and come to know God. "From the beginning, Smith dreamed of creating jobs for those from disadvantaged communities and backgrounds so they could earn an income and look after their own families," Meyer tells *African Fusion*.

Along with his wife Joan, Tich Smith has relentlessly pursued this goal and, nearly 25 years later, LIV is today a well-established organisation with three sites in South Africa that look after the physical, spiritual, educational and training needs of vulnerable people, preparing them and their children for a better future.

Initiated in 2016/2017, the LIV Training Academy was a more recent addition to LIV's community services. According to Meyer, it was set up to help unemployed members of the local community with the idea of developing successful graduates that are employable when they leave: providing them with a new hope and future.

"LIV Training initiated the training and skills development phase of LIV – to rescue, restore, raise and upskill community members who are unemployed and unskilled," adds Meyer.

LIV Culinary School was launched in 2016 with a training kitchen that can accommodate up to 10 students, who are given a solid academic background coupled with intensive practical training courses. As from March 27, 2020, the Culinary School has been granted QCTO accreditation for awarding NQF Level 5 Chef Diplomas.

LIV Welding Academy, initially developed in association with Afrox and fully sponsored by Afrox, was launched in 2017 with CHIETA accreditation. Following successfully passing their trade tests, which – lockdown permitting – may yet be able to take place before the end of 2020, the current group of LIV welding apprentices who started at that time may be among the first in the country to graduate from the new QCTO programme.

On a visit to their sponsor, Afrox, are LIV Welding apprentices, from left: Bulelani Quishane; Mfundo Mthembu; Thobani Ngwane; Thulasizwe Mgobozi; Simphiwe Makhanya; Senzo Mthembu; Sakhile Nzuza; Nqobile Blose; Nombuso Vundla; Mdu Buthelezi; and Chris Phewa.

Ashley Beldon, workshop manager for Hi-Tech Pressure Engineering:
"Congratulations on your QCTO accreditation as a skills development provider. Hi-Tech Pressure Engineering is proud to be associated with Lungisisa Indlela Village as a host for your learners carrying out their practical workshop experience in welding. We have been very impressed with your learners' welding skills, their outstanding general behaviour in the workplace and, on a social level, how they stand out as proud individuals."

"The announcement that LIV Training Academy has QCTO accreditation is such an exciting development for us," says Johann Pieterse, Afrox business manager for manufacturing industries. "This is the new welding apprenticeship programme that replaces all the other SETA-based qualifications in the country. It means that the apprentices who have been on the LIV Welding Academy programme since 2017 will be able to take their trade tests and, when they pass, will be among the first artisans in the country to become qualified as red seal welding artisans from the QCTO programme," he notes.

Afrox's involvement with LIV goes back to 2014, when the idea of a welding school was first considered. "We started to build a welding school in 2016 by coupling together a collection of second-hand shipping containers. We then added welding booths, added electricity and gas, and fitted the booths with Afrox-sponsored multi-process welding equipment," Pieterse recalls.

Following interviews conducted by Anne Meyer, 12 disadvantaged youngsters from the local community were chosen for the three-year pilot programme, with the full costs of their training being borne by Afrox. "At the launch of the academy in 2017, I remember a moving and very happy moment when we handed over the first set of weld-

Lorien Chettiar: SAIW ISO 3834 Best responsible welding coordinator award winner, 2018:
While on the SAPREF shutdown, the LIV Welding Academy apprentices were extremely helpful, not only with respect to welding. They always showed an energy and willingness to learn and help, even carrying pipes and taking care of nuts and bolts. They are a great bunch of youngsters and I have no hesitation in recommending them.

ing PPE to each candidate: auto-darkening helmets, gloves and tools. The reaction of every candidate was unbelievable," he tells *African Fusion*, boding very well for the programme's future success.

"Over the three years and under the excellent guidance of Anne, these youngsters have developed into young adults who are going to be able to contribute enormously to society. Some have already bought their own houses for their families and two students have established small side businesses, proving that what they get from LIV is far more than just a qualification," he adds.

As part of the QCTO welder programme, apprentices have to complete a predefined number of hours of theory in a classroom and on practical welding in the workshop. In addition, they have to have regular workplace experience.

"Through Lorien Chettiar, a welding co-ordinator, LIV Welding Academy apprentices gained work experience at Aveng Grinaker LTA during last year's SAPREF refinery shutdown," continues Pieterse. "Grinaker was exceptionally impressed with their energy and their welding. The apprentices were paid at hourly contract welding rates, which put real money into their pockets, possibly for the first time in their lives. This is exactly the measure of training success that LIV was initially looking for," he says, adding that he has received some excellent testimonials, from Grinaker and other placement companies, about the apprentices' energy, attitude in the working environment and their welding skills.

The future of the programme? "We are on a follow-on campaign to recruit and fund ongoing groups of apprentices and to solidify the long-term future of the LIV Training Academy," says Meyer. "As an accredited apprenticeship programme, companies who sponsor apprentice training at the welding academy can reclaim significant percentages of the costs from the Skills Development Levy. They are also entitled to triple points on the B-BBEE scorecard as well as further financial support from SARS' Employment Tax Incentive (ETI) scheme, which was initiated specifically to encourage industry to focus on the young and disadvantaged," she advises.

"Most importantly, though, industry and South Africa need skilled people, to foster growth in our economy and to eradicate the scourge of unemployment and poverty," Pieterse concludes.

The success of LIV Village and its now-accredited QCTO training programmes is already proving that this is not just a dream.

Built by coupling together a collection of second-hand shipping containers, welding booths were added and equipped with Afrox-sponsored multi-process welding equipment.

On completing their Trade Tests later this year, apprentice welders trained at the Academy may be among the first in South Africa to graduate from the new QCTO programme as Red Seal artisan welders.

The Afrox-sponsored LIV Welding Academy has now been awarded QCTO accreditation as an occupational development provider for welders.

Sakhile Nzuza: LIV Welding apprentice and BRICS Welding Competition entrant.

"As part of this amazing journey, I was part of the competition which was held in Johannesburg and I got to be in a plane for the first time. I am really grateful to LIV and Afrox and, especially Mrs Anne Meyer, for this opportunity. I pray that God gives her strength to continue to head this project and that corporates and organisations help LIV to help other people like myself."

Sharpening the SA supply chain with 'proudly local' consumables

As South African industry returns with the precautionary measures and prescribed phased integration of the current COVID-19 national lockdown, companies are having to consider how to safely optimise performance, recover lost revenue and preserve jobs. Gary Willis, director of the First Cut's Consumables Division, talks about his company's approach.

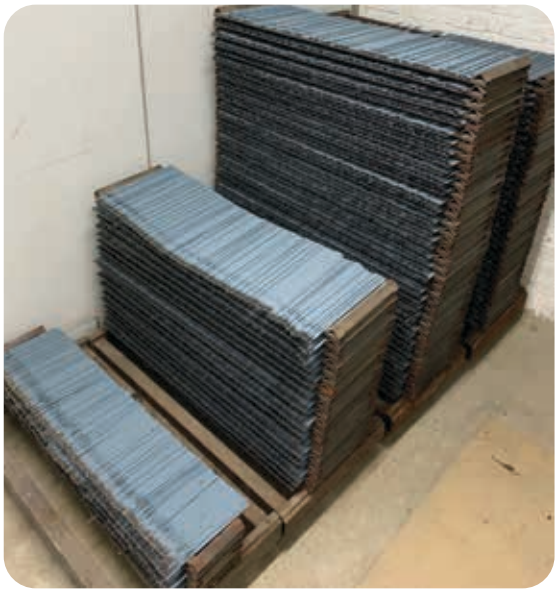
First Cut's new electrode range is manufactured under licence from Messer to comply with DIN, AWS/ASME and BS standards.

"The swift and necessary action taken by our government has helped to mitigate the worst impact of the coronavirus and flatten the infection curve. However, there is still a long road ahead. In light of the sustained and serious impact of this pandemic and our national lockdown, we should all be thinking and acting in a way that protects our local economy," asserts Gary Willis, director of the First Cut's Consumables Division.

First Cut has been at the cutting-edge of South African industry for the past 64 years. As a proudly local manufacturer and supplier of cutting and welding equipment consumables and distributor of steel cutting and processing equipment, the company is well-positioned to assist customers with time- and cost-effective, localised solutions tailored to suit South African businesses.

Willis observes that COVID-19 has brought with it doubts and concerns about the security of the supply chain, availability of stock and lead times: "Throughout our years of operation, First Cut has balanced the sourcing and supply of world-class cutting machines and consumables with a strong local manufacturing presence, and trusted technical support teams.

"As such, our consumables division is the 'beating heart' and lifeblood of this company, and has been for the past 64 years. We have been manufacturing bandsaw blades at our Cape Town factory since the company's inception. By also establishing solid relationships with trusted local and international brands, we have been able to extend our core manufacturing capability, to the benefit of our valued customers," he adds.



First Cut has made a substantial investment in a high-quality electrode press; as well as industry-standard drying and baking ovens.

Most notably, In 2019 First Cut concluded an agreement with leading German company Messer Cutting Systems, to take over the existing South African agency. With the conclusion of the new agreement, First Cut saw the opportunity to take Messer to new heights by locally manufacturing a wide range of Messer welding electrodes at its factory in Benrose, Johannesburg.

"As First Cut has always been a manufacturer and distributor of premium quality products, the opportunity to locally manufacture Messer welding electrodes was one we welcomed, as this range very much fits with our quality ethos and current product portfolio," explains Willis. While there are many cheaper brands of welding electrodes imported into South Africa, he asserts that First Cut is not in that market: "Our electrodes are a cost-effective and quality mid- to upper-range product," he adds.

As a reputable local manufacturer with a solid track record, First Cut is able to satisfy its South African customers' requirements within short lead times. "Prior to the disruption caused by the pandemic, companies ordering cutting and welding consumables from overseas would often have to order large quantities 4 to 6 months

in advance. In a state of global uncertainty, we anticipate increased import delays and hiked prices because of spiking foreign exchange rates. Therefore, supporting South African supply chains and local manufacturing just makes far better business sense," he advises.

A further benefit of First Cut's local manufacturing approach and ethos is the ability to produce world-class private label products for local customers. "Coronavirus has caused companies accustomed to ordering international private label products to re-evaluate their supply risk. First Cut is able to offer these customers a quick and cost-effective, local solution," he points out, adding that the company is also supplying its blades and welding consumables to many critical-supply industries including the fabrication, meat and timber industry sectors.

At present, First Cut manufactures a wide range of Messer electrodes. These include electrodes for welding mild steel, carbon-manganese steels, stainless steels and so-called 'problem' steels, where welding has to take place under difficult circumstances or dissimilar types of metal need to be joined together. "We are also manufacturing and distributing electrodes for gouging and hard-facing applications," Willis continues.

As First Cut's new electrode range is manufactured under licence from Messer, the products have to comply with German, British and American quality standards, respectively, DIN, AWS/ASME and BS standards. Sample product has been sent to Messer for quality certification and there is continuous monitoring of formulae and processes.

As a further commitment to its customers, First Cut has made a substantial investment in a high-quality electrode press; as well as industry-standard drying and baking ovens. Both the metal used for the rods and the flux coating are of superior quality.

"First Cut is mindful that each of our staff members represents a family and a broader community impacted by the drastic and widespread economic disruption of this pandemic. Every South African company and individual can play an active role in our country's economic recovery by supporting local businesses.

"In the case of our Messer welding electrodes, supporting local means that customers will not only be saving on import costs, but can buy top-quality, locally-manufactured electrodes at an affordable price," Willis concludes.

First Cut: a brief profile

With 64 years of industry experience, First Cut is a leading South African distributor of a range of cutting consumables and capital equipment.

Since producing its first band saw blade in 1956, First Cut has grown its offering substantially, and is able to meet the needs of a vast range of industries through the supply of band saw blades, circular saw blades, hacksaw blades, and other cutting consumables.

First Cut's merger with Alexander and Poole in 2002, an exclusive agent for the Starrett range of cutting tools, was a significant milestone in the company's history, as was its acquisition in 2008 of Band Sawing Services, which meant that the company could expand into capital equipment.

Since then, First Cut's capital equipment division has grown exponentially, thanks to its partnerships with some of the best-known global brands.

The company's capital equipment division specialises in metal cutting, sheet metal processing, structural steel equipment such as CNC bending and punching, and tube and pipe processing machines.

First Cut has also invested substantially in its service programme enabling the company to provide repairs and maintenance services for a wide range of machines, from entry level band saws to state-of-the-art CNC controlled drilling and cutting lines.

Employing 240 people, First Cut is based in Benrose, Gauteng, but has a national footprint and distribution facilities across South Africa.

Quality istop of the agenda at First Cut and the company has achieved the ISO 9001:2008 certification and adheres to strict quality and safety regulations.

Kemppi's new Flexlite torches focus on ease and efficiency

Kemppi's new Flexlite family consists of state-of-the-art welding torches for GMAW and GTAW welding professionals.

Finnish welding equipment manufacturer Kemppi Oy has launched a brand new family of welding torches called Flexlite. Jani Leikas, Kemppi's product manager for the aftermarket presents the advantages.

Kemppi's brand new Flexlite family consists of torches for all manual gas metal arc welding (GMAW/MIG/MAG) and gas tungsten arc welding (GTAW/TIG) processes. With this product launch, Kemppi's entire welding torch selection is renewed. Designed with comfort, reliability and efficient use of consumables in mind, the Flexlite torches have a strong positive effect on welding productivity and savings in inventory costs.

Flexlite state-of-the-art welding torch models for professionals include two product series: Flexlite GX for MIG/MAG welding; and Flexlite TX for TIG welding. Both share the same Flexlite key features: excellent ergonomics, great usability and high-quality consumable parts.

Flexlite torches are high-performance torches that use the power source capacity efficiently to help welders create smooth and spatter-free welds. They are available in alternative power classes and lengths, including different neck versions, and on-torch remote controls are available as optional accessories.

It feels like a natural extension to your hand: Excellent ergonomics is one of the key features of all Flexlite torches. Their flexible cable sets and an innovative ball-jointed cable protection system reduce wrist loading and allow the welder to concentrate on the challenging task of achieving the perfect weld.

There is also an ergonomically designed pistol grip handle available for every Flexlite GX delivery package. These are optional accessories to further ease the stress on the hand, so that it makes the gun feel like a natural extension to the welder's arm.

Quality is more than meets the eye: The quality of the consumable inside a welding torch reflects clearly in the quality of the welds. To achieve the best welding results, Kemppi recommends using genuine Kemppi consumables in all Flexlite models.

Shielding gas flow, for example, has a significant effect on weld quality. Normally, shielding gas is invisible, but with Schlieren imaging technology it is possible to observe the gas flow and see how the high-quality Kemppi consumables really give best shielding gas coverage.

The inner structure of a welding torch also plays an important role in weld quality. In Flexlite GX welding guns, the shielding gas channels are separated and the cooling circulation runs to the very end of the gun neck. This keeps the neck cooler and enables cleaner welds, less spatter and reduced shielding gas consumption.

Fewer torch consumables means lower cost: In Flexlite torches, the number of replaceable parts has been reduced by improving cross-matching across corresponding models, and by combining the functions of some of the torch consumables. As a result, the total number of consumables has been reduced per individual gun model. This lowers inventory costs and makes Flexlite a better choice for workshop cost management.

Support for Flexlite torches could not be easier, because all Flexlite welding guns and torches are equipped with a Quick Response (QR) code to help users find the right parts and accessories. Scan the code, and it takes welders directly to relevant ordering codes, consumables, product documents and Kemppi contacts.

Optional pistol grip handle and its ergonomically designed shape reduces the load on welder's hand.

Flexlite TX welding torches for GTAW welding increase user comfort and lower welder fatigue.

PIPEFAB: an ideal welding setup for pipe and vessel fabrication

Cosmo Industrial general manager, Petrus Pretorius, talks about the features and advantages of using Lincoln Electric's new PIPEFABTM welding system.

"Everything about Lincoln's new PIPEFAB system was designed with piping and vessel fabricators in mind, from the initial concept to laying down welds on the shop floor," begins Pretorius. "The result is a welding system that removes set up complexity to enable welders to focus on what matters most, delivering high quality root, fill and capping weld seams for pressure piping and vessels," he says.

Lincoln Electric has a long history of developing total welding solutions for pipeline contractors. "The company is the world leader in providing complete pipeline solutions, comprising the equipment and all of the consumables needed to best match the process and material being used, which must also be easy to use in the environment in which the solution is being applied," notes Pretorius.

"The wide range of available equipment, consumables and solutions positions Lincoln Electric to enable the pipeline industry to expand and make the technological advancements necessary to meet increasing global and African requirements, he adds.

Pretorius suggests that in order to stay profitable in ever more competitive times, the pipeline industry has to increasingly adopt high productivity solutions. "Travel speeds, deposition rates and weld quality all have to increase in order to reduce welding time, rework and total costs," he argues.

At the starting point of achieving these goals for pipeline welding is the company's next generation STT® II (Surface Tension Transfer®) power source, which enables more flexibility for high speed, high quality root passes. "Achieving a sound root in a pipe weld is absolutely vital as any defect will have to be ground out and rewelded. The advancement of Lincoln Electric's STT process makes it possible for a careful and skilled welder to achieve flaw-free welds repeatedly, at increased production rates, which immediately reduces weld costs per metre while significantly lowering repair costs.

Lincoln's patented STT process was the earliest open-root modified short circuit MIG solution on the market. "After decades of leading the industry, STT process performance is better than ever, offering breakthrough travel speeds and industry-leading arc stability. Based on root pass comparisons using 0.9 mm (0.035-inch) welding wire with an argon-based shielding gas mix, deposition rates increased by up to 55% when using the latest STT technology," Pretorius reveals.

For pipe-welding, there often has to be a process change between completing the root run and moving on to fill and cap weld runs. PIPEFAB incorporates its latest Smart Pulse™ technology to achieve this far more simply.

"Also tailored for pipe welding, Smart Pulse delivers simple, high performance pulse welding. It uses Lincoln Electric's Waveform Control Technology® to monitor the machine settings and to automatically tailor each pulse to deliver the ideal arc needed at every point along the pipe joint's path," Pretorius explains.

Available features include:

- Low wire feed settings for out-of-position pipe welding, for which Smart Pulse automatically adjusts to give a narrow and focused arc.
- High wire feed settings for 1G pipe welding, for which Smart Pulse automatically delivers a wider and softer arc.
- Easy adjustment between the two, which enables more welding time welding.

"The PIPEFAB system comes fully programmed with weld modes optimised specifically for pipe and vessel fabrication. All processes – Stick, MIG, TIG and FCAW – can be accommodated and each one has been fine-tuned for maximum performance when using industry-standard filler metals, wire diameters and gas mixtures.

"In addition, stick modes are optimised for cellulosic and low hydrogen electrodes while MIG modes incorporate programmes optimised for 1.0 and 1.2 mm steel, stainless steel and metal-cored wires, with flux-cored modes optimised for 1.2 to 1.6 mm wires.

PIPEFAB also has a low-fume mode (Low Fume Pulse) and the power source is ideally suited for use with engine driven generators.

From a controls perspective, the PIPEFAB system allows operators of all skill levels to focus more on making sound welds by featuring: single button process changes; straightforward, easy-to-understand navigation; memory buttons for preferred settings; ArcFX® Technology for visual arc settings feedback; and single point of use controls that are all on the wire feeder.

Ready to connect to powerful, simple-to-use software, the system offers remote diagnostics and configuration, free and easy software updates; and access to Lincoln Electric's CheckPoint Production Monitoring system.

"High-quality products and customer service are important aspects of the Lincoln Electric story, and these have been 100% adopted by all of us at Cosmo. We also offer welding expertise for workshop and onsite welding. If there's a better, more cost effective or easier way to weld pipes or vessels, we at Cosmo have the expertise and full access to Lincoln Electric's PIPEFAB technology to enable us to help," Pretorius concludes.

Robots critically important for South Africa

In South Africa, manufacturers experience significant challenges. From the stuttering economy to the lack of skills development, there are obstacles that prevent industries from pushing forward into a new era of automation and robotic solutions.

As a result of the effects of COVID-19, many businesses might no choice but to rapidly adopt this technology – especially if they wish to survive in this new contactless society. Automation is no longer a subpoint in a five-year roadmap, but an item of critical importance.

Stringent health and safety measures have always been a massive concern for manufacturers, but many organisations will need to double their efforts to meet the new requirements in the post-COVID-19 world. Yaskawa Southern Africa Chairman Terry Rosenberg says robotics in South Africa is already operating at international standards.

"Since our products come from an international source, they already adhere to the strictest health, safety and quality guidelines," Rosenberg affirms. "As a result, we insist on the same standards in our operations. When clients purchase equipment from us, we recommend they take the mechanical and electrical safety facilities we offer as part of the robotic solution to ensure safe and responsible machine usage. Further to this, we offer prescribed training for the safe, functional use of the equipment once in the production environment."

"We have a special academy designed for end-user training," Rosenberg explains. "This school provides modules on the basics of robotics, as well as the specific training for the application. Not only will the end users learn how to use and program the equipment, but they'll also be taught how to operate it in a safe environment. Furthermore, we provide ongoing training for new employees and other applications that might be introduced at a later stage."

Globally, the automotive industry accounts for a significant portion of every robot produced, but Rosenberg has seen the adoption of robotics in another key industry. "We've seen growth in the food manufacturing industry, particularly in the materials handling aspect of the production line where robots are used to pack and palletise large volumes of products," Rosenberg says. "When there are mass quantities and heavy lifting, robots are capable of performing the functions that might be too dangerous or impossible for humans to execute."

He adds that the food manufacturing industry is also cognisant of the impact of the 2017 listeriosis outbreak and now COVID-19. There's a need to increase the cleanliness of operations and remove the need for human contact. And this can be achieved through the use of robotic solutions.

According to Terry Rosenberg, automation is no longer a subpoint in a five-year roadmap, but an item of critical importance.

One of the most common misconceptions about robotics is that it's strictly aimed at large enterprises; however, Rosenberg stresses this isn't the case. In fact, he's seen a substantial interest and increase in the use of robots in the SMME sector in recent times.

"For some smaller companies, the only way they can produce the required quantity of products is through the use of robotics," he explains. "As an example, we encountered a small company that operates its dispenser business from a farm. Because of the current pandemic, the demand for its automatic dispensers drastically increased, so to meet demand, a robot solution was implemented that is able to work around the clock."

While increasing its production, this business has also had to expand its labour force by 50%; therefore, creating more jobs. "There's a fallacy that robots replace human workers," Rosenberg says. "There will always be a need for people to complete challenging tasks that require human reasoning."

www.yaskawa.za.com

Yaskawa Southern Africa names new MD

The Southern African arm of leading industrial robotics company, Yaskawa, has appointed national sales manager, Andrew Crackett, to head up operations in the role of managing director. He will be taking the reins from previous MD, Kurt Rosenberg, who is starting a new chapter within the Yaskawa family's Swedish division.

Locally manufactured protective equipment

"Safety regulations – which require the use of Personal Protective Equipment (PPE) and other personnel protection during the operation of arc welding equipment – have been introduced to protect workers in or near welding areas," explains Lynette Badenhorst, product manager – Manufacturing, INDUSTRI Tools & Equipment, part of the Engineering Solutions Group (ESG) of Invicta Holdings Limited. "INDUSTRI's locally-manufactured welding safety curtain and screen products are used in conjunction with other protective measures, such as ventilation, cooling fans and respirators, to keep everyone in the environment safe.

"The company's flame-resistant welding curtains and screens form a safe enclosure, that withstands extreme heat exposure and limits the movement of welding chemicals and fumes, protecting welders and others in the facility from the harmful effects of weld flash, radiation and hot debris from welding operations. Exposure to ultraviolet and infra-red radiation can lead to skin burns and severe eye disorders, such as 'arc eye' or 'welders flash' – a painful inflammation of the cornea that may affect vision."

INDUSTRI welding screens are manufactured using a laminate vinyl material with high tensile strength and the seams of the safety curtains are electronically-welded for durability and tear-resistance.

These systems, which have been designed for quick installation, easy access and simple re-arrangement, can also be positioned to create a sound barrier that contains the noise produced on-site during welding operations.

www.industri.co.za

Thuthuka Welding expands ISOARC hardfacing range

"There are a growing number of applications where weld hardfacing can be applied to rebuild high wear areas of expensive equipment: for railway applications; wear surfaces for excavator and dumper truck buckets; screw conveyors and augers; chute systems and a host of mining applications where the tools and equipment used need to be protected against rapid abrasive and/or impact wear," says Thuthuka Welding MD, Matthew Dudley.

"The correct choice of welding electrode is essential for ensuring that rebuilt parts last as long, if not longer, than as-new originals. By rebuilding components, a huge saving can be gained compared to replacing components subject to wear, which is very costly."

A local manufacturer of a wide range of welding electrodes, Thuthuka manufactures very competitively priced ISO ARC 453 chrome-carbide (CrC) electrodes for coating sugar mill rollers, for example, and HF350 and HF450 chrome manganese electrodes for railway work, which are approved by Transnet and Prasa.

The company's ISO 9001 2015-certified Kempton Park facility has a manufacturing output of more than 120 t per month from its two extrusion lines, with its premium quality ISOARC VYTEC E6013 mild steel electrode dominating production.

"We are currently in the process of increasing our range of ISOARC hardfacing electrode formulations to better address the growing need to maximise component and equipment life for mines and industries across Africa. Ultimately, hardfacing is an essential tool in keeping costs low and businesses sustainable," Dudley concludes.

www.thuthukawelding.co.za

Thuthuka Welding's ISO 9001 2015-certified Kempton Park facility has a manufacturing output of more than 120 t per month from its two extrusion lines.

Transforming NDT with artificial intelligence and machine learning

"In an ever-changing inspection environment that demands a specific and efficient reaction to the needs of clients, technologies need to be constantly evolving. This is driving the provision of smarter inspection processes and report delivery," says Grant Meredith of Applus+ in Australia.

"Applus+ has been providing asset integrity services to a variety of clients since the 1940s, and with the major contracts we are currently working on, we have stepped up a gear in developing and accessing advanced technologies, including Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL) capabilities," begins Meredith.

Currently, Applus+ performs tube inspections on a large scale on a range of assets including chillers, heaters, coolers, boilers, air coolers and heat exchangers, to name a few. For the inspection of hundreds of thousands of tubes annually, the company relies on the expertise and experience of analysts who are specialists in signal interpretation. "While we already provide a high-quality, world-class service for the evaluation of tube bundles, we are continually looking at ways of improving the efficiency and effectiveness of our service provision," he continues.

In line with the fourth industrial revolution, equipment manufacturers – including Applus+ for its inspection and testing services – are responding to industry's challenges by developing robotic and automated inspection equipment to meet the needs of physically demanding inspection zones and safety-critical inspection environments. As software improves, the analysis and reporting on thousands of data points are now also being simplified by machine learning and the creation of analysis platforms with Artificial Intelligence.

"Creating algorithms for specific, known information about signal responses from ultrasonic reflectors can provide a platform upon which to work. For example, for the purpose of analysis and evaluation, general wall loss in a tube produces a distinctly different eddy current signal to that caused by localised pitting. By collecting this information and creating the algorithms for signal recognition of the full range of known variables, analysis and evaluation platforms can be created," Meredith explains.

"With the consistent, known variables factored into the algorithm, additional variables such as material types and geometrical considerations (tube supports) are added. With machine learning, the algorithms can update themselves through the consistent and continual addition of data files, and thus reduce the amount of human interaction required. This is where deep learning starts to take effect," he adds.

In current industry practice, where there is inspection data in the tens of thousands of acquisition points for quantities and tube lengths, as is the case with heat exchanger tube inspections using the eddy current inspection method, the onus is on the highly skilled and experienced analyst to trawl through this data in a very short time frame to deliver precise and accurate results for a range of degradation mechanisms. "This human element in both inspection and analysis is bound to cause some issues at some time or another," he notes.

Using digital twin models to integrate inspection results collected and an AI Inspection model, enables equipment to be updated, repaired or exchanged as the sentencing requirement dictates. A model of degradation of tubes can be built up for each inspection type, for a heat exchanger or other company asset, for example, to assist with the assessment of the remaining life and condition of the asset.

Reported data can be stored in virtual space, in the digital twin rather than in bulky and cumbersome pdf or paper reporting formats. Interactive views showing the location of degradation in the tubes can be accessed.

When multiple inspection techniques are used on the same asset, the results can be interwoven into the software models as confirmation or additional data of degradation mechanisms. "This all gives added benefits when accessing areas where one inspection technique is either not able to detect, or is less sensitive to, a particular degradation mechanism (e.g. tube internal degradation or tube external degradation)," Meredith says.

"With our drive to continually perform beyond standards and exceed our clients' expectations, the Applus+ Group strives to improve on every service it currently delivers," he concludes.

Applus+ performs tube inspections on a large scale on a range of assets including chillers, heaters, coolers, boilers, air coolers and heat exchangers.

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