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# YASKAWA

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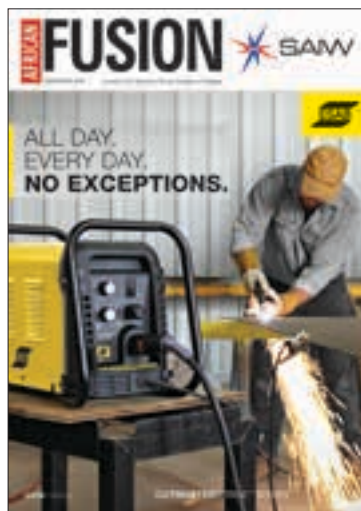
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*African Fusion* talks to ESAB South Africa's country manager, Kim Brightwell about the release of its new hand-held range of plasma cutting equipment, the Cutmaster True series, a simple, robust range of plasma cutters ideally suited to small, medium and micro enterprises (SMMEs).

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In spite of a very difficult year for the welding, fabrication and steel industries, we had an excellent response to our annual dinner this year and were again able to fill Golf Reef City to capacity. I was astounded by the response we received from our sponsors and I am very grateful for their contributions. So a big thank you to all our sponsors, without your support this event would not have been possible.

To all of the award winners, well done. Your achievements represent excellence in welding, which is what SAIW stands for and strives to promote.

Particular congratulation to Jim Guild, our Gold medal award winner, who is, perhaps, due to his exceptional service to the Institute over the years, one of the most deserving winners we have ever had. I would also like to make mention of SAIW's new Honorary Life Members, Jim Guild, John McLeish and Louis Breckenridge. Honorary life membership is awarded to acknowledge extraordinary service to the industry and activities of SAIW.

Jim Guild was part of SAIW long before he joined the Institute as a full time employee and we can honestly say he has given the Institute a significant percentage of his career. John McLeish was also an SAIW employee and he was largely responsible for establishing SAIW Certification as an independent company in the SAIW Group. John, who is working in industry again, still makes a valuable contribution. And Louis Breckenridge is certainly another SAIW stalwart, he has been part of the Institute for as long as I can remember and he continues to be a faithful promoter of SAIW and its activities to the industry at large.

Looking to next year, I am pleased to be able to announce that SAIW will be fully adopting the IIW International Welding Inspection Personnel (IWIP) training programme. As the starting point, we will be converting our SAIW Level 1 Inspectors course over to the new IWIP – Basic curriculum from next year. And as soon as we have a cohort of students qualified to this level, we will be introducing the IWIP-Standard diploma, the International equivalent of the Level 2 Inspectors Certificate.

While the standard is not significantly different to the one currently on offer, the changes are fundamental. These new qualifications are much better aligned to International requirements such as ISO 3834, Quality Requirement for Welding; ISO 14731, Welding Co-ordination Tasks and Responsibilities; and will complement our ISO 9712 compliant NDT programmes – all of which are particularly relevant for export-oriented industries.

We are currently preparing for the arrival of our SAIW Welding Challenge finalists, who will be put through their paces from 21 to 25 November. As well as the Youth Challenge, we have added a Senior Welding Challenge this year, with the winner to compete in the IIW Arc Cup in China later this year. We look forward to seeing how well our welders compete against the world's best.

As we all know, 2016 has been a challenging year, full of uncertainty. I am more optimistic about 2017, however. We are seeing a little more movement with respect to refinery maintenance and upgrades; we expect some news about the replacement of our ageing fleet of power stations; and we hope to get a definite decision about the nuclear build programme.

SAIW wishes all its members and *African Fusion* readers a restful, happy and safe Christmas and New year and we look forward to working with you all again in 2017.

Sean Blake



# SAIW 68<sup>th</sup> Annual Dinner and Awards

The 68<sup>th</sup> SAIW Annual Dinner and Awards Presentation was held on September 23 at the Gold Reef City Casino Convention Centre. Compèred by Bongani Nxumalo with entertainment by Coda Africa, the South Africa welding fraternity attended in numbers to celebrate, following a difficult year.

“It is indeed an honour to be here tonight celebrating our 68<sup>th</sup> Annual Dinner with the welding and fabrication industry,” said Sean Blake, opening his keynote address. “There can be no doubt that we are experiencing challenging times at the moment. The challenges are numerous: we have social and political unrest coupled with low economic activity driven by low oil and commodity prices. Some may call these events a perfect storm,” he says.

Admitting to have consulted his two favourite friends, Google and Wikipedia, he says that he discovered 1984 to have been a stormy year from a meteorological perspective, with two devastating tropical cyclones in quick succession, Domoina and Imboa. “32 years later and 2016 is again proving to be stormy,” he notes.

“But South Africans are known to be a tough bunch, after all we play rugby. We have weathered many storms over the years and I am sure we will rise to the challenge and come out stronger from

our current circumstances. I am hoping that we can soon put the stormy years behind us and look forward to calm weather for smooth sailing in the years ahead,” said Blake.

Despite the difficult economic position that industry finds itself in, he said that it is extremely encouraging to experience the tremendous support which industry has provided to SAIW. “We have had an excellent response to our annual dinner and filled up this hall to capacity once again. I was also astounded at the response we received from our sponsors and I am most grateful for the contributions we have received from our nine event sponsors tonight. From my side, a big thank you, without your support this event would not have been possible,” he added.

Shifting attention to the achievements of SAIW in the past year, he said that the Institute continues to issue internationally recognised qualifications. “Since the beginning of 2015 we have presented 38 International Weld-



Sean Blake, SAIW executive director, presents at the 2016 SAIW Annual Dinner and Awards.

ing Engineer diplomas in collaboration with our academic partners, Wits and University of Pretoria; 39 International Welding Technologist diplomas; 631 SAIW Welding Inspector Level 1 diplomas; 353 SAIW Welding Inspector Level 2 diplomas and 393 International Welder diplomas. As an organisation, that is an achievement that makes us feel proud,” Blake revealed.

In 2013 SAIW formed a Foundation and “I am pleased to inform you that we have provided valuable training opportunities out of the SAIW Foundation. We have recently completed the training of our four SAIW Foundation students on the International Welder programme and they are now working on one of the power stations doing repair work on the

Below left: Winner of the SAIW Presidents Award for NDT, Wessels Vermeulen receives his award from SAIW president Morris Maroga (left) and executive director, Sean Blake. Right: Phil Santilhano Award winner, Berita Blaauw receives her award.





boilers. In addition, we currently have two students undertaking the Welding Technologist course supported from funding provided by the Foundation.

“At the beginning of this year, we began operations at a permanent purpose built facility in Durban,” he continued. “We have two permanent staff manning the facility and can offer a wide array of courses at the facility, including NDT training.

“Our Material Testing Laboratory is going from strength to strength and earlier this year obtained ISO 17025 accreditation from SANAS. The laboratory can offer a full range of tests specifically designed to evaluate welds. The laboratory is equipped with modern state-of-the-art equipment and is run by well-qualified and experienced personnel,” he reported.

Turning attention to SAIW’s ISO 3834 Manufacturer Certification Scheme, Blake said that it continues to go from strength to strength. “SAIW started the scheme late in 2007 with the support of industry. I am pleased to report that we now have 106 certified companies on the register. This is a tremendous achievement and it would not have been possible without the support of our industry partners.

“We have now extended our Manufacturer Certification Scheme into the railway sector.” He continued, “and we are partnering with GSI-SLV, our German colleagues, to offer EN15085 certification for the South African market. To date the Germans have visited South Africa twice to undertake audits

*Continued on page 7*



## Jim Guild – A tribute from SAIW

**J**im Guild, winner of the SAIW Gold Medal Award for 2016, is one of the most deserving Gold Medal winners in the Institute’s history. This highly successful organisation owes its current status and achievements almost entirely to his inimitable, charismatic and professional management.

When he took office in 2000, the SAIW was a small organisation with no international recognition for its courses. It was struggling financially and was fully reliant on sponsorship for its income.

When Jim Guild left in 2015, not only had it become the leading welding training organisation on the African continent with its courses recognised internationally, but it had also become financially self-sufficient, largely through a doubling of its training population.

Guild says that his tenure at the Institute can be described as “steady progress”. The fact, however, is that it is more apt to describe his achievements as massive. These include:

- In 2001, the SAIW becomes a Regional Designated Centre of the African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology.
- In 2003, the SAIW becomes an Authorised National Body of the International Institute of Welding.
- In 2005 the Young Welder of the Year competition is established and soon becomes the premier welding competition in South Africa.
- In 2006, permanent representation of the Institute is established in Cape Town and Durban.
- In 2006 and 2012, the SAIW hosts the IIW Regional Congress with speakers and experts from all over the world in attendance. SAIW also celebrated its 60<sup>th</sup> Anniversary by holding an Anniversary Conference in 2008, which included a number of well known international speakers in the field of welding.
- In 2008 the SAIW is accredited by the IIW as an Authorised National Body for Company Certification enabling it to certify fabricators to the ISO 3834 standard.

The Institute expanded significantly in 2010 when under Jim’s leadership an additional building was built with extra office space and a state of the art multi-purpose auditorium. The inside of the existing building also underwent a major refurbishment, modernising the Institute.

Between 2011 and 2013, SAIW started an ambitious project to begin a material testing laboratory. This initiative expanded the services of the Institute to include testing of



welds and the laboratory was equipped with state of the art metallurgical and mechanical testing equipment.

“Jim has had a long association with the Institute, both as Executive Director and prior to that. His relationship with the SAIW started in the 1980s when he was involved in the establishing of the welding inspector programme as well as with the activities of SAIW Council. During this time Jim established many excellent relationships thanks to his warm and likeable character,” said current Executive Director, Sean Blake.

“Jim’s achievements were based on sheer hard work and his professional work management style. During my association with the Institute, his reputation was well established. He is well known in many circles both locally and internationally. Many of the speakers at SAIW Conferences visited South Africa on Jim’s personal invitation and he went to great lengths to make them feel at home here,” Blake remembers.

He was also well respected at the IIW where he was chair of IAB Group B from 2004 to 2011 and Chairman of IAB from 2015, a position he still holds today. One aspect that characterises Jim Guild’s success in the IIW is his ability to deal with difficult situations. “He listens to both sides of the story and develops solutions that are acceptable to both parties, whilst always upholding the principles of the IIW,” Blake adds.

Jim Guild’s undoubted successes are based on impeccable business acumen and leadership traits. SAIW grew many fold in the 15 years that he was at the helm.

“SAIW, the Welding Industry and IIW have much to thank Jim for, including the hard work that he put in over the years and the numerous SAIW and IIW successes that he delivered. Jim, tonight we honour your achievements and celebrate with you,” Blake concludes. ■



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Continued from page 5

and we now have three companies that have achieved this certification for the design and manufacture of railway equipment.

In addition, SAIW's NDT department continues to achieve: "Earlier this year, the SAQCC NDT Qualification and Certification scheme was registered under Schedule 2 of the ICNDT Mutual Recognition Agreement. This gives our SAQCC NDT scheme international recognition and puts it on a par with other schemes around the world such as the British Institute of Non-Destructive Testing PCN scheme. South African NDT qualifications can now be internationally recognised, which will be of great benefit to the South African NDT industry and its personnel.

"SAIW also sent a delegation to the World Conference on Non-Destructive Testing, which took place in Munich earlier this year. Four technical presentations were delivered by SAIW staff, for which we received positive feedback. Harold Jansen has also been appointed Chairman of the International Certification Executive Council, which further entrenches our position in the international NDT community," reported Blake.

SAIW is also well represented in IIW where we make a significant contribution to this global organisation. "An SAIW delegation recently attended the Annual Assembly which was held in Melbourne this past July. Jim Guild continues to represent SAIW and South Africa in his role as chairman of the International Authorisation Board. We are also working on bringing more IIW qualification and certification programmes to South Africa to further benefit our industry and the people of our rainbow nation," he said.

SAIW has established a Thermal Spray Association and Blake expressed pleasure to have members of TSASA join SAIW at the dinner. "We look forward to this association growing and playing a greater role in future annual dinners as well as making a significant impact on industry," he added.

Finally, he announced that SAIW had completed an office reconfiguration project at its Johannesburg head office. "This has created a customer service centre at the front of our building, which also houses our administration staff. We have built a new library and updated this important service to our members. The canteen and kitchen facility has received a significant upgrade and we have



The award for the best paper presented at a SAIW/IIW event was awarded to Pieter Pistorius (centre right), Charl Orsmond (centre left) and Kris Kruger (not present).



Jim Guild was made an Honorary Life Member and received the SAIW Gold Medal Award, SAIW's highest honour.

been able to bring SAIW Certification into its own facility, which will improve its independence and impartiality. An additional classroom and extra office space has also been added as a result of this project.

"I look forward to report further positive SAIW and industry developments at future annual dinners, but for now, please enjoy this evening with us," Blake concluded.

## 2016 SAIW Awards

**Honorary Life Members:** Three welding industry stalwarts became SAIW Honorary Life Members at the start of the awards ceremony: Louis Breckenridge, John Mcleish and James Christopher (Jim) Guild.

**The Phil Santilhano Award:** Berita Blaauw won the Phil Santilhano Award

for the best student on an SAIW Fabrication, Welding Inspectors or Welding Supervisors course.

**SAIW Presidents Award for NDT:** The 2016 award for the best student on an SAIW NDT course was awarded to Wessels Vermeulen.

**The Harvey Shacklock award:** The award for the best paper presented at a SAIW/IIW event was awarded to Pieter Pistorius, Charl Orsmond and Kris Kruger for their paper: "Repair welding of carbon steel pipe that has experienced partial graphitisation during elevated temperature service".

**SAIW Gold medal award:** The highest SAIW Award, awarded to a member of a company or person who has made an outstanding contribution to the SAIW was awarded to James Christopher (Jim) Guild. ■



# The 2016 SAIW Welding Challenge

The week of November 21 to 25 sees the finals of two new SAIW Welding Challenges, the Youth Welding Challenge and the Senior Welding Challenge, which culminate in an Awards Ceremony on Friday 25 at SAIW's City West headquarters in Johannesburg.

The SAIW Youth Welding Challenge

replaces The Young Welder of the Year competition, the biennial youth welding competition hosted by the SAIW since 2005. The change results from an overhauling by WorldSkills South Africa of its welding competition, the winner of which is sent to the International WorldSkills event.

A countrywide series of regional competitions organised by the Technical Vocational Education and Training Colleges (TVETs) and the Further Education Training Colleges (FETs) began in April this year, with 20 of the best performing young welders participating in the SAIW Youth Welding Challenge. The top three candidates from the SAIW Youth Challenge qualify for WorldSkills SA, the national competition scheduled to take place at the ICC in Durban from 16 to 18 January, 2017. The South African winner will then compete in WorldSkills International in Abu Dhabi from 14 to 19 October, 2017.

SAIW's Etienne Nell will again be South Africa's National Expert. Nell, who has coordinated the competition since its inception, has been given the task of implementing the new process.

"I am pleased with the changes because more young welders will have the opportunity to demonstrate their skills, which is excellent for the welding industry in South Africa," says Nell.

The three categories of the competition remain unchanged and successful competitors are required to successfully complete carbon steel, stainless steel and aluminium welding projects using the SMAW, GTAW, GMAW and FCAW processes.

## SAIW Senior Welding Challenge

Targeting the IAW Arc Cup in Shanghai in 2017, SAIW has added a Senior Welding Challenge to its biennial Youth Challenge. "There is a huge market for welders in the 22-35 age bracket and we need to give them an opportunity to show their skills," says SAIW executive director, Sean Blake. "Welding is truly the 'miracle' career in that jobs are available to anyone with the right training and skills," he adds.

The Senior Welding Challenge seeks to identify a welder who is the most



A collection of past welding projects completed by contestants in SAIW's welding challenges. As well as plate and pipe welds in steel, stainless steel and aluminium, contestants are also required to assemble and weld projects from given blueprints, the most onerous being the carbon steel pressure vessel project (bottom shelf).

## Comments from sponsors

### Johann Pieterse, Afrox business manager for manufacturing industries:

"As a sub-Saharan Africa market leader in the supply of welding and cutting gases and products we believe it is imperative that Afrox also plays a leading role in the development of the welding industry and its people. We are, therefore, actively involved in promoting, equipping and training young students and teachers to enter this lucrative career option at school level. Afrox proactively supports national and regional welding competitions aimed at identifying, developing and testing new talent and have been involved with the SAIW Youth Welding Challenge since its inception as the Young Welder of the Year Competition in 2005. We are also very proud of our Afrox winner, Houston Isaacs, in 2013 and to have employed Thembinkosi Matyeka, the 2005 winner."

### Sean Young, Air Products South Africa:

"South Africa is currently experiencing technical skills shortages, particularly in the welding field. This shortage is not only relevant to qualified artisans, but also dedicated and qualified welding facilitators. For Air Products, the SAIW Welding Challenge is an opportunity to invest in the youth of this country, which is an integral part of our corporate social investment strategy. This sponsorship is not only aligned to our strategic focus, but also contributes to much needed skills development in the manufacturing sector."

### Rajen Moodley: MD of Alexander Binzel S.A:

"As the importers and distributors of the Binzel brand of welding and cutting torches, we are proud to be associated with the South African Welding Institute and thankful for the work that the Institute does: in training local welders in a world class facility; and also for promoting the use of local fabricators through its accreditation schemes. We are, therefore, also proud to be associated with the SAIW Youth Welding Challenge."

### Wiehan Zylstra, technical manager, Welding Alloys South Africa (WASA):

"We at WASA are proud to be part of the SAIW Welding Challenge. WASA believes that training is key, not only to growing SA's economic development but also for the empowerment of our nation. Training of artisans is crucial to sustain and grow manufacturing as an industry. We also believe that talent and performance should be rewarded."

### Dave Smith, Columbus Stainless:

"When selecting a stainless steel for an application, the corrosion resistance and aesthetic appearance are often the only criteria that are considered. Welding of stainless steel is often neglected. Poor welding or ignorance of the effect of welding parameters can destroy an otherwise sound component. It is, therefore, important to us that the welding skills required for stainless steels are promoted, hence Columbus' support for the SAIW Welding Challenge."



## The 2016 SAIW Welding Challenge is sponsored by:



proficient in South Africa in welding three metal categories – carbon steel, stainless steel and aluminium – using four welding processes – SMAW, GTAW,

GMAW and FCAW. Although no projects have to be welded in this challenge, candidates will be tested in all welding positions, including pipe welding.

The first prize is R15 000 and the winner gets to go to Shanghai to represent South Africa at the 2017 IIW Arc Cup in China. ■

## SAIW's new Basic Level IIW Welding Inspection course

The new International Welding Inspection Personnel (IWIP) – Basic Level training programme is set to become an SAIW flagship for welding inspectors, eventually replacing the SAIW Level 1 training course.

“This programme is tailored to meet industry requirements for welding inspectors involved in the fabrication, petrochemical, refinery, process plant, power generation, construction and other industries,” says SAIW training manager, Shelton Zichawo. “Qualification as a welding inspector is an ideal platform to build a career as a third party inspector or to progress further as a technical expert or manager for an inspection service provider,” he adds.

The IWIP – Basic Level course is designed to equip an inspector to conduct basic inspections, to identify welding defects and witness and validate welder qualification tests. “It a useful qualification for those seeking employment in the inspection field,” Zichawo assures.

“It is important to note, however, that the new basic level course is the first of a new three-level programme, which will comprise IWIP – Basic; IWIP – Standard; and IWIP – Comprehensive levels,” he points out.

Upon completion of the basic level, two years work experience is required before moving on to the standard level – and from the standard level to the

comprehensive level, two further years of work experience is required.

“SAIW has decided to fully implement the IIW IWIP Programme because it is an Internationally recognised qualification. Those who pass receive a certificate from the IIW, the leading welding organisation in the world and represented in more than 50 nations across all five continents,” Zichawo tells *African Fusion*.

“The programmes are also better aligned to international requirements such as ISO 3834 for weld quality requirements, ISO 14731 for welding coordination responsibilities and ISO 9712 for NDT personnel, which also makes the qualification more suitable for local fabricators participating in international markets,” Zichawo says.

The first week of the four-week IWIP – Basic Level course will be presented in Johannesburg from 16-20 January 2017.

### The IWS bridging course

An alternative way of achieving IIW qualifications for those people who have already have SAIW Welding Inspection Level 1 and Level 2 qualifications is via the International Welding Specialist (IWS) Bridging course. “This is largely a self-study course that deals with topics in the IWS modules that are not covered in the SAIW Inspection courses – and the self study component has allowed us

to limit the taught contact time to one week,” explains Zichawo.

An ideal route for SAIW Level 2 Welding Inspectors wishing to progress into welding supervision and coordination roles, the first IWS Bridging Course for 2017 takes place at SAIW's City West facility in Johannesburg from January 30 to February 03, 2017.

### Welding Metallurgy by Andy Koursaris

Andy Koursaris' Welding Metallurgy course is one that should not be missed – and there is only a one-week window of opportunity to participate. “This course targets welding personnel who may not have a sound appreciation of the metallurgical principles of welding,” says Zichawo.

“During welding, the heating cycle leads to substantial overheating while the rapid cooling cycles lead to substantial undercooling. This has a significant effect on the microstructure and properties of the metals concerned. This course deals with these effects on the metallurgy of carbon, low alloy and high alloy steels as well as stainless steels,” he explains.

Preheating and post weld heat treatment are also dealt with as well as stress and distortion. The 2017 opportunity to participate in the Welding Metallurgy course is from February 27 to March 3.

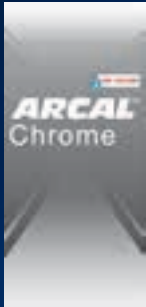
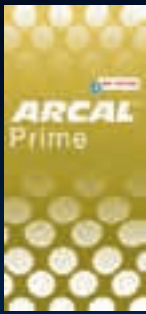
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## Women in NDT: A day of inspiration

On October 14 at the CSIR, the Southern African Institute of NDT (SAINT) organised a day of inspiration for women to both celebrate the success of women in the NDT industry and to encourage more women to take up careers in NDT.

"My history in NDT goes back to when I was three years old and went onsite with my dad with an ultrasonic set that was twice the size I was," said MC for the event, Elaine McDonald from SANDE, while delivering the opening address. "I was born in NDT and, like Amanda, I am now an NDT granny who will retire having been in the profession for my whole career, McDonald said, adding, "and to all you young ladies who are starting your careers, we are proud of you. You are all wonderful women."

SAINT president Keith Cain, while welcoming and thanking guests and sponsors, announced that SAIW has sponsored three bursaries for deserving women: one for ultrasonic testing (UT) Level 1 and Level 2 courses and exams; one for radiographic testing (RT) Level 1 and Level 2 courses and exams; and a third for the Level 1 and Level 2 Welding Inspector qualifications.

Presentations by the NDT Industry's women followed, starting with a keynote address by Emma Snyman from the Radiation Control unit of the Department of Health, who dealt

with RT and pregnancy.

Zanele Mjiba, who has a masters degree in welding and now works for Rotek, presented and inspiring talk about the importance of mentorship. She urged women not to use their gender or motherhood as excuses to avoid becoming a fully integrated NDT practitioner. "You are of capable, organised and strong. There are opportunities in NDT and the future of the next generation of women depends on you taking a stand," she urged.

Sunithi Barends from Murray and Roberts talked about new generation woman; Kathryn Wooldridge of UCT tackled the way in which women in the NDT industry experience gender roles, attitudes and discrimination; and motivational talks by Suzaan Badenhorst of ANDTC, Rochelle Slaffa of Stanley Inspection, GE's Amanda van der Westhuizen and Thea Wagner of Gammatec followed.

"When I was pregnant I was basically kept inside a maze of red lines, because at Gammatec we have trucks of isotopes coming in all the time. But you don't have to stop working. In hospitals and dental surgeries, the dentists, nurses and radiographers often use lead aprons. And on the industrial side, UT and other techniques are perfectly safe for women, even while they are pregnant," Wagner assured. ■



Sunithi Barends from M&R.



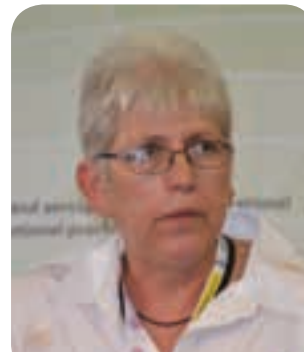
Rotek's Zanele Mjiba.



Thea Wagner from Gammatec.



Elain McDonald from SANDE.



GE's Amanda vd Westhuizen.



Emma Snyman from DOH.



A day of inspiration for women was held at the CSIR to celebrate the success of women in the NDT industry and to motivate more young women to take up careers in the industry.



# Kelvion: SA's heat transfer pioneer

Earlier this year, GEA Aircooled Systems and GEA Nilenca became Kelvion Thermal Solutions and Kelvion Services, respectively. *African Fusion* visits the Roodekop premises of the two adjacent companies and talks to Alex Dreyer of Kelvion Thermal Solutions, Pieter Herbst of Kelvion Services and welding engineer Angel Krustev, who supports both entities.



**K**elvion Thermal Solutions and Kelvion Services both have roots in the GEA group, which was founded by Otto Happel in Germany in the 1920s, as the 'company for dust removal plants', or in German, 'Gesellschaft für Entstaubungs-Anlagen'.

GEA pioneered direct air-cooled steam condensation systems and became the world leader in this field as well as in the design and manufacture of finned tube heat transfer equipment. To supplement and complete this specialised engineering and product range, an evaporative cooling tower division was established.

In South Africa, GEA Aircooled Systems was founded 1975 to design, manufacture and service large contracts awarded by the power and petrochemical industries. Following a total technology transfer from the German parent company, the local GEA subsidiary became largely independent.

In recent times, the heat exchanger companies in the GEA Group were all moved into the GEA Heat Exchangers Group, which was then sold to an investor called Triton.

"Globally, GEA Heat Exchangers' businesses have been split into three: DencoHappel now represents the HVAC and filtration offering – which was never really a big part of our South African business; ENEXIO, now the conduit for the large power station solutions – wet and dry cooling systems, ash handling systems and components for water treatment – and Kelvion," explains Dreyer.

In 2016, GEA Aircooled Systems changed its name to Kelvion Thermal Solutions, retaining substantial thermodynamic and mechanical design expertise as well as engineering, manufacturing and contract management capabilities. GEA Nilenca, formed in 2004 from the Service Division of GEA Aircooled Systems, became Kelvion Services at the same time, operating from its own premises adjacent to those of Kelvion Thermal Solutions.

"Here in South Africa, we continue to offer a full Kelvion suite of heat exchanger products and services, while also taking responsibility, on an agency basis, for ENEXIO-branded power station solutions, most notably, the large air-cooled condensing systems and services," he adds.

"When building pressurised heat exchangers, the bending rolling and cutting of the steel is relatively simple; it is the welding that becomes complex," says Dreyer. "Our in-house thermal engineering, pressure engineering and welding engineering capabilities – the welding of advanced material and material combinations to the exacting quality standards required – sets us apart from other equipment fabricators," he tells *African Fusion*. "We have specialist know-how in welding applications that require high-levels of integrity for rigorous applications," he adds.

He cites the recent construction of an acid scrubber column for the petrochemical industry, a 68 m column for removing acid from a process water stream. "This column is split into two

sections with respect to materials. The base is made in carbon steel, explosively clad with Inconel, while the top sections are made with 316 stainless steel. During construction, therefore, we had to deal with the complexity of joining several dissimilar materials, particularly the seam connecting the clad carbon steel to the stainless steel upper section," he says.

Krustev explains how this was done. "At the bottom of the vessel is a carbon steel dished end, which had to be weld clad with Inconel using submerged-arc welding. The carbon steel section of the column was made from sheet brought in with an explosively clad Inconel layer. Sections of plate were rolled into cans and, before joining the longitudinal seams, the Inconel layer along the seam had to be stripped away.

"The steel seams were then joined to make the cans. This process was repeated for the circumferential seams, and following carbon steel welding, the inside weld seams were re-clad with Inconel," he tells *African Fusion*.

At the join between the carbon and the stainless steel sections, "an Inconel filler metal was used, which is austenitic and so compatible with all three of the materials at the joint," he adds.

The stainless steel top section, according to Krustev, is made of relatively thin plate. "This creates challenges with respect to distortion. Complete penetration for all the welds was required, which had to be 100% verified by radiographic examination. We were able to successfully complete the welding using the submerged-arc process, but a careful weld sequence had to be developed, which almost completely eliminated distortion," he reveals.

In support of its finned tube heat exchangers of various designs, Kelvion has patented a novel tube to tube-nipple welding technique that significantly raises productivity and quality levels. Describing a typical use for the technique, Krustev shows *African Fusion* a weld sample: "This shows a nipple



*Above: For tube-to-tubesheet welding, Kelvion Thermal Solutions has developed a modified orbital welding technique using copper weld retainers that enables single-pass welding without any overlap into the tube bore. Left: Kelvion Thermal Solutions has developed a way of tube-to-tube welding on serpentine heat exchangers. The method uses filler-metal inserts (inset) to enable an orbital system to be used to complete each weld in a single pass without under filling the joint.*

welded onto a pipe header. We have developed and patented a fast and reliable way of butt-welding the ends of our finned tubes onto the header nipples or to the return U-bends," he says.

These are commonly used for serpentine-type heat exchangers, which have the inlet and the outlet header pipe on the same side of the unit. Fluid passes from the inlet pipe, through finned tubes up the heat exchanger, around a bend at the top and then back again, into the return header pipe. "This design can take higher pressures – 186 bar at 700 °C for a recent fabrication – using thinner materials, because all of the interconnecting components are cylindrical," says Dreyer, adding that conventional units with straight sided header boxes at each end have to be made of thicker section to cope with the high pressures.

Also with header boxes, the flow velocity decreases as fluid passes into the box from the tube. For media containing particles this can be a problem because suspended particles can drop out and accumulate in the header boxes. "The serpentine design ensures even flow velocity, which is better for preventing blockages," Dreyer explains.

Turning attention back to the orbital welding technique, Krustev says that each serpentine heat exchanger contains more than 500 nipple-to-tube butt welds, and these used to be done in two passes. "In the past we would weld the first pass using the GTA process without filler material. But if filler is not used, there is always sagging, which compromises the material thickness at the joint. For an acceptable weld, a little reinforcement is required. So we would then do a second pass with filler to give each joint a visible cap.

"Our new orbital welding technique eliminates the need for the second run. We use special filler metal inserts, which are fused into the joint using the orbital welding system, creating a full penetration weld with a little overfill, guaranteeing integrity equivalent to unwelded pipe," he explains

"The process has dramatically improved our production and quality and we have now developed the welding parameters to also suit carbon steel serpentine designs. I can safely say that Kelvion is now a world centre of excellence for serpentine heat exchangers," he adds.

Kelvion Thermal Solutions also makes extensive use of automatic orbital tube-to-tubesheet welding technology. A modified orbital welding technique has recently been developed, based on the use of specially designed copper weld retainers. This innovation allows the weld to be executed in a single pass, without any overlap into the tube bore, thus increasing productivity and weld quality.

The welding expertise from Kelvion Thermal Solutions is also shared with sister company, Kelvion Services, which operates its own service and repair workshop on an adjacent site. "We are frequently contacted by companies in the petrochemical industry to perform weld repairs," says Herbst, citing a current case where the Monel cladding repair on a vessel has failed. "We believe the process and the cladding materials were not correctly specified and we are currently busy solving this problem by seeking a more suitable cladding material and weld repair process – and we have the process, welding and metallurgical skills necessary to evolve a better solution," he assures.

"We also have a strip cladding capability that allows us to deliver solutions such as these more cost-effectively," adds Dreyer.

Herbst cites another success in Qatar for Dolphin Energy. "We were asked to refurbish a sulphur crystalliser condenser during the plant shutdown. These had a knuckle-type tube sheet heat exchanger to take the high pressure. After removing the internal components and baffles, we did our usual integrity test, only to find that the casing was severely eroded and the wall thickness compromised.

"Because of our welding expertise, we were quickly able to develop an onsite weld repair procedure for the Inconel build up required, which we successfully performed before rebuilding the unit – without delaying the shutdown.

"A few years ago, we also participated in the return-to-service project for the Komati power station. We were contracted to do the HP and LP heat exchanger pressure vessel refurbishments, but ESKOM also wanted the same contractor to supply all of the associated high-pressure pipework. So we developed this expertise and can point to the successful completion of this work, nearly a year ahead of schedule, as a reference," he points out.

"We pride ourselves on our ability to find and overcome the complications that are often associated with routine refurbishment work. We have thermal design specialists, pressure vessel engineers, welding engineers and metallurgical expertise, all in-house. We are therefore able to produce successful turnkey solution, on the service and refurbishment side and for new installations," Herbst concludes. ■



# TRUE series plasma

*African Fusion* talks to ESAB South Africa's country manager, Kim Brightwell (left), about the release of its new hand-held range of plasma cutting equipment, the Cutmaster True series, a simple, robust range of plasma cutters ideally suited to small, medium and micro enterprises (SMMEs).

The ESAB Cutmaster TRUE™ series has been designed with the idea that recommended cut capacity should also be the true cut capacity. "This range of hand held plasma cutting machines eliminates the need for customers to 'buy up', that is, buying a machine larger than the one actually needed. With the Cutmaster TRUE series, a machine that is recommended for a 25 mm cut capacity will cut 25 mm material all day long," Brightwell begins.

There are five machines in the range: the 40 A Cutmaster 40 for light industrial use; 60 and 80 A machines for general industry and the 100 and 120 A units for heavy industrial fabrication.

The smallest and most portable of the series, the ESAB Cutmaster 40 is an affordable, high quality 110/230 V plasma cutting system designed for production quality cutting of plate up to 12 mm – and, "while it can also punch through 22 mm plate, it can cut at its 12 mm recommended capacity at a 100% duty cycle," Brightwell says.

The unit comes complete with a carry bag; a power supply with work leads and ground

clamp; a 6.1 m SL60 quick disconnect 1Torch torch for easy maintenance or machine torch conversion; welding gloves; shade five glasses; an operating manual and a training DVD.

Weighing less than 12 kg, this unit is designed to maximise portability. Key features include:

- A True-Cut™ thickness of 12 mm, a maximum cut capacity of 22 mm and production piecing capacity of up to 8.0 mm.
- Automatic input voltage selection between 110 and 230 V.
- TD Surelok technology, a system that locks the electrode into its exact position before every start for better quality cuts and longer consumable life.
- Microprocessor controlled front panel LEDs ensure error-free use from setup to clean up, giving operators confidence to focus on the cutting itself.

"These small units are ideal for auto-body restoration and repair; plumbing

and HVAC system installation; light construction and general maintenance, repair and ornamental work," Brightwell tells *African Fusion*.

At the opposite end of the range is the Cutmaster 120, which weighs 28 kg and can provide 120 A of cutting power for a 40 mm recommended cut, a 55 mm maximum cut and a 25 mm piecing depth. As with all other machines in the range, this compact unit comes standard with the quick disconnect 1Torch®, which is "well-known for its comfort and reliability in the industry". The Cutmaster 120 package includes: the power source; an SL100 1Torch; a spares/consumables kit; an air filter/regulator; the work cable and clamp and a power cable.

In addition to the automatic input voltage selection and TD Surelok technology incorporated into all the machines in the range, the 120 features: auto-restrike for cutting mesh or expanded metal at maximum productivity; and a true-Guard™ roll bar for ultimate protection of the machine and its controls.

Suitable applications include:

**TRUE GUARD™ roll bar**  
Provides easy transportation, protects the front and rear of the power supply for unmatched durability.

**User Controls**  
All user controls are conveniently located on the front panel.

**Color Coded LED's**  
Indicate pressure status and setup errors.

**Mobility**  
Lightweight design improves portability (Reduced nearly 50%).

**Storage**  
Convenient storage compartment for spares and consumable parts.

**60 Amp Tip**  
The industry's only 60 Amp Drag Tip.

**Flexibility**  
Multiple torch capacity (hand, Mechanical and Automater).

**Auto Pilot Restart**  
This feature instantly regenerates the pilot arc while cutting expanded metal.

**Quick Connect**  
ATC™ (Advanced Torch-Connect) quick torch connect/disconnect with no tools required.

A summary of the features of the ESAB Cutmaster True series, the company's new hand-held range of plasma cutting equipment.



# cutting, ideal for SMMEs

heavy fabrication, ship building, construction, manufacturing, structural steel, rental fleets, pipe and pipelines, mining, demolition and scrapping.

Sitting between the 40 and the 120 A Cutmaster machines are 60, 80 and 100 A versions, with 20, 25 and 35 mm recommended cut thicknesses respectively. "All of the machines use the same torch consumables and the only difference between the two 1Torch variations used – the SL60 and the SL100 – is the size of the power lead in the hosepack," Brightwell says.

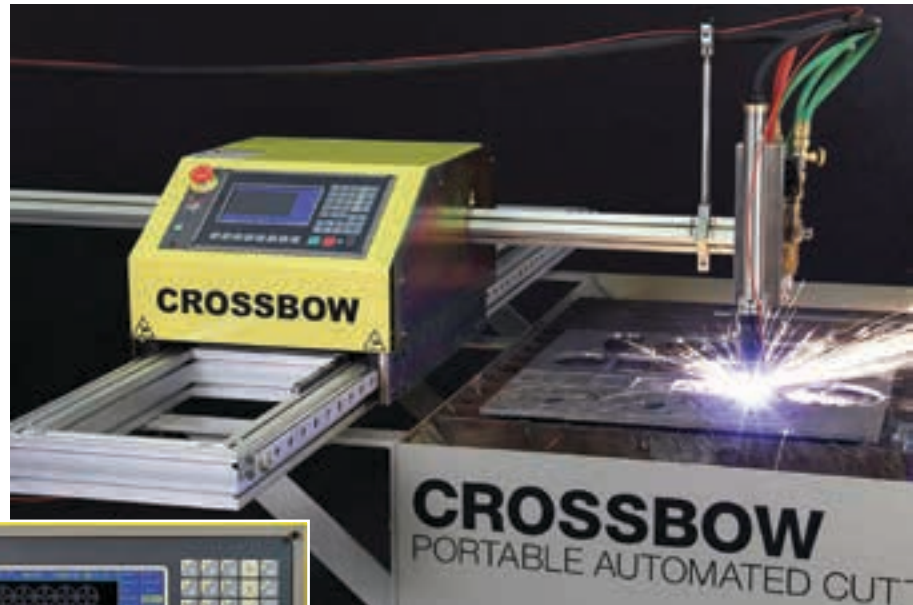
Responding to the question about the advantages of plasma cutting compared to oxyfuel cutting systems, he says that the greatest advantage of plasma is its ability to cut stainless steel and non-ferrous metals such as aluminium and copper. "Oxy-fuel systems are limited to cutting carbon steels and are best suited to thicker sections. Modern plasma cutting systems such as the Cutmaster can produce high precision cuts with minimal slag, often with a narrower kerf than can be produced by an oxy-fuel torch," he responds.

On thinner sections such as those targeted by the Cutmaster range, the plasma cutting speeds are faster and distortion can be almost entirely overcome. "The process is also simpler and safer to use than oxy-fuel systems, because compressed air is used instead of fuel gases, which are explosive and require special handling," he adds.

Compressed air at 5.2 bar is recommended for the Cutmasters, with flow rates varying between 190 and 212 l/m for the 40 A and the 120 A machines, respectively. "Piped compressed air is almost always available on workshop floors and, via compressors, at construction sites," Brightwell suggests.

An additional advantage of plasma systems is their gouging ability. "Plasma gouging can be done with a lot less fume and noise than that offered by carbon arc gouging. The clean nature of the process, which melts metal rather than burning it, also makes it ideal for weld repair use, where a defect might need to be gouged out before inserting a repair weld," he tells *African Fusion*.

Modern plasma cutting systems such as the Cutmaster can produce high precision cuts with minimal slag, often with a narrower kerf than can be produced by an oxy-fuel torch," he responds.



Above: A mechanised plasma torch and a Crossbow CNC cutting system convert a cost-effective Cutmaster plasma cutter into a simple, compact, portable and very economical CNC cutting system. Left: An HMI screen and CNC control panel enable simple profiles to be programmed directly into the system and a library of basic shapes is available to further simplify this process.

In the hands of a good operator, Brightwell says that clean, good quality cuts can be achieved with ease. In addition, however, a number of guides are available, for circle, radius-roller and straight-line cutting. Standoff cutting guides are also available and the "ESAB Cutmaster system offers the only 60 A drag cutting tip on the market today. Drag tips and standoff guides enable the operator to maintain the ideal standoff distance and avoid any possibility of the tip touching the workpiece," he explains.

## Mechanised plasma cutting

Cutmaster machines are also ideal for use with ESAB's low-cost Crossbow XY manipulator.

"By using a Cutmaster plasma machine with an ESAB Crossbow manipulator, these hand-held systems are instantly converted into simple CNC profiling systems. The Crossbow runs on tracks in the x-axis and has a sidetracking bar for y-axis travel. We have installed systems in South Africa with travel lengths of up to 15 m, and the side bar can accommodate 1.5 m widths," he says.

An HMI screen and CNC control panel enable simple profiles to be programmed directly into the system and a library of basic shapes is available to further simplify this process. "A USB

port can be used for loading programs and the system also includes a facility for quickly setting up pattern nesting to minimise waste. It is also able to automatically compensate for cutting the kerf – for plasma and oxy-fuel cutting systems.

"A mechanised plasma torch and a Crossbow CNC cutting system convert a cost-effective Cutmaster plasma cutter into a simple, compact, portable and very economical CNC cutting system. The Crossbow was only launched earlier this year and we have already sold several systems into the automotive sector of South Africa," Brightwell reveals.

"Both these solutions are particularly well suited to the SMME sectors where competition is fierce and margins are tight. The Cutmaster hand-held plasma cutters are highly flexible with respect to the materials that can be cut and their portability for workshop or outdoor work.

"Everyone has to fight to reduce costs and improve their quality and service offering in the current economy. ESAB's Cutmasters come with a three-year unlimited power supply warranty and, with or without a Crossbow, are ideal for the flexible, fast and cost-effective cutting of any metal," Brightwell concludes. ■

# The susceptibility of X70 Linepipe Steel to WMHACC

*CJ Van Niekerk, M du Toit and L Kuzmnikova: University of Wollongong*

This paper from the 69<sup>th</sup> IIW International Conference held in Melbourne this year, describes an investigation into the influence of welding parameters on the susceptibility of X70 Linepipe Steel to weld metal hydrogen-assisted cold cracking (WMHACC) during root pass welding with cellulosic consumables.

Shielded metal arc welding (SMAW) with cellulosic consumables is still widely used in Australia for field girth welding during the construction of small diameter gas transmission pipelines. Decomposition of the cellulosic electrode coating during welding introduces high levels of hydrogen into the arc and the resulting welds are potentially susceptible to weld metal hydrogen-assisted cold cracking (WMHACC), especially in the absence of preheating.

Increases in pipe wall thickness are likely to further reduce the safety margin for preheat-free welding and potentially place the pipeline construction industry at risk with regards to weld metal cracking, should sufficient guidelines on the prevention of weld metal hydrogen-assisted cold cracking (WMHACC) not be available to support the pipeline industry.

This study therefore focuses on the development of a safe operating envelope with regards to welding parameters that will render the heat input and cooling rate such that sufficient time is allowed for hydrogen effusion from the root bead to prevent WMHACC. This will supplement the guidelines on WMHACC prevention as outlined in the Australian Standard for pipeline welding AS2885.2.

## Introduction

Domestic gas markets in Australia tend to be small and located far from natural gas sources. Hence, the norm for gas transmission across Australia is small diameter (less than DN500), thin-walled, high-pressure pipelines. This makes the Australian pipeline industry unique compared to its international counterparts [1-3]. Minimising pipeline construction costs is critical in justifying any gas transmission pipeline project and Australian pipeline construction practices therefore focus on maximising productivity.

Despite advances in mechanised welding technology, the development of high productivity, low-hydrogen self-shielded flux-cored arc welding consumables, and substantial improvement in the performance of basic-coated low-hydrogen vertical-down shielded metal arc welding (SMAW) electrodes, manual welding with cellulosic consumables is still considered one of the most economical joining methods for small diameter pipelines with wall thicknesses up to 10 mm.

Therefore, there is a certain reluctance to adopt more advanced welding processes. The pipeline fabrication in Australia entails the welding of X70 pipe with Exx10 electrodes at high welding speeds and removal of line-up clamps at 50-70% completion of the root bead [1, 2].

The use of cellulosic welding consumables can be attributed to the deep penetration, forceful spray-type arcs and the high welding speeds that can be realised during manual welding with cellulosic electrodes [4]. Decomposition of the cellulosic electrode coating during welding, however, introduces high levels of hydrogen, up to and even exceeding 40 ml H<sub>2</sub> per 100 g of weld metal [5, 6] into the arc and the resulting welds are susceptible to hydrogen-assisted cold cracking (HACC).

This cracking phenomenon occurs due to a loss of ductility at near-ambient temperatures caused by a diffusible solid solution of hydrogen atoms within the crystal structure of the weld metal. The use of preheat can reduce the cooling rate sufficiently after welding to eliminate the risk of cracking by allowing some of the absorbed hydrogen to effuse out to the atmosphere, but this is expensive and lowers production rates considerably [7].

With existing procedures, small diameter X70 gas transmission pipelines

can usually be welded successfully without preheat in wall thicknesses below 10 mm. AS 2885.2 considers the risk of WMHACC as 'remote' when X70 is welded preheat-free in wall thicknesses up to 10 mm, provided lifting practice and delay times between the start of the root pass and the start of hot pass welding are controlled; the heat input does not fall below 0.5 kJ/mm and the carbon equivalent is limited to a maximum of 0.40 [8]. These welding practices have been used in Australia for many years, and thousands of kilometres of pipeline have been constructed successfully with few issues related to hydrogen-assisted cold cracking.

New participants in the Australian pipeline industry are, however, often more familiar with heavier wall thicknesses; slower welding speeds associated with the use of preheat; extended line-up clamp hold times; and welding with low hydrogen consumables [1] – and these may not have confidence in existing Australian pipeline construction practices.

The Australian approach of welding high strength pipelines preheat-free with fully cellulosic procedures and employing high travel speeds is unique. New companies lacking in experience may not follow established procedures, potentially leading to compromised quality. It can also result in dilution of the economic benefits by imposing over-compensating practices such as removing the line-up clamp only after completion of the root pass, reducing welding speeds, or specifying hybrid procedures where the root and hot pass are deposited using cellulosic consumables, while the fill and cap passes are deposited with low hydrogen electrodes.

## Weld metal hydrogen-assisted cold cracking, WMHACC

HACC is a form of hydrogen embrittlement (HE) and is the designation given to the branch of HE that deals with embrittlement during welding. HACC in the heat-affected zone (HAZ) of carbon steel welds has been the focus of numerous investigations, but very little information is available in published literature on the HACC of weld metal. It is widely accepted that the factors responsible for WMHACC in pipeline steel welds are similar to those responsible for HAZ hydrogen-assisted cold cracking in steels.

As shown in Figure 1, four requirements have to be satisfied simultane-

ously for hydrogen-assisted cold cracking to occur in steel during welding: the presence of a critical amount of diffusible hydrogen; a crack susceptible microstructure; a critical tensile stress; and a temperature near to normal ambient [9]. These translate into: the diffusible hydrogen content dissolved in the metal matrix (absorbed from the arc plasma); the fracture toughness of the weld metal (derived from the microstructure); and the combination of stresses to which the joint is exposed. Such stresses include shrinkage stress, residual stress, and external stresses due to lifting, lowering, and any irregular handling during routine pipe placement and critical tie-ins.

Between these, a crack susceptible microstructure is considered the least important factor in determining susceptibility to WMHACC and even weld microstructures that are regarded as having a low susceptibility to HAZ cracking, such as acicular ferrite, can develop cracking when the hydrogen concentration, local stress intensity and temperature favour crack initiation [10]. It is, therefore, recognised that even a weld with low hardenability or an 'ideal' microstructure may be susceptible to WMHACC if the hydrogen concentration is high enough [11].

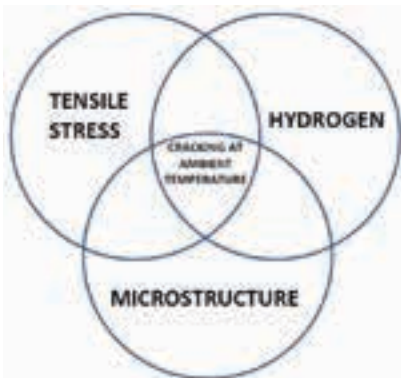


Figure 1: Causal factors of HACC in steels [9].

### Premise

Although extensive or specific weld metal hydrogen-assisted cold cracking has not been reported to date, there has been mention of WMHACC being highly prevalent during welding with Exx10 cellulosic electrodes. While this information is not widely published due to its negative impact on fabricators, it is assumed that it occurs more frequently than has been reported in the literature [1].

The reason for this is that WMHACC is not only possible, but likely, under conditions promoting high weld hydrogen

concentrations and restraint stresses. The mechanism of WMHACC in cellulosic weld deposits is, however, complex and the role of the factors that influence the initiation and propagation of cracks in the weld metal are not well understood at present. It is not clear whether the combination of conditions causing WMHACC during SMAW with cellulosic electrodes overlaps in any way with the conditions found during the field girth welding of pipelines.

AS 2885.2 suggests that in modern high-strength pipelines, WMHACC is more likely than heat-affected zone HACC [8]. The shift from HAZHACC towards WMHACC came about with the development of thermo-mechanically controlled-rolled processing (TMCP) of steel specifically tailored to reduce carbon equivalent values and consequently increasing toughness and weldability of steels [12].

These high strength low alloy (HSLA) steels do not attain their strength primarily from alloying, but from a highly refined grain size resulting from controlled rolling and cooling; transformation strengthening; micro-alloying; precipitation strengthening; transformation strengthening; and tempering after quenching [13, 14]. The use of X70 HSLA steel for gas transmission pipelines was prompted by the need for steel with high strength and toughness and good weldability to withstand the high operating pressures prevailing in small-diameter, thin-walled pipes [12].

The lowering of the carbon equivalent of linepipe steels raises the austenite ( $\gamma$ ) to ferrite ( $\alpha$ ) transformation temperature in the HAZ to such an extent that the ferrite transformation in the HAZ occurs prior to that in the weld metal. The difference between the  $\gamma/\alpha$  transformation temperatures in the weld metal and the HAZ determines the direction of hydrogen diffusion, mainly because hydrogen solubility in ferrite is lower and diffusivity higher than in austenite [15, 16].

The Australian Standard for pipeline welding, AS 2885.2 [8], places more emphasis on the avoidance of hydrogen-assisted cold cracking than comparable international standards. This is because of the occurrence of HACC, precipitated by the occurrence of root pass defects, during construction of the Moomba to Sydney pipeline in the 1970s. The damage was severe and caused extensive delays in commissioning. Despite this,

there is continued use of cellulosic consumables during field girth welding of pipelines in Australia. Sufficient guidance is given in the standard on the avoidance of heat-affected zone (HAZ) hydrogen-assisted cold cracking [17, 18], but although qualification tests provide some assurance that WMHACC will not occur during field welding, clear guidelines on reducing the likelihood of WMHACC are still lacking.

Amongst other objectives, this study, therefore, aims at defining a standard welding parameter window of safe operation where welding can be carried out with a minimum risk of root bead WMHACC on Australian pipeline steel, X70, using E6010 consumables.

Recent years have also seen a number of prominent welding consumable manufacturers introducing changes to the electrode formulations of cellulosic consumables in order to promote the formation of acicular ferrite, improve weld metal strength and increase the overall joint toughness. Modern consumables may contain higher amounts of alloying elements and produce enriched welds with harder microstructures and a higher susceptibility to hydrogen-assisted cold cracking [2].

Due to the wide specification limits for cellulosic consumables in AWS A5.1/A5.1M:2012 [4], E6010 electrodes from different manufacturers, and even different electrode batches from the same manufacturer, may display significant variations in chemistry while still satisfying the classification requirements in AWS A5.1. This concern has been identified and recognised by the local pipeline industry and common practice is to require the consumable manufacturer to provide a certificate with the full chemical analysis of the consumable. More guidance is, however, required on acceptable limits for various alloying additions and impurity elements in E6010 consumables.

Current field welding practice may also be displaying increasing overlap with the conditions known to promote cracking. Qualified welding procedures are currently in use for preheat-free root pass welding of X70 in wall thicknesses up to 15.24 mm – but more commonly for 12.7 mm – at heat inputs ranging between 0.39 and 1.0 kJ/mm and at welding speeds up to 600 mm/min [19].

These procedures fall outside the limits of accepted practices for pre-heat-free welding and may result in

Where there is wear,  
*'wear'*  
the right partner



#### **WA Integra service includes:**

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- Supply of liners prepared to specification and ready for assembly
- Fabrication of components with site assistance for installations
- On site weld repair of worn components
- Research & development of impact plates to customer requirements

#### **WA Welding consumables and services:**

- FCAW Hardfacing & Cladding consumables.
- FCAW Stainless Steel and Duplex Stainless Steel wires
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- Application development.
- Welding procedures.
- Welding process optimisation.



**Welding  
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Group**

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excessive cooling rates in the root pass, effectively preventing hydrogen from escaping through diffusion and increasing restraint stresses on cooling. Recent years have also seen a shift towards larger diameter, thicker wall coal seam pipelines for the export of natural gas. Even though mechanised gas metal arc welding (GMAW) is the preferred process for mainline welding of large diameter pipelines, cellulosic procedures are still widely used for repair and for the welding of tie-ins. Heavier wall thicknesses reduce the safety margin for preheat-free welding and, potentially, place the pipeline construction industry at risk with regards to weld metal cracking [20].

These observations suggest that the phenomenon of weld metal hydrogen-assisted cold cracking in linepipe steel needs to be revisited, and that clear guidelines are needed to assure the industry that the risk of weld metal cracking during pipeline construction can be controlled.

### Welding practice in Australia

Generally, a hydrogen-control approach is taken during the welding of high-strength steels whenever there is a risk of HACC. This approach entails the use of low-hydrogen consumables, preheating the joint to specified temperatures,

maintaining a minimum interpass temperature, and post-weld heating to minimise the amount of hydrogen in the joint and reducing the risk of HACC [21]. The negative aspects to this approach are heavy time consumption and high cost. Time is a major constraint in pipeline welding and, as described above, pipeline-welding practices in Australia have been optimised over many years to yield high production and low repair rates.

During fabrication, welding of the root pass is the rate controlling step, therefore, cellulosic electrodes is preferred above its low-hydrogen counterparts for the root- and hot pass of the operation. The process is also well suited to accommodate poor pipe fit-up [22].

Mainline pipe girth welds are produced by aligning the abutting ends to be welded using an internal clamp while the root pass is deposited. Once 50 to 70% of the root pass is complete, the clamp is released and the pipe is positioned by lifting and lowering off onto a support skid [23]. The time between consecutive lifting and lowering of joined pipe segments determines the productivity of pipeline fabrication, hence the lifting before completion of the root pass. At this stage, the root pass has sufficient hot ductility to accom-

modate the lifting operation without cracking [24, 25].

### Results and conclusions

Welding during the parameter window optimisation (i.e. heat input, welding speed, and tentative preheating to simulate field conditions) was carried out using the modified WIC test, originally developed by the Welding Institute of Canada and shown in Figure 2. The level of restraint resulting from the design of the test pieces imparts a considerable safety factor to the results obtained.

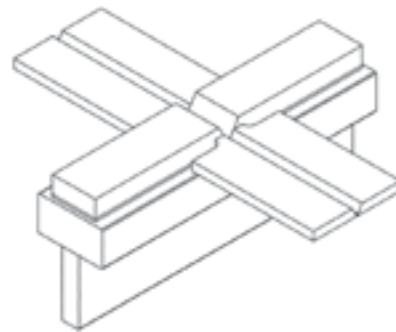


Figure 2: Modified WIC test piece [26].

This information will provide guidance on the welding conditions in the field that should be avoided to prevent WMHACC and supplements the limited guidelines currently available for WMHACC avoidance in the Australian Standard for pipeline welding: AS 2885.2. ■

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# Robotic welding and cutting of mining equipment

In this paper, also presented at the 2016 IIW International Conference in Melbourne, P Kuebler of Linde Group company, BOC and R Lenzi of Robot Technologies Systems Australia, present an innovative Australian robotic welding and cutting system developed for mining equipment and infrastructure.

**A**lthough Australia has not been a leader in the development of robotics, it has produced some innovative applications which are world leading.

In 2015, a unique robot welding system was developed for adaptive maintenance welding of heavy mining buckets and dump truck bodies. The portable robot utilises a laser camera for multi-pass welding and to cope with complex weld joint geometry. Results show that weld completion timesavings of 70% are typical whilst 90% is not unusual. This paper describes the innovations that enabled the rapid deployment of this system with minimal jigging and programming in challenging environments.

## Introduction

In recent years the significant falls in iron ore and coal prices have led to dramatic collapses in the profitability of mining companies. As a result, their suppliers have been under tremendous pressure to reduce the costs of maintaining, repairing and remanufacturing mining and haulage equipment. Repair of buckets and truck trays requires a large proportion of welding time due to the volumes of weld metal required and the preheat temperatures involved. 2 000 man-hours of welding is not uncommon on a single dragline bucket.

With the downward pressure on costs, some mining and haulage equipment repairers investigated the suitability of utilising robotics. In the past, automation of welding this type of equipment was not considered viable or physically possible due to the size and geometry of the equipment as well as the damage, distortion and uneven wear of components. Robotic welding of large components has been hamstrung by the limited reach of standard industrial robots; their need for tight tolerances on part geometry and location; and the tooling required. Extensive programming time has also been a significant factor discouraging the use of robotic welding of large and unique components.

In this study, laser vision has been utilised to successfully robot weld large complex structures that have been tack welded, thereby minimising the need for and access restrictions associated with tooling and jigging. This allows customers to fabricate and assemble their product using conventional methods.

## Laser imaging

Laser imaging for welding and other processes has been commercially available for over 30 years and has evolved into intelligent laser vision and sensing systems. Laser cameras for seam finding and tracking use range detection and triangulation as the basis for measuring the distance and orientation of the component being welded or plasma cut (Figure 1).

Using a line configuration, the camera only requires three measurements to recalculate the welding trajectory in 3D or 6D with accuracies to  $\pm 0.05$  mm. Seam finding only takes a matter of seconds depending on the complexity of joint geometry.

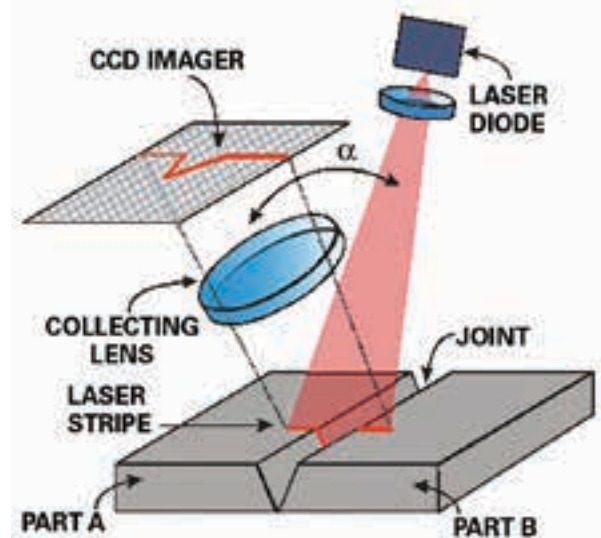


Figure 1: The laser camera principle.

Laser seam tracking normally involves the laser line scanning 90 mm ahead of the torch. Real time tracking enables high-speed adaptation to dimensional variations thereby requiring minimal programming and little or no tooling. Tracking ensures precise weld wire positioning in the joint, which enhances weld quality and appearance.

The laser camera used for this project includes adaptive welding software, which is essential for multi-pass welding. The software enables real time adjustment of weld placement and welding parameters for each pass using a fill control algorithm.

Travel speed and weave amplitude are modified to suit variations of root gap and joint cross sectional area. If the gap exceeds a given dimension, the algorithm will stop the robot and it will move to the next tack or joint. The laser scan enables the controller to calculate the location of subsequent passes in multi-pass welding. This dramatically reduces programming time, thereby maximising productivity.

The laser camera is also used to 'visually inspect' the completed weld. The images can be recorded and therefore provide a permanent record of the weld profile. Acceptance levels can be set for surface breaking weld defects, thereby enabling the software to report the location and dimensions of non-conforming defects, which are downloaded in a report. An integral video camera enables remote monitoring of the weld and captures 2D images that can be recorded.

## Programming

As programming time needs to be minimised for maximum robot productivity, much effort has been devoted to developing offline-programming software. Conventional offline-programming software has had mixed success. It converts a 3D CAD model of the job into robot language, which is then uploaded to the robot controller. Unfortunately the software does not cater for optimising torch angles or arc start and end sequences, nor does it cater for multi-pass welding.

Due to these limitations, generic program libraries were developed for certain types of multi-pass welds. The current state of development has resulted in a range of fillet and butt weld libraries, which are being constantly added to. Each library contains the essential welding program data, which requires little or no intervention by the robot operator who only needs to teach the start and end points of the joint.

In the case of welding insert pieces into bucket walls, an import utility was developed to convert data encoded within a DXF file to data the robot can use to scan and weld the piece. The operator was only required to tell the robot where the piece was in space by teaching a few locations. The robot would then use the laser camera to search the part and build weld paths based on data within the DXF file.

This has enabled mining equipment refurbishment customer SMW to not only minimise programming time, but also to rapidly deploy the robot as new jobs arrive. Furthermore, the robot can be taken on site to minimise downtime of critical components.

## Welding

The robot cell for SMW was manufactured by BOC's integrator partner Robot Technologies Systems Australia. The Kawasaki RA 15X robot is equipped with an EWM Phoenix 552 welding package and a ServoRobot PowerCam laser vision system. A customised bracket on the robot wrist houses the laser camera, preheat temperature sensor and monitoring camera for the operator.

The robot cell can be positioned on, beside or beneath the component being welded. The cell is used to repair large mining dump trucks and buckets by welding on new components or pad welding worn areas. As most of the high strength steel components ranging in thickness from 30 to 300 mm are preheated to 200 °C or more, operator safety, heat stress and fatigue are major considerations affecting productivity. The

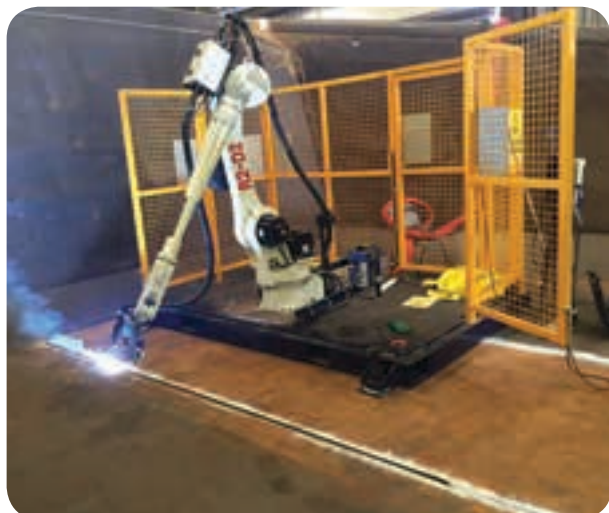


Figure 2. Welding floor plates into a dump truck.

robot is capable of operating at ambient temperatures of up to 45 °C and can weld continuously within its reach envelope, with minimal downtime between passes.

Utilising a liquid cooled torch permits welding of these components at currents of up to 500 A. Deposition rates of up to 6.0 kg/hour are regularly achieved even in the vertical welding position using 1.6 mm gas-shielded flux-cored wire. The resulting savings in welding times are typically 70%. Robot welding of new 25 mm floor plates into a dump truck took less than 10% of the time taken for manual welding.

## Plasma cutting

Another novel use of robotics was for the construction of a coal export jetty and ship loading wharf. The fabrication of the 1.8 km WICET jetty offshore of Gladstone, Australia involved cutting and bevelling slots in the driven steel piles to accept box girder headstocks. This was achieved by mounting a robot in-situ on the pile being cut. The robot used a laser and touch sensor to map the surface of the pile to identify the pile's shape and orientation. This data was used to recalculate the initially programmed robot path using algorithms jointly developed by RTA and Monadelphous. A high definition oxygen plasma cutting system enabled each pile to be cut and bevelled in one operation.

Figure 3 shows a typical robot plasma cutting and bevelling a pile. The alignment accuracy of adjoining piles was  $\pm 2.0$  mm over the 10 m length. One robot achieved in one hour what previously took two men four to six hours. This was primarily due to the accuracy of the robot path coupled with the cutting speed and quality of the high definition plasma cutting system.

## Conclusion

An Australian family-owned business has manufactured portable robot cells capable of plasma cutting and welding structures much larger than the cell itself in challenging environments. By combining new generation robotics, laser camera technology, plasma cutting and welding packages with local innovations, these cells are proving highly effective and extremely competitive. ■



Figure 3: The robot system plasma cutting and bevelling a pile.

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Noel van Onselen talks about the filling facility for medical oxygen.

# Afrox unveils R60-million KwaZulu-Natal investment

On 21 September 2016, Afrox unveiled a new flagship facility in Riverhorse Valley, Durban North, a filling and engineering services hub that represents an investment of more than R60-million. *African Fusion* attends and reports.

“This modern 18 000 m<sup>2</sup> site is designed to international best practice and standards to guarantee our gases and services are of the highest quality,” says Afrox GM for operations, Jan Ntuli, adding that “operations are backed by the technologies and expertise of the global gases, engineering and technology giant, The Linde Group.”

Afrox now has the ability to meet the growing demands of large and small industry across KZN with a filling capacity of 22 000 cylinders a month, an improvement of 15% from the old Maydon Wharf plant. The new facility has a fully stocked warehouse, customer engineering services, a service engineering department and a fleet of 10 distribution vehicles,

all under one roof. “This ensures that we maximise the synergies between various departments to deliver excellent customer service,” Ntuli says.

Afrox Riverhorse Valley offers a convenient one-stop-shop for Argoshield, CO<sub>2</sub>, Nitrogen, Helium, medical and food grade gases as well as portable cryogenic containers.

## A plant tour

A tour of the facility by Afrox’s area production manager Noel van Onselen started in front of the four cryogenic vessels dominating the Riverhorse Valley skyline. The plant takes delivery of liquid CO<sub>2</sub> from NCP in Durban, Nitrogen and Oxygen from the ASU in Pietermaritzburg as well as Argon from Pretoria.

These liquid gases are all transported in road tankers.

Inside, van Onselen’s first stop is the filling facility for medical oxygen. “We operate two separate filling plants here,” he says. “The legal requirement for medical gases requires that the medical and industrial filling facilities are 100% separate,” he explains. “You can see that this filling station has a hospital feel about it, very modern and clean, to ensure that we comply with the stringent medical gas quality requirements.”

Describing the filling process, he says that liquid oxygen from the tank outside is pumped through vaporisers, allowing it to evaporate and expand, which, with the help of a pump, takes it up to a pressure of about 200 bar. It is



Four cryogenic storage tanks dominate the Riverhorse Valley skyline. The plant takes delivery of liquid CO<sub>2</sub>, Nitrogen, Oxygen as well as Argon from Pretoria.



then fed into the filling station where, under PLC control, a manifold of oxygen cylinders is filled.

“We have separate pumps for delivering the medical and industrial oxygen, both of which are at above 99.5% purity. On the medical side, though, we are required to add several additional processes: a pre-purge and vent to make 100% sure that no impurities have entered the empty cylinder and, after filling, a purity analysis is carried out and a batch number is added,” he says.

On the industrial side of the plant, he explains that all the filling stations are supplied with compressed gas. Beverage grade CO<sub>2</sub> is filled in liquid form into the cylinder at approximately 60 bar and settles in the cylinder at 27 bar. When used, gas boils into the void at the top of the cylinder before passing out through the regulator. “We are also waiting for a nitrogen-CO<sub>2</sub> mixing station, a mix now used by many beer brewers. The nitrogen is used to bring the CO<sub>2</sub> out of the beer to give it a good head,” he explains.

Alongside these two stations, a row of mixing stations for industrial gases sits across the width of the facility, for high purity argon and the welding shielding gas mixtures such as Argoshield 5, Argoshield Light and Argoshield Heavy. “The operator attaches a manifold of cylinders to the filling station, selects the recipe required from the SCADA and the PLC will automatically fill the cylinders to the correct composition,” van Onselen explains.

Embedded in each filling system is advanced temperature-pressure compensation. “The temperature rises as the pressure inside the cylinders increases, so a higher partial pressure of each constituent might be required for compositional accuracy. This is automatically controlled so that, at 200 bar and 20 °C, the composition is spot on,” he notes.

“We also control the fill rate using VSD drives on the pumps to prevent the cylinder temperature rising too high. This slows down the fill time but it shortens the waiting time required for the cylinders to cool following filling,” he explains.

The facility also has cylinder filling stations for industrial and certified high-purity Nitrogen, along with Industrial Oxygen – “and to cater for growing nitrogen demand, a second nitrogen rig will be installed before the end of the year,” van Onselen notes.

To the left of the filling stations is



*Behind the filling facility is warehousing: for filled and empty cylinders; Afrox’s hardgoods and welding consumables; and the service engineering department. “We are now an ‘under-one-roof’ distribution outlet for the KZN region,” says Van Onselen.*

an empty cylinder sorting, testing and repair facility. “We have a hydro-test rig, two spray booths, wire brush machines and valving and devalving equipment to enable us to maintain and pressure-test our cylinders to meet legal requirements,” he continues.

In a warehouse behind the filling facility itself, van Onselen points out the storage facility for filled and empty cylinders and the warehouse for Afrox’s hardgoods and welding consumables. “We are now an ‘under-one-roof’ distribution outlet for the KZN region. Through our service engineering department, we offer a repair service for customer’s welding equipment and Afrox CES deals with installations such as bulk gas supply systems; gas mixing panels; LPG; restaurant installations; and much more. This is the first time in many years that all of our offerings have been together,” he says, concluding the tour.

### Schalk Venter’s growth optimism

“We have belief in the African growth story,” says Afrox MD, Schalk Venter. “While we are currently still bound to the commodity cycle, underneath this exposure, Africa is still growing at four and five percent in places such as Kenya and Botswana,” he tells *African Fusion*.

Venter sees a relatively poor middle class in Africa getting richer in the medium term. “By 2030, Africa will have close to 2-billion people and about 40% of them will be 16 and younger. These people will have aspirations and increasing wealth,” he predicts. “We see ongoing investment in facilities such as hospitals. These consume medical oxygen and, for the likes of MRI scanners, need helium for cooling.



*The operator attaches a manifold of cylinders to the filling station, selects the recipe required from the SCADA and the PLC will automatically fill the cylinders to the correct composition.*

“As the income of the middle classes rises, we expect to see growing demand for higher quality foods and beverages, with an associated rise in the need for nitrogen for food preservation and chilling and CO<sub>2</sub> for carbonating beverages.

“LPG use is also exploding,” he adds, citing the government in Ghana, which, to reduce deforestation, “has procured 50 000 nine kg LPG cylinders for the supply of gas to rural communities.

“Across Africa, we now have manufacturing facilities and offices in 13 countries, along with four ASUs outside of South Africa,” he says.

“Our R60-million Riverhorse Valley facility is geared specifically for efficiency and cost-effectiveness, aimed at benefiting customers in the medical, hospitality and industrial sectors, and sets a new standard by which modern industrial gases hubs will be measured.

In support of its new investment, “Afrox supplies of Handigas LPG via our Pinetown operations are guaranteed with added support of imported product into the Bidvest Tank Terminal in Richards Bay, where upgraded road and rail links ensure that we can deliver LPG in bulk,” Venter concludes. ■

# Yaskawa's 'on-the-fly' fibre laser

Having been awarded the seat-manufacturing contract for the next-generation VW Polo, Adient Pasdec is investing in a significant upgrade to its manufacturing facility in Port Elizabeth, the centrepiece being a Yaskawa laser welding cell that enables 'on-the-fly' laser welding of the seat cushions and side frames. *African Fusion* visits the facility and talks to quality assurance manager, Russel Rudman of CRH Africa and Terry Rosenberg of Yaskawa Southern Africa.

**A**dient Pasdec, the seat manufacturing business of CRH Africa Automotive (CRH), was formed following the acquisition earlier this year of Linde and Wiemann's seat assembly business in Port Elizabeth.

This facility currently manufactures and assembles a range of seats for local manufacturers: 280 to 325 rear bench seats per day for the Ford T6 Ranger; 120 Nissan DM22 bench seats per day; and VW Polo Vivo (P240) and Polo (P250) front and 60/40 real split seats, for which it manufactures between 280 to 325 per day.

In addition, at its Wynberg facility in Gauteng, CRH Africa makes the BMW IBK2 seats – "and we are also preparing for the new X3, which is expected during 2018".

The current modernisation of the 20-year old factory in Port Elizabeth is in preparation for the August/September 2017 start of production (SOP) of the new VW Polo P270. "Since being awarded this contract, we have been on a mission to upgrade our produc-



Russel Rudman of CRH Africa photographed in front of a Yaskawa Motoman RM2 manipulator at Adient Pasdec's seat manufacturing facility for the new Polo P270.

tion facilities and to raise quality and productivity levels to international standards, with the latest in Yaskawa Motoman robotic manufacturing cells," Rudman says.

CRH Africa, according to Rudman, operates various centres of excellence for automotive manufacturing. "Out of our pressings factory in Korsten, Port Elizabeth, we produce two million metal pressings per month, which are

used by a host of South African second and third tier automotive component manufacturers. In our Deal Party facility we manufacture mild and stainless steel fine blanks, for catalytic converter flanges, for example; and for seats, we are busy establishing the Adient Pasdec name as a local centre of excellence," he explains.

VW's Uitenhage production facility is currently undergoing a R4.5-billion upgrade in preparation for the start of production of the next-generation VW Polo (P270) supermini, which is due in showrooms during the second half of 2017. South Africa is one of two production facilities in the world that will be making this vehicle, the other being in Spain. Published investments in the VW's Uitenhage plant include: R3-billion for production and quality control equipment; R1.5-billion for the development of local supplier capacity; and R29-million for employee development and training.

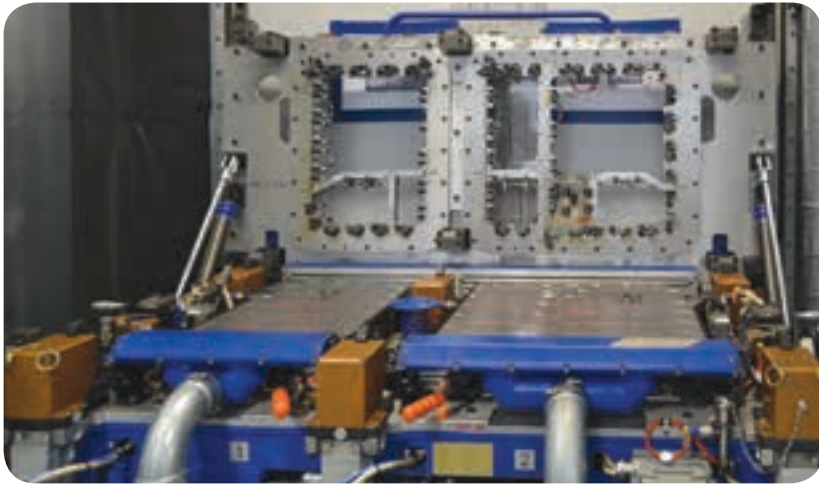
"This is all very good for the Eastern Cape and for South Africa. We are establishing an automotive manufacturing centre of excellence footprint that is sure to attract business. We will deliver the seat frames to JCI, which upholsters them and passes them on to the VW Plant in Uitenhage on a just in time/just in sequence basis.



A 6.0 kW Trumpf TruDisk 6002, diode-pumped, solid-state disk laser is used to generate the laser beam, which is fibre-guided to a laser head (inset) with programmable focusing optics (PFOs) on the end of the Yaskawa robot.



# robotic welding system



*For the cushion, a complex sandwich jig is used, which opens to enable the parts to be loaded.*

“The VW plant is Uitenhage exports 70 to 80% of its production, so global competitiveness is paramount, in terms of quality, price and on-time delivery. So in our seat plant, we are applying this competitive thinking from the get-go so that when these cars start to be produced next year, our manufacturing is seamlessly integrated with theirs,” Rudman explains.

## Yaskawa’s Motoman robot welding cells for the P270

At the time of writing a team of Yaskawa specialists from Slovenia, assisted by Port Elizabeth-based colleagues from Yaskawa Southern Africa, were busy installing and calibrating the tooling for three purpose-built robot cells for the manufacture of the new Polo’s seats.

For manufacturing sub-components, two Motoman MH2010 six-axis GMAW robot-welding cells were being tested. These each have RM2 manipulators to enable jigs to be loaded from the outside while loaded jigs inside the cell are being welded.

“Yaskawa Southern Africa has enormous resources to call upon to develop, install and calibrate these cells,” says Rosenberg. “We have factories in Sweden, Germany, Slovenia, France, Benelux and all over the EMEA region. They all specialise in different areas of expertise and we use the resources that best match the needs of Southern African customers. Yaskawa Slovenia has particular expertise in seats, so it was chosen to implement the solution at Adient Pasdec,” he tells *African Fusion*.

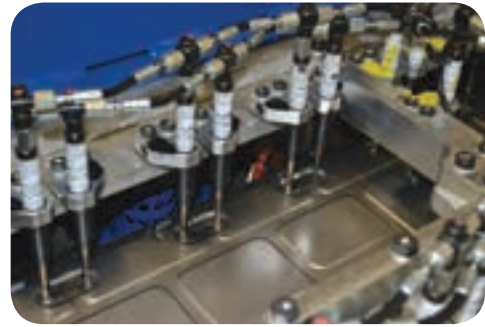
The centrepiece of the new seat production line is an ‘on-the-fly’ fibre

laser welding cell with three sets of tooling serviced by a single Motoman MC2000 high precision robot with a 50 kg payload. The tooling accommodates the final weld assembly of the seat cushions, backrests and the left and right side frames, respectively.

A 6.0 kW Trumpf TruDisk 6002, diode-pumped, solid-state disk laser is used to generate the laser beam, which is fibre-guided to a laser head with programmable focusing optics (PFOs) on the end of the Yaskawa robot. This latest-generation diode-pumped laser has an efficiency of over 30% and the outstanding beam quality and very low divergence angles enables large working distances between the focusing optics and the workpiece.

“A laser can weld to a depth accuracy of within 2.0  $\mu\text{m}$ ,” says Rosenberg, “to give very precise penetration. In the past, the laser head would need to be taken down to within 100-150 mm of the workpiece, with the head being moved by the robot along the weld path. This is relatively slow in comparison to beam manipulation.”

Using the on-the-fly technique, the PFO optics can be used to manipulate the beam along the surface of the weldment from a fixed position above the part – the laser beam being guided along the weld path at much higher speeds. “The robot positions the PFO head 300 to 400 mm above the part. Most of the welding can then be done with minimal movement from the robot. The beam is automatically focused and moved very precisely by programmable mirrors,” Rosenberg explains, adding that the sandwich jigs are made with cut-outs to



*Hundreds of sensors and pneumatic clamps are used to hold the surfaces in close contact while welding.*

give the beam direct access to the weld areas of the part.

“The jigs used are sophisticated and expensive. For the cushion, a complex sandwich jig is used, which opens to enable the parts to be loaded and, when closed, presses the mating surfaces together ready for laser welding. Hundreds of sensors and pneumatic clamps are used to hold the surfaces in close contact while welding. This jig alone cost in the region of R1-million,” he reveals, adding that argon-based gas purging and fume extraction is also built into these jigs, allowing a clean environment/weld zone for the laser.

Determined by the design of the part and jig accessibility, the laser tack welds can be of any shape – straight line, J, C and O shaped laser welds are all used on the P270 seat cushion.

While all robot cells are designed with safety in mind, laser cells have more onerous requirements. Each of the three stations of the laser cell has both outer and inner doors. When welding, two of the three inner doors are closed, giving the robot access to only the part in the cell being welded. The outer door of the live cell must also be closed. “These doors are both light-tight and light-sensitive. Should any laser light beam strike a door, the laser is immediately shut down,” Rosenberg assures.

For unloading and reloading jigs, the outer doors of the non-live cells can be opened for access to the jigs.

“Yaskawa Southern Africa has local expertise and access to international support from our specialist EMEA factories that enable it to offer the most modern and complex robot welding solutions available. And it is only by installing such systems that automotive manufacturing plants can remain globally competitive,” Rosenberg concludes. ■



## Consumable specialist transforms market strategy

*African Fusion* talks to Tim Sivewright (left), general manager for the Welding division at Böhler Uddeholm Africa, voestalpine Böhler Welding Group's South African distribution partner.

The Böhler Welding division of Böhler Uddeholm Africa, the local distribution partner for global welding, maintenance and cladding and brazing filler metals specialist, voestalpine Böhler Welding, "is a different animal today than it was three years ago," Sivewright begins.

Globally, vaBW has long serviced the premium requirements in segments such as Oil and Gas and Power Generation. But these segments have been shrinking in recent years, with associated impacts on the company's global growth. "We have always focused on the development and supply of niche consumables into these important segments: Cr-Mo alloys in Böhler, Thermanit and UTP branding, for example, for both joining and cladding applications," he continues.

"With regards to our flux-cored wire portfolio, besides having long standing manufacturing facilities in Kapfenberg, Austria, for the manufacture of folded and laser seam welded cored wires for joining and, in Seneffe, Belgium, for the manufacture of folded maintenance and repair cored wires, in 2013, vaBW purchased a 90% stake in Fileur, based

in Cittadella, Italy, a specialist in the production of tubular seamless flux-cored wire. These high quality seamless cored wires offer low moisture pickup and hydrogen content, making them especially suitable for welding high strength, low temperature and creep resistant steels.

"When I started here in June 2014, we were experiencing the drop off in demand from the Medupi and Kusile power station construction projects, which had traditionally been our bread and butter. While we had started to bring in some low-hydrogen, 7018-1 LH electrodes and mild steel ER70S-6 GMAW wires, the volumes were very small," he informs *African Fusion*.

"Böhler Uddeholm RSA acts as the official distributor for vaBW in South Africa, with most of its products procured out of Europe. The brands were traditionally all controlled by the vaBW production facilities from a transfer price and source location point of view, so, at that time, we were finding it hard to compete," he recalls.

"In 2014, the senior vice president for global sales at vaBW convinced the managing board of vaBW to invest in the region by creating voestalpine Böhler



*Electro-slag welding (ESW) single layer cladding using UTP Soudotape 825 in combination with Record EST 138 flux. The ESW process enables the required surface chemistry to be achieved in a single layer on certain applications.*

Welding – Sub Sahara Africa, a regional sales team reporting directly to him, this with the intent of driving the growth in sub-Saharan Africa, including RSA. The vaBW regional sales team is headed by regional sales director, Herbert Abbott, who is based in South Africa. Further to this, vaBW introduced a functional pricing model that allowed the regional sales units to manage the responsibility of market driven pricing.

"The regional sales team of vaBW, in cooperation with Böhler Uddeholm Africa, identified the need to tap into volume markets where traditionally we were not regarded as a player and also to expand on the product portfolio in order to make our product more appealing, not only to direct end users, but to distributors too," says Sivewright.

"We analysed our markets and there was a clear need to complete the basket by adding more products to the mix, consumables such as unalloyed MIG & TIG wires, unalloyed and medium alloyed flux-cored wires and premium unalloyed and high-alloy SMAW electrodes. Broadly speaking, we needed to add some faster moving products to



*voestalpine Böhler Welding now offers an extended range organised into three core brands: Böhler Welding, commonly known as Böhler Blue; UTP Maintenance; and Fontargen for brazing alloys.*

the premium products already in the range," he says.

As a result, as from November 2014, Böhler Uddeholm Africa has added and now stocks at least 30 new/additional products, each in a variety of diameters and packaging formats. "These are all products that have never been sold in the South African market before – and they are all vaBW products made in vaBW factories to vaBW quality standards," Sivewright tells *African Fusion*.

The deployment of its new market strategy resulted in quick success. "We are, for example, doing very well with our GMAW stainless steel range and our cost effective GMAW carbon steel wires. We have also brought in an excellent Böhler TIG range, which allows us to compete with anyone in the local market," he says.

The general purpose Böhler Fox range of premium 6013 electrodes, though, is a surprising success. "The general purpose offering in the Southern Africa market is quite divided. There are a number of cheaper brands that sell for around R20/kg, and some premium brands at around R100/kg, but there is very little in between. We can offer our Böhler Fox electrodes at around half the price of current premium 6013 offerings, which, with its excellent welding characteristics, is appealing to both direct users and our distributors who were traditionally obliged to stock both premium and cheaper branded products," Sivewright says.

Focusing on the repair of heavy mining equipment, the company has introduced a range of SMAW electrodes and FCAW wires tailored to application for both joining and repair and maintenance applications. "We are also targeting the sugar industry with our UTP range of dedicated sugar segment SMAW and FCAW products which are manufactured in vaBW production facility in Brazil. These are a market breaker!" he exclaims, explaining that "their use for repairing hammers, knives and mill rolls for cane crushing and shredding is currently outperforming anything else on the market."

Turning attention to the new flux-cored consumables, Sivewright lifts out the Böhler Ti 60T-FD, a tubular seamless flux-cored wire with a fast freezing slag – for customers wanting to "remove any risks of hydrogen cracking" while thick-section repair/manufacture welding of earthmoving equipment.

The E71T-1 Böhler Ti46-FD is another excellent cored wire for manufacturers using mixed gas and wanting minimum hydrogen levels (H5). "In addition, though, for applications where hydrogen levels are a less of a concern, we have an excellent product in our Böhler 71T-1 which is competitive with most suppliers of inexpensive flux-cored wires on the market," he adds.

"Submerged arc consumables are also part of the new offering. We cater for manufacturers of fabricated pipe, structural steel, pressure vessels, wind towers, and any other joining application that could benefit from the high deposition efficiency of this process," he says.

"We can now offer high-end as well as high-quality lower cost alternatives based on a fitness for purpose approach. We are no longer tied to the low-volume high end-only model," Sivewright explains, adding, "while we are sourcing some of our volume products from vaBW factories in China, Indonesia, India and Brazil, we and our fast growing customer and distributor base rest assured that with a vaBW product, there is absolutely no compromise on quality," he adds.

From a testing and qualification point of view, Böhler Uddeholm's Welding division in South Africa has also begun to negotiate directly with key clients, particularly in the petrochemical and oil & gas sectors, about their testing and qualification requirements. "Customers do not always understand the real costs of testing. So to reduce costs, we prepare our consumable qualifications to suit the specific needs of these clients," Sivewright reveals.

We now keep stock selected specially pre-tested consumables in order to remove any doubt about whether the consumables conform to the special client requirements. This does require that we work closely with the technical teams of our clients, so that everyone is satisfied," he suggests.

The net effect of this new market strategy? "We have tripled our sale volume in the 18 months since deploying the new products – this in the prevailing tough economic climate.

"In order to support our growth, we have had to increase inventory levels by 35%. We hold stock in Johannesburg, Port Elizabeth, Cape Town and Durban.



*Böhler Uddeholm has also brought in an excellent Böhler TIG range, "which allows us to compete with anyone in the local market," says Sivewright.*



*Dedicated UTP sugar segment SMAW and FCAW products for repairing hammers, knives and mill rolls for cane crushing and shredding are currently "outperforming anything else on the market".*

We also have an offsite warehousing agreement in Johannesburg with Dachser, the warehousing and logistics specialist. Dachser handles containers for us and also breaks consignments down, which it stores for us. Volume is delivered directly to key accounts and we draw stock from them on a replenishment basis.

"Today's market is very cost-sensitive. Customers used to be prepared to pay 40% premiums for imported quality products. Now the focus appears to be more on price and our new strategy has ensured that we cater for this shift. We now offer a much more comprehensive and competitive range whilst maintaining the market's high regard for the quality of our brand."

"We are breaking down the perception that Böhler is expensive and that we don't keep stock. We are cost competitive compared with our major competitors, our market approach is fresh, we have stock of a comprehensive range of products, we have good welding people, global backing from vaBW and Böhler Uddeholm is a Level 4 B-BBEE company. We are ready to play." Sivewright concludes. ■

# Advanced high deposition rate

On November 3, 2016 at its Midrand premises in South Africa, Lincoln Electric held its Welding Technology Centre open day. *African Fusion* attends and reports on the company's high deposition rate submerged-arc welding process, presented and practically demonstrated by Lincoln's senior technical representative, Josef Henning.

**N**ow available for advanced submerged-arc welding (SAW) in extreme environments, Lincoln's Electric's new Power Wave 1000 SD ac/dc power source uses Waveform Control Technology® to bring software-driven square wave ac, dc-positive or dc-negative current waveforms to this high deposition rate process. By allowing users to control the deposition rate and penetration independently, increased weld speeds, consistently higher quality welds and improved efficiencies in single or multi-arc environments become possible.

"The drive is to weld faster so that production rates increase," says Henning, pointing out the two Lincoln Electric 1000 SDs interconnected on an SAW system at the company's Welding Technology Centre. Along with the 2 000 A of current available from two of these power sources, two MAXsa™ wire feeders with two pedant controllers are mounted on a column and boom system at the centre.

"By interconnecting 1000 SD systems, up to six arcs delivering up to

6 000 A of combined current can be used simultaneously, with huge associated increases in productivity," he says.

"The power sources can also be operated in parallel, though, to give a combined current into a single submerged arc wire, which is typical of how pipe mills are running, with two machines coupled to produce 1 250 A to close an 18 to 20 mm pipe seam," Henning says.

"Two arcs can sometimes also be used separately, one inside and another on the outside – and with a technique called punch through welding, back gouging of the root can often be avoided," he says, adding that typical weld preparations include a V-prep of between 55 and 60° with a 2.0 mm nose – and if the seam is going to be closed from the inside following punch through welding, an X-preparation with a smaller V on the inside can be used.

Presenting a bar graph showing the productivity increases on offer by using two and three arcs, respectively, Henning reveals that, with a dc-positive lead arc and a balanced ac trailing arc, 100% productivity increases are immediately

available over single arc SAW. This can be further increased by using two balanced ac arcs and, by carefully synchronising the fast-switching square wave current outputs, up to 125% increases can be achieved.

The Power Wave machines offer a number of special waveform options: CV, CC, ac and dc, but the ac waveform is not the traditional sine wave. The power source is an inverter type power source that operates at 40 kHz, allowing it to produce fast-switching square wave ac power. "You can also tell the machine exactly how long you want the positive and negative half cycles to be," he explains.

This is called variable balance. By extending the dc+ percentage, penetration increases, while increasing the dc- balance increases deposition and decreases penetration – "and this can be done on multiple wires without causing arc blow," Henning assures.

As well as variable balance, the entire wave pattern can be offset to be more electrode positive or electrode negative. This again shifts the penetration and deposition values to give further options to optimise weld quality while maintaining highest possible production levels.

"And the waveform parameters can be adjusted on the fly!" says Henning. "Should you need to start a job with higher penetration for the first 300 mm, then switch to higher deposition as the heat builds up, all you need to do is switch in a higher deposition setting on the MAXsa pendant box, which has eight pre-programmed settings available. While welding proceeds, the welder simply pushes the switch to access the next programme required," he explains.

Henning goes on to show us how to set up a single wire system for welding. The menu-driven process starts with the selection of the material, wire diameter and mode. He chooses CC, DC+, "which is closest to normal sub-arc welding, but because of the machine response speed, the control is much better".

He then selects 600 A of current at



Josef Henning demonstrates submerged-arc welding using a Power Wave 1000 SD in dc constant current mode.



# submerged-arc welding

36 V and says that in CC mode, the wire feed rate will self adjust to maintain the selected voltage. After feeding a little flux over the start point, he sets the machine welding. A gentle hiss comes from the covered weld seam. After stopping and vacuuming up the excess flux, we see the flux lifting itself off a perfectly even weld seam.

“Now I am going to show you the combined effect of using the ac square wave mode, along with a stick out extender,” he says before selecting a second programme on the pendant, “I am using 60 Hz for this programme, but it can be up to 100 Hz. The balance percentage is adjustable from the 50/50 dc+/dc- point and the offset can be varied between -25 and +25 percent of the zero offset position,” he says.

Expanding on the difference between CV and CC control modes, Henning explains that in CV mode, the current will change with stick-out to keep a constant arc gap. “In CC mode, if the stick out increases, the current does not change. Instead, the wire feed speed automatically increases to maintain the voltage. So the deposition rate increases at the same amps,” he explains, adding that CC mode, is best for thicker wires – 3.2 mm and up – while for thinner material and wires, he prefers CV mode.

Henning then adds the stick-out extender, which is fitted onto the end of the torch instead of the normal contact tip. “This is a 125 mm extender and we will maintain the gap to the plate at the 30 mm we used previously. The electrical contact tip is now higher, so the wire will experience more resistive heating before reaching the arc. The extender supports and directs the wire, because



Two Power Wave 1000 SDs are interconnected at the Lincoln Welding Technology Centre allowing twin-wire welding with up to 1 000 A per arc. The units can also be operated in parallel to give a combined current of up to 2 000 A into a single submerged-arc wire.

it will soften due to the additional heating,” he explains.

“I am also going to increase the voltage, which increases the actual arc length. This is to flatten the weld bead, which would otherwise become peaky due to the additional deposition, which we expect to be up to 75% higher,” he notes.

When the second weld is started, the 60 Hz hum confirms ac-pulsing and the wire feed rate has jumped to 2.0 m/min, compared to 1.2 m/min previously. After welding, the flux falls away and a slightly higher and significantly wider weld bead is evident.

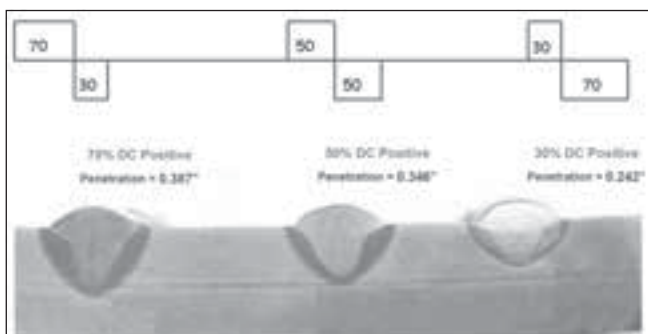
“All Lincoln Electric Power Wave products come with Production Monitoring built in,” continues Henning, directing attention to a side screen. While welding, monitored data for every registered and connected Power Wave power source is stored on the cloud. After welding, it is possible to browse to see the exact welding parameters used from a time-stamped record of every weld – and because the data



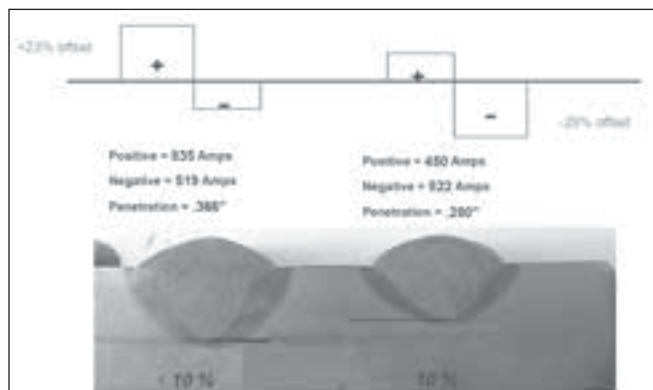
The stick-out extender, which is fitted onto the end of the torch instead of the normal contact tip, raises the electrical contact tip for more resistive heating. Along with the deposition advantages of ac pulsing, stick-out extenders increase deposition rates significantly.

is stored in the cloud, this can be done from any web-connected device. Data analytics also enable deposition rates and True Energy – an accumulation of instantaneous VA values that better reflects the actual heat input effect of fast switching and pulsing data – to be recorded for analysis.

“Power Wave process control for SAW offers complete configuration flexibility; outstanding efficiency and power factor correction; and bigger welds produced faster under optimum fusion and process control. If thinking about expanding in the future, then this is the choice to make now,” Henning concludes. ■



The effect of variable balance on the ac waveform: by extending the dc+ pulse width percentage, penetration increases, while increasing the dc- pulse width increases deposition.



The effect of dc offset: Increasing dc+ offset has a marked effect on penetration, while dc- offset can be used to minimise penetration.

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# Sigma<sup>2</sup>, Sigma Galaxy and Pi – the new generation

*African Fusion visits Air Liquide's stand at Electra Mining and highlights the novel Migatronic range of welding equipment now available through the company's subsidiary, Weld-Cut, Southern Africa.*

**S**igma<sup>2</sup> is one of the new-generation Migatronic welding power sources. With 300, 400 and 500 A power sources in the range, these advanced MIG/MAG welding machines come in compact versions or with separate wire-feed units and welding systems that can be combined using up to four optional control panels. Suitable for welding all types of materials – with or without pulsed current – the units are suitable for light, medium and heavy industrial use. They can also be used offshore or coupled with robots in automation systems.

Sigma Galaxy is the result of even further progress in welding technology. Developed in co-operation with universities and users throughout the world, this high-tech welding machine, bundled in self-explanatory industrial design, optimises welding parameters automatically allowing the welder to focus on good workmanship.

The Sigma Galaxy range contains all the best features from Sigma<sup>2</sup>, with added intelligence via the digital soft-key control panel, which enables: MIG/MAG welding based on the latest research in arc physics along with three program packages: Standard, Standard Plus and the newly developed IAC™, which includes smart mild steel and stainless steel arc control.

The IAC package is a new process control strategy for sheet metal and root pass welding in mild and stainless steels. It results in significantly lower heat input and less distortion to better retain the mechanical properties of the materials being joined. It also offers less weld spatter and less associated post-weld cleaning. The Sigma Galaxy with IAC is also ideal for robot welding.

The newly developed MJCTM (Miga Job Control) feature allows welders to save up to 200 individual welding jobs and, for every job name saved, an additional nine sequences can be saved,

which means that the Galaxy can hold 1 800 records.

Sigma<sup>2</sup> and Sigma Galaxy are both green throughout, with power consumption much lower than machines relying on traditional technologies. In addition, the Intelligent Gas Control IGC function enables significant savings to be made with respect to gas consumption and associated costs.

## Intelligent Gas Control

IGC® is a unique feature for MIG and TIG welding embedded in Migatronic's user-friendly Sigma<sup>2</sup>, Galaxy and Pi welding machines. Traditional gas regulators create excessive consumption of gas, particularly on striking the welding arc, whereas IGC automatically calibrates the gas flow. The result is 100% optimised gas protection from the start to the end of the welding process. IGC is the easy way to achieve more uniform welds and lower failure rates, as well as notably lower gas consumption and improved bottom line profitability.

## The Migatronic Pi TIG welder

Migatronic's Pi power sources are high performance welding inverters covering every TIG welding need, for stainless steel, aluminium and other high-alloy metals. Pi is innovation in every detail – user-friendly with state-of-the-art welding technology and an innovative design.

There is a Migatronic Pi machine for any welding need: repair, assembly, construction and industrial and/or robot applications. Processes include TIG HP (high-frequency with pulse), TIG H (without pulse), TIG AC/DC, and MMA welding with coated electrodes.

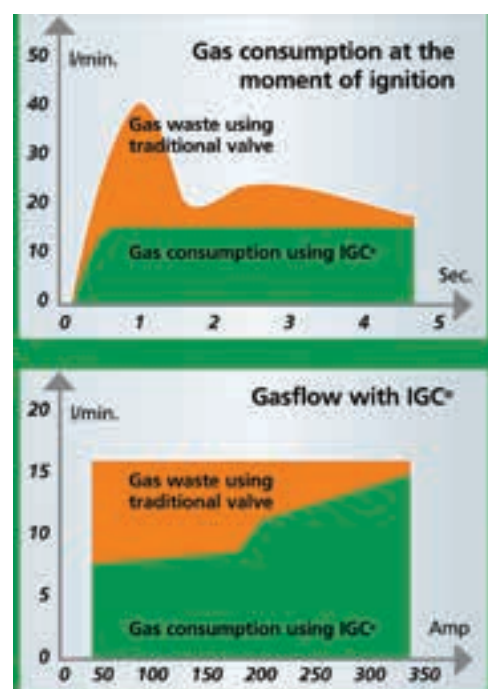
Migatronic's Pi 320, 400 and 500 for TIG welding with the TIG HP and TIG AC/DC control panels both feature Migatronic's IGC gas saving feature, which is



*Migatronic's Pi 320, 400 and 500 for TIG welding are available with two different control panels, TIG HP and TIG AC/DC, both of which feature IGC. Inset: A cold wire feed system for TIG welding using the Migatronic Pi.*

factory-fitted or available as an upgrade into existing machines.

Sigma<sup>2</sup>, Sigma Galaxy and Migatronic Pi systems, along with IGC, reduce energy and gas consumption, which benefits the environment and the profitability of the operators; eliminate rework through better welding process and gas control; and are investment that pay for themselves in very short times. ■



*Intelligent Gas Control, IGC® is a unique feature for MIG and TIG welding embedded in Migatronic's user-friendly Sigma<sup>2</sup> and Pi welding machines.*

# Twin-pack welder/generators for

At Electra Mining Africa 2016, Renttech SA debuted its new Uniarc Twinpro twin pack welder/generator with two 300/400 A welding units, 30 kVA three-phase power and two 6.0 kVA, 230 V power outlets. *African Fusion* visits the stand and talks to MD, Gerrit van Zyl.

In keeping with the company's core focus of offering on-site welded construction solutions for plant and industries across the sub-continent, Renttech's new Uniarc Twinpro twin pack is a compact and robust welder/generator system that includes two independent any-process welding machines along with three-phase and single-phase utility power to fully support remote construction requirements. Adding to its mobility and versatility is a trailer-mounted option that enables the unit to be conveniently parked and ready for use within minutes of arriving.

Primary power comes from a built-in Kubota V3300 diesel engine. This Japan-based tractor company began making compact diesel engines in Illinois, USA in 1999. The advanced V3300 has a new 3-valve per cylinder construction that boasts high output and torque while keeping both vibration and exhaust emissions down to a minimum. The combustion system is made up of two air intake and one exhaust valve per

cylinder, which improves the air intake rate over that of conventional engines, enabling higher power densities from a more compact package.

The engine is directly coupled to a Stamford Newage Alternator, a Cummins brand, with a continuous output rating of 30 kVA. "This engine/alternator offers unrivalled performance and reliability, making it the ideal choice for the harsh environments in which many of our clients operate," says Van Zyl.

The inclusion of two independent welding power sources that can accommodate shielded metal arc/stick, gas tungsten arc, gas metal arc or flux cored arc welding, means that two welders can be operating simultaneously off the same welding generator. The system is designed to suit the modular Uniarc range of power units, which can be slotted into the welder/generator unit depending on the process requirements of the job.

"Customers can select between standard or pipeline welding units, for example, which can easily be removed for servicing or replacement to minimise downtime. The twin pack dual-purpose welder/generator dovetails with Renttech's focus on offering solutions to contractors through the supply of high-quality equipment that significantly reduces production and transport costs while enabling downtime to be almost eliminated," Van Zyl explains.

In addition, the unit can be used to supply 30 kVA three-phase power at 50 Hz to any piece of site equipment. Also accessible are two 6.0 kVA, 230 V power outlets for support activities such as preheating, grinding, drilling and lighting. "This allows the unit to function as a conventional 230 Vac generator, a boon when starting on a greenfield site where mains power has yet to be connected," he adds.

As a power source, the Uniarc twin pack complies fully with OHSA speci-



The centre piece of Renttech SA's stand at Electra Mining 2016, the new Uniarc Twinpro twin pack welder/generator powered by a four-cylinder Kubota engine running at 1 500 rpm for reduced maintenance.

fications. A switch controls the required function of the unit and the twin pack's diesel welder operates at 1 500 rpm instead of the typical 3 000 rpm of other diesel-driven welders in the 300 to 400 A range. The lower engine speed makes the engine quieter, significantly reduces maintenance needs and increases engine life.

"Renttech equipment not only stands up to the safety standards of the respective industries we serve, it surpasses these standards," Van Zyl claims. "Our equipment is CSIR-tested, and manufactured to SANS specifications – and our twin pack welder/generator carries the international CE mark. Furthermore, the CSIR undertakes statutory batch testing on our behalf in order to maintain our ISO 9001 accreditation, for equipment such as our web slings, for example," he adds.

Turning attention back to the twin pack, he says, "there is nothing available in the market place comparable to this unique Renttech brainchild, which is supplied with a full backup service countrywide and into Africa."

## Benefit to the mining industry?

"At present in the mining industry, following a long period of depressed commodity prices, mines are striving in every



As well as showcasing its Uniarc range at Electra Mining 2016, welding equipment and machines from Harris, Gentec, Lincoln, Uniarc and Multiarc were also on show.



# rugged on-site power



*Two independent welding power sources are incorporated allowing two welders to operate simultaneously off the same welding generator.*



*In addition to the welding units, 30 kVA three-phase power and two 6.0 kVA, 230 V power outlets are accessible for supporting activities such as heat treatment and grinding.*



*With an IP 23 ingress protection rating and insulation class H (180°, 20 000 hours), the Twinpro twin pack is a robust power unit designed for harsh construction environments in Africa.*

way possible to contain costs while still maintaining stringent safety standards. Many mines, both locally and elsewhere in Africa, are situated in remote areas subject to harsh climactic conditions and other logistical challenges," Van Zyl responds. "With the introduction of an offering such as the twin pack generator/welder, Renttech offers its mining and other customers a versatile and reliable machine that is robust, mobile, and will save on maintenance, operational time and on-site costs," he continues.

"The demand for our range of diesel generators and top-brand welding equipment and consumables has grown enormously as customers see the benefit in the reliability, versatility and quality in our product offerings. In addition, we do not just sell or rent equipment, we provide full on-site service and support, thereby ensuring the best overall solution for the customer. From their point of view, this results in excellent return-on-investment and faster more economical project completion," Van Zyl tells *African Fusion*.

Along with the expansion of its national and sub-Saharan African footprint over the past few years, Renttech has been meeting a growing demand for its equipment in the mining sector; and in particular, for its range of diesel generators and top-brand welding equipment and consumables.

For example, the company supplied a large 'greenfield' project at one of Namibia's major uranium mines, providing

the necessary equipment and consumables for the construction of a process plant; as well as on-site technical support for the duration of the project, from mid-2014 to mid-2016.

"Renttech's new Namibian branch is proud to be able to supply brands such as Lincoln, Harris and Gentec; as well as our own Uniarc and Unilift ranges. From this branch, Renttech provided the necessary equipment and consumables for the construction of the process plant at the mine. This included engine-driven, multi-process welding machines; inverter welding packages; the Harris and Gentec ranges of gas welding and cutting equipment; and various welding consumables such as torches, stainless flux-cored wires as well as SMAW and GTAW consumables.

"Apart from supplying equipment, Renttech supported the customer with on-site technical support. Being able to offer on-site technical and project support for as long as required is an important part of Renttech's customer service offering. We established an on-site presence on the mine at the beginning of the contract, which allowed

us to ensure that all equipment and consumable requirements were being met on a daily basis. This is essential for downtime to be minimised and is, therefore, an integral part of Renttech SA's 'total package' solution," Van Zyl concludes.

As well as showcasing its Uniarc twin pack welder-generator at Electra Mining 2016, various welding techniques were demonstrated and discussed using welding equipment and machines from Harris, Gentec, Lincoln, Uniarc and Multiarc product ranges. Renttech SA's target market embraces the full spectrum of on-site, plant-based and construction services for industries such as petrochemical, oil and gas, power generation, maritime services and mining. ■

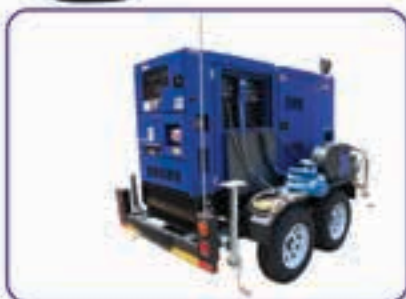
## Features of the Uniarc Twinpro twin pack welder/generator:

- Two 400 A welding power units.
- 30 to 33 kVA single- and three-phase ac power.
- Selector switch for choosing power or welding.
- Nine hour fuel tank.
- Full weatherproof and soundproof enclosure with a rating of 64 db at 7.0 m, making this one of the quietest units available.
- Four-cylinder Kubota engine running at 1 500 rpm for reduced maintenance.
- Ideal for harsh environmental conditions.
- All-round access for easy maintenance.
- Safe and secure.

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## A new era in industrial welding

Kemppi recently launched three new solutions that are mooted to redefine performance, usability, the health and safety of welders. Welding management tools have also been developed that offer capabilities in extreme industrial welding production.

For industrial welding systems, Kemppi presents a premium, multi-functional welding solution, the X8 MIG Welder, which allows for excellent welding performance and usability through new innovations in welding hardware and software. It has never been faster, easier or smarter to change system and welding settings, adjust and control welding parameters, or view weld procedure specification (WPS) content. The new technology unleashes the enormous potential of the Internet of Things (IoT) and connectivity.

For the health and safety of welders, Kemppi has redesigned the welders' personal protective equipment and optimised mobile solutions. The new GAMMA GTH3 welder respirator combines comfort with the highest TH3 level of breathing protection. The portable and cordless welding machine Minarc Cordless 150 C has been designed for the most demanding welding tasks to bring freedom and the joy of working to maintenance welding. Both the X8 MIG Welders and Minarc Cordless 150 C welding machines are made in Finland.

All the new solutions become globally available from 2017.

For welding management, Kemppi has recently introduced WeldEye – a cloud-based welding management software solution. WeldEye enables the use of digital WPSs, eliminates welding with incorrect parameters, provides full transparency into welding production and dramatically reduces the time spent on welding documentation. This increases the overall quality of welding and streamlines production management.

For automated welding, Kemppi's state-of-the-art solution, the A7 MIG Welder 450 is a complete, well-balanced process package that can be integrated with any robot brand.

Welding is becoming more and more challenging as new materials have greater strength, higher corrosion resistance and other performance-enhancing properties. Kemppi's new X8 MIG Welder is engineered to meet demanding expecta-

tations of industrial welding and to cover a wide variety of materials.

**The X8 MIG Welder** is a multi-process system for MIG/MAG welding, MIG brazing, cladding and gouging with power and accuracy, using most common electrical network voltages. Every aspect of the solution is designed to meet the best usability practices. The solution consists of Kemppi's high-duty and upgradeable power source with an all-in-one wire feeder, ergonomic welding guns, intelligent software and a wireless Control Pad for total welding control. The wireless Control Pad allows the welder to easily find the relevant WPS, view the content and activate it before welding.

Connecting the X8 MIG Welder to the WeldEye cloud service gives access to Kemppi's management tools for welding work and documentation. Digital WPS is a smart feature of the system, which ensures that the welder always has the relevant and latest version of a procedure at hand by providing detailed WPS information on the Control Pad's display. This revolutionises WPS management in welding production from both the welder's and the welding coordinator's point of view.

**Kemppi's new GAMMA GTH3 respirators** for welders offer high levels of protection and comfort for welding and related tasks. Even in demanding, low light conditions, the GAMMA GTH3 delivers, lighting the way while safely shielding the wearer from harmful airborne contaminants. All GAMMA GTH3 models offer the highest TH3 level of respiratory protection and integrate new Complex system technology.

The GTH3 improves the wearer's everyday work conditions and enhances productivity and personal safety. Innovative and practical work-based solutions include integrated LED BriteSafe work lights, LiFE+ color ADF welding lenses, fast-charge SD and HD Li-ion batteries, Hypolite face seal fabric, and ClickLenz visor protection.

**The Minarc Cordless 150 C** is a battery-powered, cordless welding machine that neatly packs welding power into a convenient, portable solution. Ready-



*Above: The X8 MIG Welder is a multi-process designed to meet best usability practices.*

*Left: AR Industrial's Sherwin Hughes demonstrates Kemppi MIG technology at Electra Mining 2016.*



to-weld anywhere anytime, the Minarc Cordless 150 C MMA cell pack frees site welders from the restrictions and safety issues of main power voltage cables and engine-powered generators. Weighing less than 10 kg, everything needed for a weld repair can be carried to the work site in one easy trip. But if needed for workshop-based welding tasks, the Minarc Cordless 150 C can be clipped into the Fueldock charging station for welding in hybrid mode. Adding this new solution makes welding 'off-grid' possible.

**WeldEye** is a universal solution for managing welding production. It dramatically decreases the time spent on documentation and gives everyone involved in welding processes unprecedented insight into the work being done. The cloud-based software gives real-time insight into the performance of welders and the progress of projects as well as 100% traceable compliance with welding procedures, regardless of which brand's welding equipment is being used.

WeldEye software has the widest coverage of different welding-related processes on the market, regardless of industry. It has proven its performance in shipbuilding, oil and gas, automotive, fabrication, construction, and machine manufacturing.

Kemppi products are available in South Africa through Randburg-based AR Industrial.

[www.arindustrial.co.za](http://www.arindustrial.co.za)

## Specialised skills secure Kusile work

Babcock's specialised infrastructure support and engineering business has secured a contract extension for Units 4 and 5 of the six new 800 MW boiler units at Kusile Power Station, in addition to current work being undertaken for Units 2 and 3. The contract was awarded by Mitsubishi Hitachi (MHPSA), the main boiler contractor for Kusile.

Babcock was originally contracted by MHPSA for the balanced erection of high-pressure pipework systems for Unit 2 in 2014. After an auspicious beginning, MHPSA extended Babcock's contract to include the same scope of work for Unit 3, and in September this



*Babcock's has secured a contract extension for Units 4 and 5 for the balanced erection of high-pressure pipework systems for the 800 MW boiler units at Kusile Power Station.*

year again broadened the contract to incorporate Units 4 and 5.

"We have steadily increased our scope of work on the Kusile project thanks to the proficient logistical, technical and project management skills we have brought to the table," says David Brook, Babcock's technical director for Africa.

He explains that the scope of work encompasses the complex rigging and geometrical alignment of the piping for the main steam and hot/cold reheat systems in the boiler units delivering steam between the boiler and turbine, together with feed water and auxiliary systems. This entails in excess of 1 000 welds per unit on piping ranging in diameter from 12 to 1 200 mm. Lasers are used to position the pipework with precision to within 0.5 mm, as demanded.

As the boiler units are 115 m high, much of this work has to be carried out well above ground level, increasing the complexities of the project. Cranes are used for lifting the piping – weighing up to 782 t per unit – into the boilers. Babcock's scope of work also includes coordinating the synchronised lifting of the pipe systems, with lifting and

mechanical gear supplied by Babcock's plant services business.

Brook reports that 85% of the main piping work has been completed on Unit 2 and approximately 40% has been finalised on Unit 3. By 2017 Babcock expects to be working on all four units simultaneously in various stages of completion and Brook is confident that Babcock has the capacity and resources to execute their growing contract.

Babcock's on-site crew for the entire scope of works currently comprises a world-class team of over 270 skilled workers ranging from welders to pipe fitters, engineers and quality control specialists. As the scope of work increases, more crew will be employed.

"The Kusile project requires specialised skills and workmanship with a focus on precise installation. We have a team of about 20 technical and logistical staff on site who are charged with ensuring that everything from rigging to alignment is accurately co-ordinated," says Brook.

Babcock has also placed a strong emphasis on skills development and risk management on the Kusile project and a culture of safety has been instilled, with particular attention to safety regarding working at great heights and near electrical equipment. The Kusile project team recently achieved 750 000 incident-free man-hours on site.

Colin Davies, project manager for Special Projects at Babcock, expands on milestones achieved to date and future expected progress on the project. "Our team is currently preparing to complete Unit 2 for hydraulic testing and has completed all ground welds on Unit 4, with only a small support installation prep crew assisting in Unit 4. We have also moved onto ground welds for Unit 5."

Davies believes that the recent extension of the scope of work will mean that by 2017 the Babcock team will be working on Units 2 through 5 simultaneously.

The Eskom-owned Kusile Power Station consists of six supercritical boiler units that will produce 800 MW each, ultimately making Kusile one of the largest coal-fired power stations in the world. Unlike other power stations in South Africa, Kusile will make use of air-cooled condensers instead of the iconic cooling towers and the electricity generated is expected to ease the strain on the South African national grid.

[www.babcock.co.za](http://www.babcock.co.za)

## New Renttech SA sales outlet

Renttech South Africa has moved its Port Elizabeth branch into a new, spacious, state-of-the-art sales outlet. The move is in line with Renttech SA's strategy of expanding and consolidating its national footprint nationally and regionally. This also follows the opening of a number of other branches to meet customers' requirements for welding, lifting and construction equipment sales and rental, wherever they are in South Africa and in neighbouring sub-Saharan African countries such as Namibia.

"Situated in Haupt Road, this new outlet offers our valued customers from Port Elizabeth and the Eastern Cape region

greater convenience and improved access to our full range of equipment and solutions," says Gerrit van Zyl, MD of Renttech South Africa.

With two busy port terminals, the Coega Industrial Development Zone (IDZ) and the ongoing development of the region's industrial sectors, Port Elizabeth is a dynamic economic gateway to the Eastern Cape region.

At the new 1 200 m<sup>2</sup> premises, customers will be able to purchase or rent world-leading welding, power generation and lifting equipment. As an example, the company offers an extensive welding solutions portfolio, including international metalworking brands from Harris, Lincoln and Uniarc.

"We look forward to welcoming our many local and regional Eastern Cape customers to our new premises in Port Elizabeth. We guarantee that they will benefit from the improved access and exposure to our best-in-class industrial products and solutions," van Zyl concludes.

[www.renttechsa.co.za](http://www.renttechsa.co.za)



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## Fronius expands Virtual Welding simulation platform

Austrian welding technology specialist, Fronius, has further developed its Virtual Welding simulation platform. TIG welding processes can now also be learned in the virtual environment – without safety risks or the use of consumables. As well as getting to grips with the welding torch, users can also learn how to handle a filler metal.

The functional package is available for new Virtual Welding systems as stan-

dard and can be ordered as an upgrade kit for existing devices.

Virtual Welding provides the perfect environment for first experiences with welding equipment. The system consists of a terminal with a screen and a shelf on which the user places a plastic workpiece. A faithful replica of a real welding torch is then used to draw a virtual weld seam, which is reproduced in real time as a graphic on the screen.

3D glasses held in place by a headband give the user a realistic view of their work. The existing training functions for MIG/MAG, robot and manual metal arc processes have now been extended to include a virtual welding solution for TIG welding processes.

The new package contains a special TIG welding torch and a separate sensor, which helps teach the user to apply the optimum amount of

filler metal. A total of ten training and simulation tasks are available, which can be performed on a variety of different workpieces. Here too, Fronius has expanded the range of possibilities: joining the existing models for the execution of fillet welds, single-V butt welds, pipe-pipe and pipe-plate joints and melt runs comes the ability to perform three-millimetre square butt welds.

Virtual Welding offers a whole host of major benefits for training and educational establishments. Beginners can learn about the welding systems and complete their basic training without any safety risks whatsoever. Furthermore, this is achieved without an expensive outlay on consumables such as metal, wire or gas. A mature didactic learning system comprising training and simulation sequences ensures a high level of motivation and enables rapid progress. Welding results are recorded and can be subsequently analysed and evaluated either directly on the terminal or on a PC if a network connection is available.

[www.fronius.com](http://www.fronius.com)



Fronius has developed a new function package for its Virtual Welding simulation platform: the teaching of TIG welding processes.

## AIR PRODUCTS

Air Products South Africa (Pty) Limited manufactures, supplies and distributes a diverse portfolio of atmospheric gases, specialty gases, performance materials, equipment and services to the Southern African region.

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## Five new nickel-based welding consumables launched

At India's Essen Welding & Cutting, Bombay during October, Sandvik Welding added five new welding wires and covered electrodes to its Sanicro™ nickel-based welding materials programme. Complementing the introductions is a new flux, Sandvik 69S, specifically designed for ESW high-speed cladding.

Designed for use in the most demanding environments, these latest introductions significantly increase the advanced welding materials portfolio available from Sandvik. The new, nickel-based grades include: welding wire Sanicro 55 (Alloy 686/ERNiCrMo-14); covered electrodes, Sanicro 53 (Alloy 617/ENiCrCoMo-1), Sanicro 54 (Alloy C22/ENiCrMo-10), Sanicro 56 (Alloy 276/ERNiCrMo-4) and Sanicro 59 (Alloy 59/ENiCrMo-13).

"We now offer customers a complete portfolio of welding consumables for stainless and nickel alloys to help them overcome corrosive environments in the most demanding applications," explains Clemente Tallarico, Sandvik global product manager for welding. "This is part of a strategic move to make Sandvik the go-to one-stop-shop when it comes to advanced material solutions for joining and cladding."

The Sanicro portfolio of welding con-



*Sandvik Welding has added five new welding wires and covered electrodes to its Sanicro™ nickel-based welding materials programme.*

sumables from Sandvik is particularly appropriate for fabricators and customers offering specialist welding services to the oil and gas, chemical and petrochemical industries and on pollution control equipment for thermal power and waste incinerators. In use they are designed to offer good weld puddle control and low spatter combined with excellent resistance to corrosion.

Detailed information on all the new Sanicro nickel grades and the growing portfolio of welding consumables can be found on the Internet at [smt.sandvik.com/welding](http://smt.sandvik.com/welding); in the recently updated Sandvik Welding handbook, which can be downloaded from this website; or via the new Sandvik Welding Handbook smartphone app, which is available for iPhone and Android.

[www.smt.sandvik.com](http://www.smt.sandvik.com)

## Portable ac magnetic yoke inverter

Many surface crack detection jobs in steel structures are remote from ac power. This has led NDT Inspectors to resort to the use of permanent magnet yokes and dc yokes for magnetising the inspection area while performing magnetic particle inspection (MPI). Both of these, however, have significantly lower sensitivity to surface defects than offered by ac-yokes. This is due to the ac skin-effect which tends to concentrate an ac magnetic field on the surface, following the part contours and the pulsing of the field at the frequency of the input current gives dry particle mobility.

The YP-1000 enables an ac magnetic yoke to be used when utility power is unavailable or difficult to bring to the inspection area. It consists of a portable ac power pack for powering ac magnetic yokes. Battery-operated and using inverter technology, the unit is suitable for use with most portable yokes and is ideal for use in remote areas.

Features include:

- A low battery indicator and safety cutout circuit, which protects the inverter from over charging, over temperature, over current and also short circuit.
- Belt accessories, including an aerosol holsters, spare battery and yoke case.
- An internal high-capacity Li-ion battery that can typically support 220 Vac operation for four hours at a 25% duty cycle.
- Low weight, only 1.3 kg.

The unit is suitable for use with 220 Vac yokes drawing less than 3.0 A and 110 Vac yokes drawing less than 6.0 A.

The YP-1000 is available in South Africa through Gammatec, a manufacturer and distributor of all types of NDT equipment and accessories for onsite or factory-based inspections in all spheres of industry.

[www.gammatecsa.com](http://www.gammatecsa.com)

## DCD Venco settles in Vereeniging

The incorporation of DCD Venco into DCD Heavy Engineering in Vereeniging is consolidating the capacity of two iconic South African manufacturing operations into an optimised business well placed for growth, according to DCD Heavy Engineering general manager Dawie Marais.

"Moving DCD Venco from Newcastle was not an easy decision, but it was clear to the holding DCD Group that the businesses needed to be resized and aligned to market conditions," says Marais. "Over recent years, the depressed state of the mining industry in particular made trading conditions very difficult for both firms."

With operations now being brought under DCD Heavy Engineering's three operational units – North Works, South Works and Vanderbijlpark – the cost base is being reduced and the utilisation of facilities optimised, he explains. While DCD Venco's Newcastle facilities offered light and medium fabrication and machining capabilities, the Vereeniging sites service customers across a range of work from light to ultra-heavy grades.

"The result is that the consolidated facilities can provide the same services as the two facilities offered separately," continues Marais. "For Venco customers, we can now offer more capacity in terms of manufacturing space, lifting capacity and 'under hook' clearance."

While not all staff could be relocated, he highlighted the importance of retaining the decades of specialised engineering skills within the DCD Group that allows high quality standards to be applied throughout the planning, procurement and manufacturing processes.

"The company has in recent years invested over R100-million in equipment and machine upgrades to improve its overall technological offering," he reveals. "We also invest heavily in skills development, having expanded our training facility in 2014 where apprentices are trained as fitters and turners, electricians, boilermakers, welders and riggers."

DCD Heavy Engineering's Vereeniging facilities boast crane capacities of 20 to 70 t at South Works and 20 to 60 t at North Works – with 13 m and 9.0 m under hook respectively. On the machining side, there is crane capacity at North Works from 7.0 to 40 t and at Vanderbijlpark from 20 to 100 t.

Services at DCD Heavy Engineering include vertical and horizontal rolling, turning, machining, heat treatment, shot blasting and painting.

[www.dcd.co.za](http://www.dcd.co.za)

# Lindoflamm for optimal pre-and post-heating

Whether preheating, postheating, flame straightening, flame hardening, flame brazing, fusing or hot forming, Lindoflamm flame solutions from Afrox ensure optimum performance at the lowest processing costs for precision fabrication.

Lindoflamm is a range of innovative preheating, flame straightening and heat-treatment solutions that provide optimal heat transfer to the workpiece, reducing gas consumption, improving productivity and quality and reducing total cost. It also enhances safety on the factory floor.

At the heart of each heating installation is the Lindoflamm burner with shapes and capacities that can be modified to customers' applications and matched with the right fuel gas mixture. The special burners can be customised to create the perfect fit for every heating application. The heating solutions can be semi and fully automated and are tailored to customer's requirements. Components and additional services can be offered from automatic ignition to monitoring, temperature control and documentation.

Unlike slow burning fuel gases, where main heat is in the secondary zone of the flame and a large amount of heat deflects from the material, resulting in gas losses, preheating time and loss of production, the unique Lindoflamm burners operate with acetylene and compressed air and the main heat contribution sits in the primary

zone of the flame. This helps to direct the heat to the actual area to be preheated with very little heat being deflected off the plate.

Preheating can prevent cracking and ensure specific mechanical properties and must be used whenever specified by applicable codes. Applications in industry where Lindoflamm offers quicker preheating times, saving on production costs and labour include: stationary preheating before welding and cutting (hand held preheating); maintaining interpass temperatures; post-weld heating required where low alloy steels are used from minimum plate thickness of 30 mm upwards; flame straightening; and flame hardening.

Prior to installing the Lindoflamm system and integrating with customers' existing equipment, Afrox's Application Development team will visit the customer's site to tailor-make a solution that is optimised according to pipeline installation, flow rates and pressure requirements – and the team will conduct trials if appropriate.

Lindoflamm equipment is part of Afrox's acetylene offering, which supports the fabrication industry in the market place. Acetylene is the ideal fuel gas when efficiency, precision and accuracy are required as it produces the highest flame temperatures, providing rapid and concentrated heating. Acetylene also has the highest flame propagation rate, increasing thermal efficiency.

"The introduction of Lindoflamm torches and burners has been one of the most innovative developments in the South African welding and cutting industry for some time," says Afrox application development manager for cutting, heating and safety, Hennie van Rhyn. "Trials conducted for customers have achieved significant cost savings, compared with existing liquefied petroleum gas heating applications," he says.

[www.afrox.co.za](http://www.afrox.co.za)



Lindoflamm applications include: pre-heating; maintaining interpass temperatures; post-weld heating; flame straightening; and flame hardening.

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