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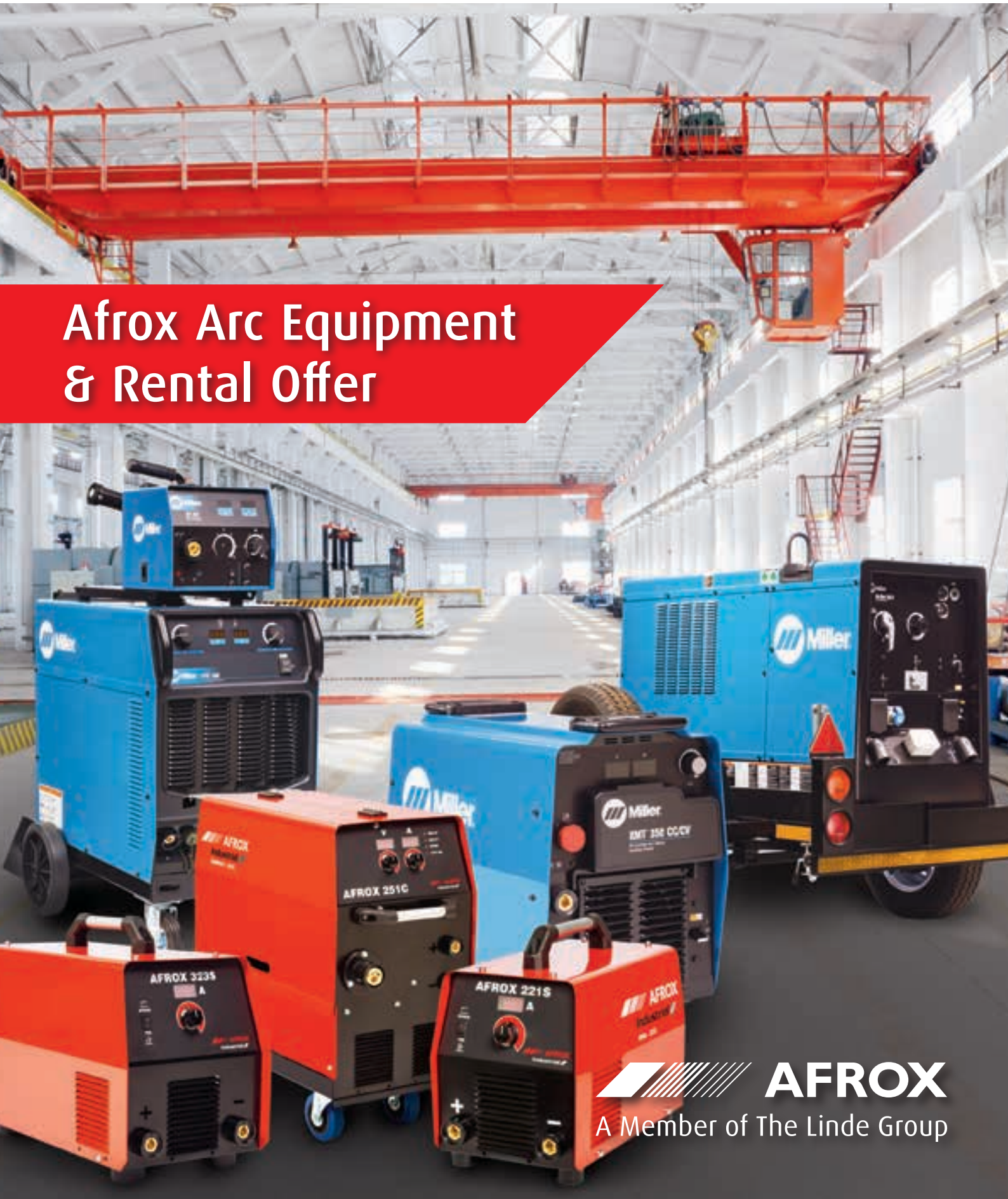

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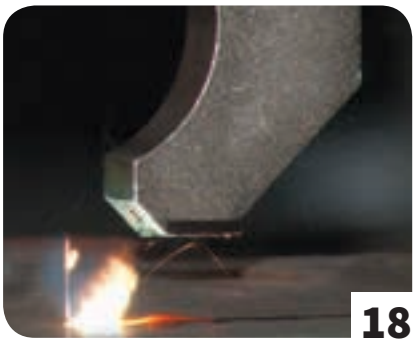
In order to better help SMEs, farmers, industrial workshops and fabricators, from large to small, to succeed in the leaner economy, Afrox has added several new cost-effective products to its Afrox Industrial range and launched a new rental service for its premium Miller brand. *African Fusion* talks to Dewald Bodenstein, the product manager for arc equipment at Afrox.

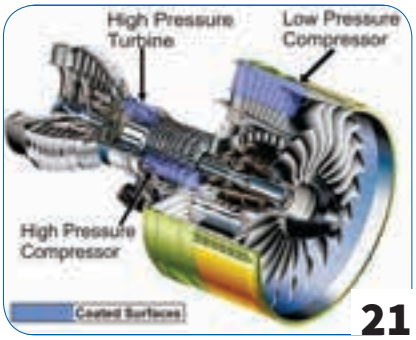
www.africanfusionmagazine.co.za

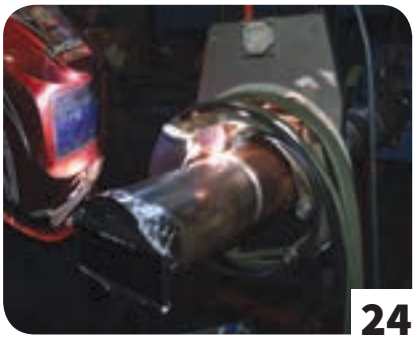
June 2017

FEATURES

REGULARS







Welding – the miracle career

There is no better career choice for a young man or woman than welding. It offers a wide variety of activities from inspection to administration through to actual welding in a host of different applications.
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SAIW
Southern African Institute of Welding

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Harold Jansen and I were recently in Vienna for the EN/ISO 9712 International Conference for Certification and Standardisation in NDT, along with the ICNDT Working Group 1 meeting. The EN/ISO 9712 Standard specifies the qualification and certification requirements for personnel who perform industrial NDT.

At the conference, Harold presented a paper about the value of integrating aspects of the American ASNT system for Company Certification into ISO 9712 to broaden the scope of the ISO 9712 scheme. Practical training and theoretical aspects of NDT are already well covered by ISO 9712, but SNT-TC-1A brings in a work experience component that is currently missing. The American system is also strong on the integration of personnel and company certification, which the EN/ISO NDT community is looking to strengthen.

I am very pleased to report that Harold's paper was broadly welcomed. We find ourselves on the same page as our international colleagues, which is very encouraging for the direction we have chosen to take in South Africa. It shows that we are on the right track and that our thinking is well aligned to that of the international community.

From a welder training perspective, we remain excited by the ongoing progress being made towards implementing the new QCTO curriculum. This new welder-training curriculum has quality as its primary focus, which is most pleasing.

SAIW, mostly through Etienne Nell, is proud to have played such a major part of this initiative. Our primary role as an association is to implement and raise standards in the welding industry and quality training is integral to this goal.

It will be a long road, however. The current implementation stage will take place over five years on a trial basis. Key TVET colleges will be chosen for the implementation of the course and independent bodies will be brought online to deliver the trade test. At the end of the day, the objective is that we have skilled welders capable of producing good quality welds coming out of our training institutions: welders as good as those from anywhere else in the world.

Also, since the QCTO curriculum is largely based on the IIW International Welder curriculum, which we already offer through the SAIW Authorised Training Bodies (ATBs), SAIW will be able to offer an easy transition from a QCTO-qualification to the internationally recognised IIW-Welder qualification.

While South African industry is still struggling, SAIW is finding new avenues to keep us busy, with enquiries coming in from many African countries. Training remains robust, with private individuals still expressing faith in welding as a career that offers a good progression path for a person with skills. Welders, welding inspectors and NDT technicians are required in so many industries, so while the petrochemical and power industries are struggling right now, we see resilience in other industries such as the food & beverage and transportation industries, for example. Maintenance work is becoming more important and will never stop, so it continues to draw on welding technologies and skills.

Thanks to all of those who joined us for the Gauteng Golf Day last month. It was a good day out for industry and we are very grateful for the support of both sponsors and participants.

We are also now planning the Annual Dinner. Save the date: Friday October 20. We have scheduled an international acclaimed act, the Supreme 3: Loyiso Bala, Danny K and Tebogo Louw, who are promising a high-energy experience.

Sean Blake

Sparking skills: QCTO artisan

Following four years of CHIETA-funded planning and curriculum development work, the Quality Council for Trades and Occupations (QCTO) has released a new artisan-training programme for welders that is now ready for implementation. *African Fusion* talks to SAIW's business development manager, Etienne Nell, about this exciting change.

Talking at an education solutions seminar hosted by Lincoln Electric on May 9 and 10, 2017, SAIW's Etienne Nell presented a talk entitled *'A Sparking Change'* about the new choices South Africa has made with respect to welder training and certification.

"How many welders do we need in South Africa?" Nell asks as the question of the day. "Welding has been identified as one of the scarce skills in South Africa and a worldwide shortage, with the AWS indicating a shortage of 250 000 skilled welding personnel by 2020," he says.

Adding to the problem, he says: very few welders are properly qualified and certified; very few meet the required skill level needed for new and existing projects; very few are qualified for the welding processes or for the positions required on these projects; and very few welders or employers understand the term 'coded welder'.

Which leads directly to the need to do something more to develop skilled welding artisans, because: "welding skills secure employment with excellent financial prospects; new projects require highly skilled welders; of the legislation requirement embedded in our National Health and Safety Standards; and welding skills are required for compliance with quality standards".

The solution: a quality skills training programme

In introducing the training solution currently being implemented in South Africa, Nell cites three components for a lasting solution to our welding skills problems: Authorised Training Bodies (ATBs); the new Quality Council for Trades and Occupations (QCTO) curricula for artisan training; and reputable training equipment suppliers, such as Lincoln Electric, Afrox, ESAB, and Fronius.

Facilities accredited by SAIW Certification, which is the International Institute of Welding's (IIW) Authorised National Body (ANB) in South Africa, are at the starting point of any long-term solution to the welding skills problem. "ANBs seek to achieve excellence in the training, examination and qualification of welders throughout the world," Nell says.

IIW-accredited training bodies (ATBs) in every member country now follow a detailed welder-training guide called the 'Bratislava Agreement', which was developed and agreed by all 56 IIW member countries.

Articulated in full in the IIW Guideline document entitled: *'International Welder, Minimum Requirements for the Education, Examination and Qualification'*, the Bratislava Agreement seeks to achieve *'harmonisation in the training, examination and qualification testing of welders in the world. It provides for the assessment of both theoretical knowledge and practical skills, the latter being linked to the requirements of ISO 9606 (or equivalent standard) …'*

"The new South African QCTO curriculum, is 90% based on the Bratislava Agreement," says Nell, which makes it a truly international curriculum.

This was looked at over a period of over two years by a welder training curriculum development committee consisting of senior academic and industry stakeholders, including: Etienne Nell from SAIW, Tony Paterson from Wits University, Louis Petrick from Eskom, and people from Bell, Coega, PetroSA; Caltex; Sapref, and several other stalwarts of the South African welding industry.

This QCTO curriculum is now a national qualification called Occupational Certificate: Welder, with the SAQA Number: 94100 and QCTO Curriculum Number: 651202. While it does not replace any other qualification and it is not replaced by any other qualification, anyone wanting to register a new apprentice for a trade must, from now on, "go the QCTO route" with respect to training.

Apprentices already on existing schemes may finish these programmes, but the new welding artisan trade tests will be OCTO-based within the next three to four years.

"If one looks at the total number of hours a university student spends before being granted a degree, it equates to about 5 400 hours. Of that time, the direct number of contact hours per

SAIW's state-of-the-art welding school: an accredited IIW ATB for the delivery of the IIW International Welder curriculum.

welder training

A trainee producing fillet welds on plate in the 4F (overhead) position.

week is often low: the holidays are long and study leave is counted." Nell tells *African Fusion*.

"The welder training committee thought it best to stop labelling university trained professionals as 'white collar' and artisans as 'blue collar'. So now, to become an artisan, a candidate still has to do 5 400 hours of training so that everyone is on the same level," Nell says.

The OCTO curriculum is structured around credits, with each credit equating to 10 notional hours of time. That means that artisan courses now consist of a total of 540 credits to give the 5 400 hours that makes them equivalent to a university degree.

Breaking down the general OCTO artisan training course curriculum requirements, Nell says that 20% of the 540 credits, 108 credits, is allocated to theory; a second 20%/108 credits to practical Institutional training at a training facility; while a third 20% is allocated to relevant workplace experience. This applies to all occupations.

The remaining 40% is left up to individual training committees to allocate depending on needs of their occupation.

"For welding, we decided to increase the practical institutional training by a further 10%, from 108 credits to 162 credits. The remaining 30% was allocated to workplace experience, which was raised from 108 credits to 270 credits," notes Nell.

Being based on the Bratislava Agreement's International Welder curriculum, the QCTO's Occupational Certificate: Welder is structured around practical cutting and welding activities, including: performing cutting operations using oxy-fuel, carbon arc and plasma processes; producing fillet welds on plate; producing fillet welds on pipe; producing butt or groove welds on plate; and producing butt or groove welds on pipe – with each positional skill having to be developed using SMAW (MMA), GTAW (TIG), GMAW (MIG/MAG) and FCAW processes.

"From now on, all welding training providers will have to comply with this structure – and the instructors delivering the theory component need to be qualified artisans themselves, with experience and the requisite knowledge components," Nell says.

Also, the training provider will not be allowed to administer the trade tests themselves. TVET colleges have been earmarked for delivering these trade tests. Any provider can train, if accredited, but TVET colleges that provide welder training will not be allowed to also administer the test.

"While the curriculum is written and ready, the welding trade test development is yet to be completed," Nell says. This is being done via the National Artisans Moderation Board (NAMB), also with Nell's participation. "We are currently determining the requirements and assessment criteria and, once completed, we will proceed to the approval of testing facilities," he says.

A trainee practising his gas-tungsten arc (GTAW) skills in the SAIW welding school.

Summarising the new approach Nell lists the following advantages:

1 This is a listed trade qualification that falls within the Occupational Qualifications Framework of the NQF of South Africa.
2 Industries employ welders qualified as artisans, but they need them to perform the code certification requirements using 'Coded Welders' according to the relevant national standard applicable to the scope of work, (PER or Structural)
3 The implementation strives to eliminate skills imports by providing highly skilled local welders to our labour market.
4 The availability of this qualification, aligned to international standards is regarded as an important resource to support national artisan development.

"This qualification ensures that a sound skills base is developed at artisan level that will serve as the foundation for achieving the coded welder status required by the national standards used in South Africa," he adds.

"We at the SAIW have been IIW-focused for over 16 years now and we have already applied for QCTO accreditation for our training school. Our 2017 intake of foundation students will be the first group to be taken through the new QCTO-curriculum," Nell concludes.

SAIW training and the IWIP Programme

SAIW Training manager, Shelton Zichawo talks about the realignment of the Institute's training courses to those of the International Institute of Welding (IIW) and the most recent change, the adoption of the International Welding Inspection Personnel (IWIP) programme for welding inspector training.

SAIW is a founding member of the International Institute of Welding (IIW), with a common focus on welding related training, research, standardisation of welding related activities and governance of the IIW system.

SAIW has provided welding related training to the South African industry for many years, having developed Welding Inspection and Welding Supervision training programmes during the 1980s and 1990s, both of which preceded the respective IIW training programmes. In the early 2000s SAIW converted its Welding Supervision training programme to the IIW Welding Co-ordination training programme and has therefore been able to offer the IWT (international welding technologist), IWS (specialist) & IWP (practitioner) programmes to the industry. The IWE (engineer) programme is offered to industry through our university training partners.

In 2010, SAIW aligned the Welding Inspector Level 1 and Level 2 training programme to the IIW IWIP training curriculum, meaning that candidates who meet the access conditions for IWIP – Standard, and have completed the SAIW Welding Inspector Level 2 programme, would also receive the IIW IWIP Standard welding inspection diploma.

At the beginning of 2017, SAIW ran its first International Welding Inspection Personnel (IWIP) – Basic course and the Institute has now embarked on the journey to fully convert to the IIW's IWIP programme, which comprises three levels: Basic Level; Standard Level; and Comprehensive Level.

Candidates may progress through the three levels of training until completing the training at the highest level, which is the Comprehensive Level.

Comparison between SAIW and IIW Inspection programme

The IIW has three levels of training while the SAIW Welding Inspector programme has two. The two SAIW levels are Level 1 and Level 2, which when completed by a student, result in the individual having attained the same level as the IIW Standard level. To attain the IIW Standard qualification certificate, however, the individual needs to meet the access conditions, which require a matric with maths and science as well as two years of welding inspection experience.

The systems are laid out differently so the only cross over point is at the Standard level. This means that if a candidate goes through the SAIW Inspector Level 1 course, he or she must proceed to SAIW Inspectors Level 2, after which, on successful completion coupled with two years' experience, the IIW Standard level qualification may be issued. That is, those who have completed SAIW Level 1 must proceed to the SAIW Level 2 course in order for them to attain an IIW qualification.

The two years' experience is another point of difference between the two systems. This creates an advantage as well as a disadvantage for both students and industry in the sense that there is a two-year wait before one can proceed to the next level. This however ensures that people with qualifications higher than the basic level have appropriate industrial experience, which is good for industry because new recruits at the Standard Level and higher will hit the ground running.

An SAIW Level 1 inspector holds a partial qualification as a result of a decision taken years ago when the SAIW decided to break up the course into two portions, which were called SAIW Welding Inspector Level 1 and SAIW Senior Welding Inspector Level 2, respectively. The content was split between the two courses, so in practice, both Level 1 and Level 2 constitute completion of the entire course.

The SAIW Level 1 Welding Inspector is not taught about WPSs, NDT theory and reports, quality control aspects such as QCPs, drawings, material testing processes and reports, etc. The IIW Basic inspectors course, however, includes all these items at a lower level than the IIW Standard Inspector level, thus IIW Basic Inspectors are generally better equipped for the working environment as they have the basic knowledge of SAIW Level 2 Welding Inspectors.

The IIW Basic Inspector course, therefore, has a lower knowledge level than the SAIW Level 2 Inspector's course, but is definitely at a superior level to the SAIW Level 1 programme.

In addition, the IIW has clearly defined the duties of all three Levels of Inspection Personnel, which creates an easy system for industry.

The inspection duties of an IWIP BASIC (IWIP-B) Welding Inspector

- General knowledge of welding and inspection application and theory.
- Conduct/direct unaided visual inspection to identify and evaluate welding imperfection according to acceptance criteria.
- Verify, witness and understand all welding related activities in fabrication, including (but not limited to) the following points:
  - Verify the adequacy of information on NDT reports (VT, PT, MT, RT, UT) for conventional techniques:
  - Verify data and adequacy of material certificates (base and filler materials).
  - Verify identification and traceability of the materials during the fabrication process.
  - Verify the compliance of raw materials and consumables against the applicable standards, codes and specifications.
  - Verify the implementation of the WPS in production for conventional applications (e.g. arc welding processes, steels).
  - Verify the implementation of PWHT specifications in production.
- Witness welder approval tests including testing of the specimens or test coupons.
- Witness production test coupons.
- Read and understand an Inspection Testing Plan.
- Read and understand the construction drawings in relation to inspection activities.
- Report any of the above actions to a qualified supervisor.

First SAIW Foundation IWT student qualifies

Ndwakhulu Mufamadi, known as King, who won an SAIW Foundation bursary for the IIW International Welding Technologist (IWT) training programme last year, has now qualified as a top achiever on the programme.

King obtained both a National Diploma and B.Tech degree in Engineering Metallurgy from the Vaal University of Technology having completed his training in 2012.

Following the completion of his studies at VUT, King worked for a period of time at the University of Johannesburg Metal Casting Technology Station during 2014 and 2015. When he applied for the IWT bursary in early 2016, he was working at Metal Protection Engineering on a volunteer basis in order to obtain work experience in the hope of unearthing opportunities.

As Metal Protection Engineering is a welding company and King displayed a passion for welding, it was a match made in heaven for SAIW Foundation to provide King with additional skills to improve his prospects in the Welding field. King was dedicated during the IWT training course and made full use of this opportunity proving to be a dedicated and active participant in the group of students undertaking the IWT course. His dedication showed in his results and he was one of the top achievers in the class having passed all his exams on the first attempt, many with distinction.

SAIW Foundation is proud to have provided King with the opportunity and we know he will put the knowledge that he has learnt to improve and benefit the welding industry.

He is now a full time employee at Metal Protection Engineering (MPE) as a Welding Co-ordinator. The training he received on the IWT programme is adding value to MPE as he helps to ensure the welds the company performs are of the highest quality as required by ISO 3834.

Can you be like King? SAIW Foundation invites suitable candidates to apply for a bursary to undertake the IWT course at SAIW in 2017. Should you meet the access conditions and you have a passion for welding, please contact SAIW to apply.

Nndwakhulu Mufamadi receives his IIW International Welding Technologist (IWT) certificate from SAIW president Morris Maroga.

ISO 3834: complaints and appeals

A company certification scheme is only as good as the credibility and reputation of the scheme. SAIW Certification is committed to operating a scheme that upholds high standards for the manufacture of fusion-welded products, believes Herman Potgieter, who, in this article, describes the complaints and appeals procedures.

Gaining ISO 3834 company certification is a statement that the fabricator has a system in place that will allow welded product at an appropriate standard to be produced and that these products conform to the codes and standards according to which they are manufactured. There is therefore an expectation that the quality of product produced is at a satisfactory level and that public safety is upheld as per the requirements of the Pressure Equipment Regulations and Occupational Health and Safety Act of South Africa.

SAIW Certification operates the IIW Manufacturer Certification Scheme in accordance to the requirements of ISO 17021. When SAIW Certification undertakes an audit of a company, only a sample of the work is checked to confirm compliance with the requirements of the standard. It is impractical to verify that all the work that the company undertakes complies with the requirements of the standard. In order to maintain a scheme with credibility and a positive reputation, therefore, one that conforms to the requirements of ISO 17021, a channel is required whereby complaints from the public and users of the manufactured products can raise their concerns with respect to potential non-compliance.

SAIW Certification has been authorised by the IIW as the Authorised National Body for Company Certification (ANBCC) in South Africa. The IIW Manufacturer Certification Scheme operated by SAIW Certification in South Africa is overseen by the Welding Fabricator Board, which is composed of end users, engineering consultants, manufacturers and other interested parties. The Welding Fabricator Board is an organ of SAIW Certification and reports to the SAIW Certification Governing Board.

SAIW Certification has procedures to deal with complaints and appeals as per the requirements of ISO 17021. A complaint is defined as: A written submission sent to SAIW Certification Secretariat, either via e-mail or registered post, whereby a complainant officially lodges a complaint in respect of the competence, integrity or quality of work of any certified company.

An appeal is defined as: A written request made by any interested party for reconsideration of any substantive decision made as a result of a complaint, an inquiry panel or any other body of SAIW Certification.

SAIW Certification is obliged to acknowledge receipt of the complaint in writing within 15 working days and shall also inform the respondent of the complaint. Following the notification of the complaint, the respondent shall be required, within 20 working days of the notice, to submit a written response to SAIW Certification Secretariat setting out the respondent's point of view with respect to the complaint.

SAIW Certification will appoint a Complaints Panel, consisting of at least two members from the Welding Fabricator Board to consider the complaint. This panel will decide if the complaint has merit; or the complaint has merit, in which case it will be dismissed; or the Complaint Panel is not in a position to make a decision and further investigation is required. In the latter case, the Complaints Panel will recommend to the Welding Fabricator Board that an inquiry panel of no less than three persons is appointed to conduct an in-depth investigation into the complaint. Should any person or entity be aggrieved by the decision of the Complaints Panel, that person or entity may send a written request to SAIW Certification for an inquiry panel to be appointed to consider the complaint.

The Inquiry Panel is obliged to consider the complaint in a manner that is fair and reasonable in the circumstances, taking into account the values of openness, transparency and accountability. The complainant and respondent (or their representatives) shall both be given the opportunity to present their evidence to the inquiry panel and call witnesses, ask questions or cross examine as necessary.

Where the complaint is found to be valid, the inquiry panel will recommend appropriate sanction to the Welding Fabricator Board. The Certification Agreement between SAIW Certification and the Manufacturer provides for three scenarios where the manufacturer has not complied with the requirements of the scheme:

a) The manufacturer may opt to renounce their certification in which case the certification agreement is terminated.
b) The Welding Fabricator board may suspend the manufacturer's certification for a period of time until the reasons for suspension have been corrected and certification can be re-instated.
c) The Welding Fabricator board may revoke the manufacturer's certification if it is deemed that the cause is of a serious nature.

Where a Manufacturer is aggrieved by the decision of the Inquiry Panel, the Manufacturer may lodge an application for appeal as per the procedure. An appeals panel will be appointed by the Welding Fabricator Board to consider the matter.

Legal representation is not allowed in the SAIW Certification complaint hearing, inquiry hearing or the appeals hearing as these are dealt with as internal issues. However, the appeals panel will have the discretion to allow either party legal representation in cases that are of a very serious or complex nature. Parties do have the opportunity to use the legal justice system, however, before the internal procedure is followed to its conclusion.

SAIW Certification encourages all parties to submit a written complaint where they believe that the principles of the certification scheme have not been upheld such that the integrity, credibility and reputation of the IIW Manufacturer Certification Scheme can be maintained.

SAIW in Vienna for EN ISO 9712 conference and IAEA/NDT cooperation meetings

SAIW executive director, Sean Blake, and systems and quality manager, Harold Jansen, represented the SAIW during two consecutive international conferences held in Vienna, Austria between 29 May and 7 June 2017.

The first-ever International Conference on the IAEA Technical Cooperation Programme: *Sixty years and Beyond – Contributing to Development*, was held from 30 May to 1 June. Prior to and following this conference, meetings of National Liaison Officers (NLOs) and Focal Points of AFRA Regional Designated Centres (RDC) were held.

SAIW has been the Anglophone RDC for Africa since the late 1990s and with the cooperation and sponsorship of the IAEA, has been changing lives through SAIW NDT Level 1 to Level 3 training programmes.

SAIW has been the Anglophone RDC for Africa since the late 1990s and has been able to change the lives of 251 individuals from 21 different countries with the cooperation and sponsorship of the IAEA, through SAIW NDT Level 1 to Level 3 training programmes. Since the successful conclusion of the Regional NDT development project in 2011, obtaining sponsorship for further development in NDT has been challenging and the objective of SAIW personnel was to identify future prospects for liaison between SAIW and IAEA in the field of NDT on the African continent.

The 8th International Conference on Certification and Standardisation in NDT – *'5 years of EN ISO 9712 – What's next / how to go on?'* was held on 6th and 7th of June 2017, with ICNDT (The World Organisation for NDT) Working Group 1 – Qualification & Certification and IEC (executive committee) meetings scheduled for the 5th and 7th of June, respectively. SAIW was represented at all these meetings with Harold Jansen presenting a paper during the conference titled *'Competence of NDT personnel'*.

"The global standard for Qualification and Certification of NDT personnel, ISO 9712, is due for its systematic review and SAIW, in collaboration with SAINT, was privileged to represent the South African NDT industry at this international forum," says Jansen. "Representatives were able to actively participate within the various forums, prior to and during the conference, with proposed changes to the ISO 9712 standard being suggested from a South African perspective.

Both Sean Blake and Harold Jansen would like to express their gratitude towards the SAIW Board for making this very important international interaction possible.

ISO 3834: Also ideal for small fabricators

ISO 3834 certification is important for any fabrication company. It is the 'stamp of quality' that gives end-users the assurance that they are dealing with a professional fabricator whose work is approved by the highest authority in the land.

"But ISO 3834 is not only for big companies," says. Herman Potgieter, CEO of SAIW Certification, which manages ISO 3834. "It's for all companies. In fact, smaller, lesser known companies could benefit more by becoming certified, because this stamp of approval shows they're on a par with the best, not just in South Africa, but across the world," he adds.

Companies certified during 2017 so far include:

- LHL Engineering
- Lead EPC
- Murray & Roberts – Secunda Oil & Gas
- FFS Refiners
- HC Heat Exchangers
- Medi-Clave
- Master & Master Engineering
- Vessel Fab
- Steval Engineering
- Clarko Piping Contractors
- AWS Pipelines
- Mbali Industrial Solutions

These companies all now have IIW Manufacturer Certification Scheme certificates that testify compliance to ISO 3834: Quality requirements for fusion welding of metallic materials.

Recently certified to ISO 3834, AWS Pipelines offers qualified and professional services in the area of welding and pipe fitting to the petrochemical and manufacturing industries.

Rental and industrial offerings

In order to better help SMEs, farmers, industrial workshops and fabricators from large to small to succeed in the leaner economy, Afrox has added several new cost-effective products to its Afrox Industrial range and launched a new rental service for its premium Miller brand. *African Fusion* talks to Dewald Bodenstein, the product manager for arc equipment at Afrox.

The newly launched 200 A, single-phase Afrox industrial MMA 221S welding machine, and the three-phase Afrox Industrial MMA 323 S.

The expanded Afrox Industrial range of affordable welding equipment was launched at the 2017 NAMPO Harvest Day Agricultural show in Bothaville in mid-May. "Our industrial range is a second-tier equipment range that better suits the cost pressures that everyone in our industry is currently experiencing," says Bodenstein.

"Available through the Afrox on-line shop (www.afroxshop.co.za), co-ops, local distributors and Afrox retail outlets throughout South and southern Africa, the Industrial range has cost-effectiveness at its starting point. "Afrox Industrial equipment targets smaller fabrication and maintenance workshops and jobbing shops that typically have to cope with a variety of work in different materials. Common features of the range include their portability, ease of use and the complete packaged offering," he tells *African Fusion*.

"At the Afrox stand at NAMPO this year, we launched several Afrox Industrial welding systems: two new MMA models; three new MIG models with multi-process capabilities as standard; and two TIG welding systems," Bodenstein adds.

The newly launched Afrox industrial MMA 221S welding machine, an inverter-based 200 A, single-phase stick welder with an all-digital display, was seen as ideal for repair workshops and general industrial applications.

"These machines also include a lift TIG capability and, for stick welding, a hot-start function to make striking easier. "For enhanced safety, they also have a Volt stop feature. Until the arc ignites, this reduces the open-circuit voltage (OCV) from 60-65 V, which is dangerous, to between 10 and 14 V," he explains.

The second MMA machine to be launched was the Afrox Industrial MMA 323 S, a 300 A, three-phase machine with a dual input voltage capability of either 380 or 525 Vac.

"Initially, we are introducing two new TIG machines, the TIG 201 P (pulsed) and the TIG 303 PU (pulsed USB), which are 200 A single-phase and 300 A three-phase machines, respectively. Both of these inverters have square-wave pulsed capabilities, while the 303 PU also has USB logging to enable welding data to be recorded and downloaded for analysis. These are high specification machines that also include digital displays and high-frequency (HF) start.

"Depending on demand, we also intend to offer the TIG 343 ac/dc PU, which, in addition to the above, offers the ac capability for TIG welding aluminium and incorporates a built-in TIG spot welding function," Bodenstein adds.

Three new Afrox Industrial MIG C (compact) systems are also now being made available: the MIG 251 C; the MIG 313 C and the MIG 403 C. "All three options are highly portable with built-in feeders. The 313 and 403 versions offer full closed-loop control and the compact range boasts multi-process capabilities, including lift TIG and MMA," he tells *African Fusion*.

"We are striving to be the preferred supplier across our equipment ranges and the improved Afrox Industrial range is an easy plug-and-play offering that is also easier on the pocket. These are cost-effective options for small and big welding tasks that can deliver quality results without the high capital costs," he believes.

The premium Miller brand rental offering

To further assist those offering high-level welding services, Afrox is now making high-end Miller equipment available for rental. This rental offering from Afrox incorporates four models from the Miller range of premium quality welding machines for large industrial applications.

"We have been the exclusive distributor of Miller welding equipment in South Africa for over 50 years. Miller welding machines are widely regarded as a superior choice for welding and provide an ideal combination of strength and refinement to get the job done," Bodenstein suggests.

Bespoke rental agreements will give Afrox customers the choice of short or longer term rentals, delivery and collection options, maintenance packages, on-site service, and complete customer support through Afrox's national Service Engineering offering.

"Benefits of the Miller equipment rental option include: reductions in costs of ownership, availability of additional and/or suitable equipment to meet changing requirements, and the machines are maintenance-free to the customer, because Afrox can take care of the servicing through the rental agreement," Bodenstein relates.

"The new rental offering is ideal for short-term projects, giving customers the opportunity to lease additional welding machinery that they may not

enhance affordability

Afrox Industrial's MIG 251 C.

The Miller Big Blue 500DX Engine drive, now available for rental from Afrox.

necessarily want or need in the long term. "The offering is aimed at the project-based market segment where equipment needs vary considerably. Rental gives our customers flexible and cost-effective alternatives to purchasing new machines," he says.

He adds that the rental packages will particularly benefit the fabrication, transport, petrochemical and mining industries and will be tailor-made and customer specific, offered on a nationwide basis in urban hubs.

The range available on rental agreement

The workhorse machine chosen for the Afrox rental offering is the Miller XMT 350. "These are multi-process power sources designed for welding using the MMA, dc-TIG and MIG (FCAW, MCAW) processes. The XMT 350 is known for its flexibility and simplicity and features auto-line technology that allows input voltage selection from single- to three-phase power supplies and comes standard with wind tunnel technology, adaptive hot start and line voltage compensation," reveals Bodenstein.

A process selector switch reduces the number of control set-up combinations and large duel digital meters are easy to view and pre-settable to make welding parameter set-up easier. Applications include petrochemical, construction, shipbuilding, manufacturing, fabrication and power generation work.

The rugged 650 A Miller Dimension 812 multi-process power source has been chosen for heavier work. These are capable of producing welds with the MIG, FCAW, MCAW, lift-start TIG, MMA and air carbon arc gouging processes. The Power sources come standard with hot start and an electrode compensation circuit to ensure consistent arc control performance regardless of the electrode size. Applications include fabrication and construction, heavy manufacturing, maintenance, repair, pressure vessel fabrication, pipe welding, shipbuilding and earth-moving equipment manufacturing and cladding.

For MIG-only use, the Miller XPS 450 is a robust constant voltage package that delivers phenomenal output characteristics from a three-phase 380 V power source. It comes standard with a four-drive-roll wire feeder that presents an adjustable run-in control enabling optimal arc starting. Additional features include trigger latch option, gas purging and burn back control and multiple inductance selection ports. Applications include medium to heavy engineering, fabrication and manufacturing of mining and construction equipment.

And for off-grid construction work, the Miller Big Blue 500DX Diesel is available. The Big Blue is a rugged diesel-driven welding power source capable of producing welds with the MMA, TIG and FCAW processes and can also be used for air carbon arc gouging. The electronic engine display simultaneously displays fuel level, engine hours, coolant temperature, oil pressure, battery volts, and engine RPM. It also tracks oil change intervals and displays engine diagnostics for quick and easy servicing.

Afrox is sub-Saharan Africa's market leader in shielding gases and welding products. "We are constantly striving to meet the needs of our customers and develop solutions that add value to customer applications. We offer the most comprehensive range of gases, arc welding consumables and equipment, gas welding and cutting equipment, and welding and cutting accessories available in southern Africa.

"With the new cost-effective additions to our Afrox Industrial offering along with rental access to the Miller machines, we are further able to help southern African companies to be more competitive and productive," he concludes.

Now available for rental for MIG and FCAW, the Miller XPS delivers phenomenal output characteristics from a three-phase 380 V power source.

Increasing deposition rates using hot wire during GMAW Hardfacing

This paper, presented at the 69th IIW Annual Assembly and International Conference in Melbourne last year by B Ivanov of EWM in Germany, describes how the GMAW process, combined with the use of an additional hot wire, can be successfully used in cladding applications to produce low dilution with significantly improved deposition rates.

Many corrosion resistant materials also have good strength and toughness. Most of them are high-value and high-price alloys. Examples include nickel alloys, titanium alloys and stainless steels.

The cladding of corrosion resistant materials onto cheaper base materials is often a very cost-effective engineering solution. There are several fusion processes providing different results in terms of deposition rate and dilution. The combination of these two factors, that is, high deposition and low dilution, is the optimal solution for the cladding process. Since dilution and deposition rate are directly connected to the welding power, however, the optimal solution is usually difficult to achieve.

This paper describes a hot wire supported GMAW cladding process and presents the potential productivity increases based on a practical example.

Surfacing of materials

The surfacing of materials or cladding is mainly used for corrosion protection; hardfacing, maintenance and repair of worn parts; or for buffer layers in mixed material joints. Typical corrosion resistant clad layers include:

Element	Composition (%)
Nickel	58.0 (min)
Chromium	20.0-23.0
Iron	5.0 max
Molybdenum	8.0-10.0
Niobium (plus Tantalum)	3.15-4.15
Carbon	0.10 max
Manganese	0.50 max
Silicon	0.50 max
Phosphorus	0.015 max
Sulphur	0.015 max
Aluminium	0.40 max
Titanium	0.40 max
Cobalt (if determined)	1.0 max

Table 1: Chemical composition of Inconel® 625 [2].

- Copper based weld overlays on steels for seawater corrosion resistance.
- Nickel (Ni) alloy 625 weld overlays onto pump, valve or sealing surfaces exposed to brackish water, seawater or sour gas.
- Stellite®21, Stellite®6 or ULTIMET® (UNS R31233) weld overlay material where a combination of corrosion and wear resistance is required [1].

Cladding layers can be between 2.0 and about 20 mm thick. They can be applied using a number of welding processes including manual metal arc (MMA), gas tungsten arc welding (GTAW), gas metal arc welding (GMAW), submerged arc welding (SAW), flux cored arc welding (FCAW), plasma transferred arc welding (PTAW) and laser deposition.

The integrity of the clad layer and adequate toughness of the heat-affected zone (HAZ) during cladding must be ensured and, at the same time, the substrate material properties must stay unchanged. A thorough understanding of the metallurgy of the base material as well as the clad material is required, especially for specific base materials such as duplex steels, tool steels, high-carbon steels or martensitic steels.

The second very important consideration is the dilution of the clad material by the base material, as dilution can have a significant effect on the chemical composition and the in-service properties of the clad layer.

Surfacing wires

One of the most widespread alloys used for surfacing by welding is an alloy based on the nickel matrix called Inconel® 625. The target of surfacing welds with the lowest possible content of iron on the surface requires materials for surfacing with the lowest content of iron in the chemical composition. For that reason, the amount of iron in the available wires and rods does not usually exceed 2.0%, and is often below 1.0%.

The Inconel nickel-chromium alloy 625 (UNSN06625/W.Nr. 2.4856) is used for its high strength, excellent fabricability (including joining) and outstanding corrosion resistance. Service temperatures range from cryogenic to 982 °C. The alloy's material composition is shown in Table 1.

The strength of Inconel alloy 625 is derived from the stiffening effect of molybdenum and niobium on its nickel-chromium matrix, thus precipitation-hardening treatments are not required. This combination of elements is also responsible for superior resistance to a wide range of corrosive environments of unusual severity as well as to high-temperature effects such as oxidation and carburisation.[2]

A reason to decrease the content of iron in a surfacing weld is an increase in the resistance to corrosion. There is a significant relationship between the iron (Fe) content and the layer's resistance to corrosion, regardless of the quality of the clad surface. Exceeding a value of 10% Fe content can cause a cracked and peeled layer of iron oxides (Fe_3O_4) to appear instead of a protective layer of chromium oxides (Cr_2O_3) on the surface. This will not protect against further oxidation (Fig.1) [3].

Surfacing processes

Welding with hot wire

Welding with hot wire offers the possibility of increasing deposition rates and therefore higher productivity for the cladding process. The process setup for TIG welding is illustrated in Figure 2.

The higher deposition rate is reached with the help of the resistive preheating of the filler wire between the contact tip and the material surface. A constant contact distance between the torch contact tip and the workpiece provides the maximum efficiency of preheating. The temperature reached in the wire de-

Welding process	% Fe in Layer 1	% Fe in Layer 2	Deposition rate kg/h]
GMAW Pulse	18.48	3.40	3.17
CMT	2.38	0.37	4.61
Time Twin	15.69	3.60	10.73
CMT Twin	2.78	0.31	7.50
GTAW Cold wire	12.74	2.26	0.75
GTAW Hotwire	7.37	1.34	1.62
Laser Cladding	16.37	3.96	5.19

Table 2: Fe content in layers 1 and 2.

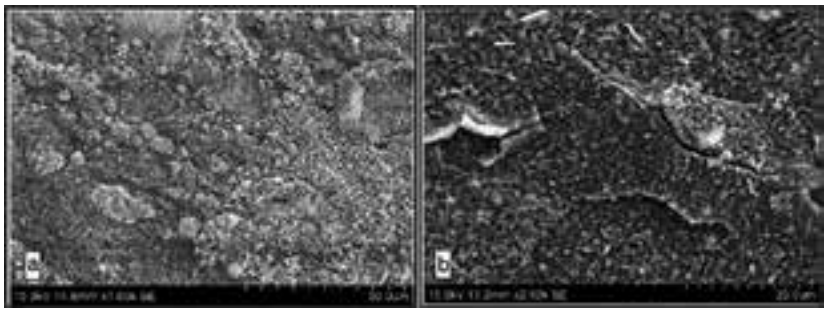

Figure 1: The surface of an Inconel 625-clad layer after a high-temperature corrosion test [3]: a) Fe content of 2,5%: b) Fe content of 10%.

pends on two factors: hot wire current, which is adjusted in the hot wire power source; and the electrical resistance of the filler material itself. The positive effect of the preheating compared to cold wire welding is shown in Figure 3. This effect can be also applied to welding processes other than TIG.

Other cladding process variants

In [5], cladding with Inconel 625 for various welding processes is investigated. Measurements of the iron content in the clad layers were taken with EDX line scans.

Energy-dispersive X-ray spectroscopy (EDS, EDX, or XEDS) – sometimes called energy dispersive X-ray analysis (EDXA) or energy dispersive X-ray microanalysis (EDXMA) – is an analytical technique used for element analysis or characterisation of a sample. It relies on an interaction of some source of X-ray excitation and a sample.

The iron content was measured in steps of 0.5 mm starting from the surface of the weld overlay to the base material. As a reference value for the dilution of the base metal, the Fe content was used. Welding processes with high energy density or ones with low welding speed (GTAW with cold wire and laser cladding) exceed the dilution rate of 5.0% iron content, while welding processes with lower heat input were shown to maintain the Fe content below 5.0%.

All samples have in common a steep rise of the iron content when approaching the base material. Table 2 shows the iron content for the two layers, and the deposition rate. The comparison shows that a process that provides a low heat input and therefore a low Fe percentage cannot achieve high deposition rates. On the other hand, high deposition processes produce the highest percentages of Fe content.

GMAW with hot wire

The use of the GMAW pulsed welding for cladding was presented in Table 2. The main disadvantage of the process is a high % Fe content in the clad layer. Combined with the limited maximum arc power and associated limited productivity in terms of deposition rate, GMAW pulsed welding is applicable only in a few cases.

The addition of filler material from outside the GMAW process could offer a significant improvement in productivity. In addition, the deposition of more filler material with a proportionally small increase in the welding power would have a positive effect on the dilution and, therefore, on the Fe content in the clad layers. The process setup is shown in Figures 4 and 5. The possible deposition rates are comparable with most twin wire GMAW processes.

Application

The application of the GMAW hot wire process is easy to setup, adjust and maintain. Highest travel speeds and highest deposition rates can be reached when the process is applied with the help of mechanised manipulators.

The welding system is put together using standard components: GMAW welding system Phoenix 551 Progress Puls (Figure 6); and an additional wire feed system with an integrated Tigspeed drive 45 hotwire power source (Figure 7).

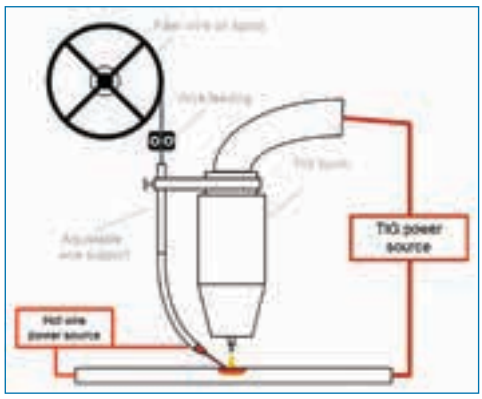

Figure 2: A welding process diagram for TIG hot wire welding.

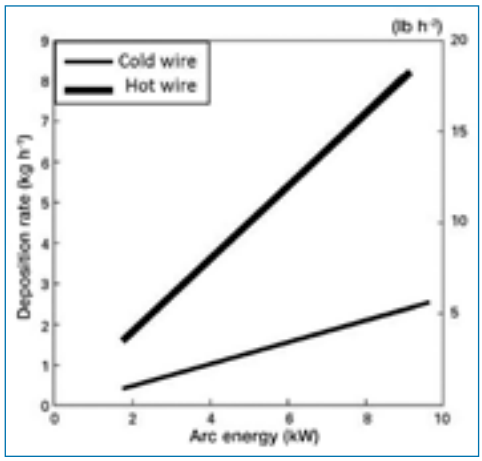

Figure 3: Deposition rates of cold wire and hot wire welding as a function of arc energy [4].

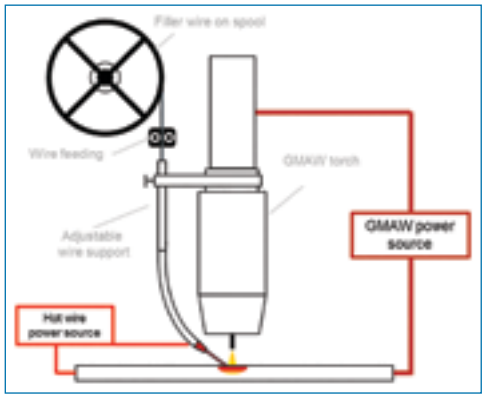

Figure 4: A process diagram for GMAW hot wire welding.

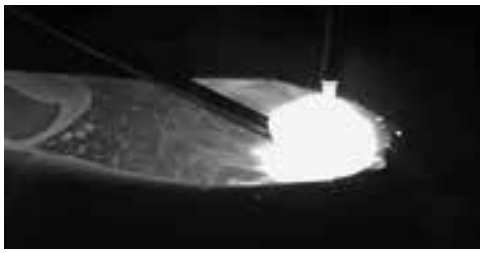

Figure 5: A photograph of the GMAW arc and the hot wire entering the weld pool.

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Figure 6:
The Phoenix 551
Progress Puls GMAW welding system.

Figure 7:
The Tigspeed
drive 45 hot wire system with its integrated power source.

The Phoenix welding system provides the GMAW process with up to 550 A in spray or pulsed mode, while the Tigspeed unit provides the wire preheating with a hot wire current of up to 180 A.

The GMAW hot wire configuration described above is being used for the cladding of alloy 625 on valves, fittings and accessories for the oil and gas industry. The individual components have diameters of up to 2.0 m and weights of several tons. The area of the surfaces, which are being clad to improvement their corrosion resistance, are also large.

Productivity and quality of the clad layers must be optimised to give the best possible outcomes for the company. Wire feed speeds of 10 to 12 m/min with 1.2 mm wire diameters for both wire feeding systems result in deposition rates of over 13 kg/h. At the same time the dilution is comparable with previously used TIG hot wire welding process. Figure 8 shows the process being used.

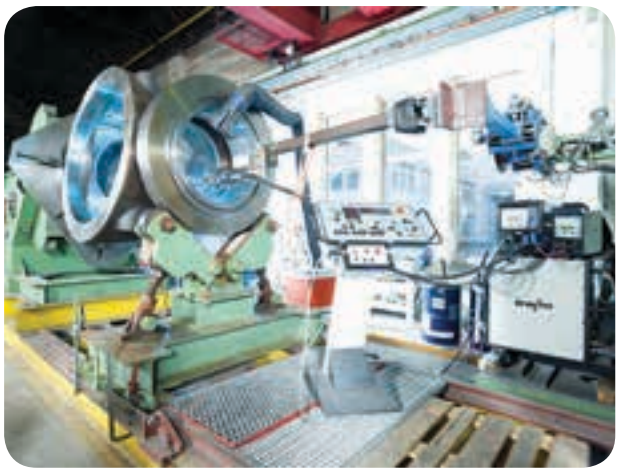

Figure 8: The GMAW hot wire welding system in use.

Conclusions

The application of the GMAW welding with hot wire support offers a realistic alternative to traditional cladding processes. It combines high deposition rate and higher productivity with low dilution and low percentages of Fe in the surface layer, which results in better corrosion resistance properties for the clad layers.

The required equipment is available as standard in today's welding technology market. All components have digital and analogue interfaces, giving the user easy tools to configure, setup and use the system with minimal investments in time and money.

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Roadmap for advanced joining and forming

EWI recently led the development of the first comprehensive US Advanced Joining and Forming Technology Roadmap under a two-year programme funded by The National Institute of Standards and Technology (NIST). Tom McGaughy, director of technology at EWI, outlines the outcomes.

The automotive industry increasingly relies on robotics to improve manufacturing processes.

EWI, supported by an external steering committee of joining and forming experts, has developed the first US Advanced Joining and Forming Technology Roadmap, having extensively canvassed leading US manufacturers, academics, industry and professional associations, and other stakeholders.

The task was to identify and rank current joining and forming challenges and to develop a list of prioritised research and development topics that would lead to differentiating competitive advantages and produce substantive economic impact.

The roadmap is the culmination of more than two years of industry canvassing across every major manufacturing segment in the US economy, incorporating input from more than 400 companies, from small family-run businesses to large multi-national conglomerates.

The importance of joining and forming

Materials joining and forming are essential crosscutting manufacturing technologies, contributing around US$200-billion to US manufactured products per year. They are closely related in terms of their applications, users, technical fundamentals, and emerging challenges. These operations are pervasive throughout manufacturers of all sizes in every sector of the economy.

Production lines often include both forming and joining processes, and design optimisation often involves assessing trade-offs between forming and joining options, as the approach used to form a component can have a significant impact on subsequent joining processes and *vice versa*.

The joining and forming areas also require similar technical understanding of materials science, heat transfer, elasticity/plasticity behaviour, and control of process equipment.

Today, there is a new wave of regulatory, economic, and technical forces impacting US manufacturers' ability to meet rapidly changing consumer demands, achieve higher levels of productivity in the face of a dwindling technical labour force, compete against lower-cost global manufacturers, and meet new and more stringent government regulatory requirements. It is clear that the US needs a renewed focus on advancing materials joining and forming technologies to address these emerging challenges and revive a critical part of the US manufacturing base.

Doing so would not only fundamentally improve the global competitiveness of US manufacturers, but would also bolster the middle class and reduce the trade balance deficit that has been steadily rising for more than two decades.

Current state of the art and existing gaps

While the volume of joining and forming operations has declined in the US over the past two or three decades, significant advancements have been made in metals forming and materials joining technologies that have reduced manufacturing costs, increased performance, and improved the quality and reliability of many of our manufactured products. However, these improvements have not been significant enough to slow the offshoring of many of these operations.

Growing use of automation has partially offset a shrinking skilled labour force and increased quality while reducing costs. Development and maturation of new joining processes such as friction stir welding and laser-based brazing have dramatically improved the ability to produce products with a wider array of metal alloys that enhance performance of aircraft, spacecraft, automobiles, and many consumer products, to name but a few.

The advancement of micro-joining processes has revolutionised the electronics and medical device industries. Advanced brazing techniques allow use of specialised ceramics, metal matrix composites, and difficult-to-weld alloys that improve performance and reliability of critical components – such as jet engines – allowing them to operate more efficiently at higher temperatures and pressures.

But many technical and business challenges impacting US industry remain, and new ones are emerging on the horizon. Today, the US is experiencing a materials revolution on a scale not seen in several decades. New ultra-high-strength steels, aluminium alloys, and polymeric and composite materials are being developed to produce dramatic performance improvements in automobiles and aircraft, fossil fuel and advanced energy infrastructures, and power generation.

New materials used in the construction of buildings ranging from homes to high-rise commercial office spaces to advanced clean-room-style automated factories are designed to improve energy efficiency and withstand natural forces from earthquakes and severe weather events. The advancement of additive manufacturing, also known as 3D printing, is opening the door to manufacturing hybrid material or multi-material products that allow the combination of a variety of metals or plastics in a single component or structure to take advantage of the economics and engineering performance of each material.

The increasing use of advanced materials creates significant challenges regarding joining and forming, particularly with hybrid or mixed-material systems. In some cases, methods of joining have

not been fully developed for advanced materials, forcing industry to use older, less efficient techniques, such as mechanical fastening.

In some cases, manufacturers are simply unable to take advantage of these new materials until joining technology catches up. Likewise, difficulties exist in the forming of ultra-high-strength steels and certain aluminium alloys now gaining greater use in the automotive industry. Current metal-forming technology can often result in high scrap and re-work rates that impede broader application of these emerging materials.

Key gaps and needs

Assessment of industry feedback during the roadmap development process identified the following overriding needs, most of which were broadly voiced across nearly all manufacturing sectors:

- Implementation of emerging materials to optimise product performance and cost, as well as new manufacturing processes, to form and join a wide range of high-performance materials and material combinations.
- Increased access to advanced computer-simulation methods to optimise designs and better predict product performance to satisfy increasing design requirements, reduce the need for physical prototypes, and reduce material or product qualification costs.
- Reduced manufacturing costs and increased product reliability by ensuring 100% first time quality, requiring more robust manufacturing processes in combination with new real-time process monitoring and control approaches to detect and correct non-conformances.
- Development of new test methods, baseline data and standards for many new manufacturing process variations to ensure robust and consistent manufacturability.
- Development of more agile, highly automated manufacturing operations that can efficiently and economically produce a wide variety of components in small batches (high mix, low volume).
- Development of near-net-shape processes to produce complex parts with fewer operations, requiring new design tools, cost models and process parameter maps to help manufacturing engineers select and implement processes that will shorten production cycle time and potentially reduce material costs.
- Expansion and maintenance of a skilled work force capable of developing and applying advanced forming and joining technologies.

Roadmap recommendations

Analysis of the data obtained from extensive industry canvassing efforts led to the series of recommendations outlined below. Successful completion of these recommended actions would measurably advance the state of the art in materials' joining and forming technologies, provide US manufacturers with critical capabilities that address today's and tomorrow's challenges, and enhance manufacturing competiveness. These recommendations are listed in no particular order and details of each recommendation are discussed in the complete roadmap document.

- Workforce skills development encompassing the emerging and incumbent labour force, including technician, skilled trades, and professional staff.
- Development of advanced weld distortion control methods (adaptive welding).
- Development of next-generation prediction tools, including automated materials exploration and optimisation for joining processes.
- Development of advanced high-productivity fusion processes.
- Development of joining processes for hybrid materials and mixed metals.
- Implementation of real-time advanced measurement, prediction, and control technologies for forming and joining processes.
- Development of practical warm/hot forming technology for aluminium, titanium, nickel, and steel alloys.
- Development of advanced technologies for producing lightweight high-strength forgings.

US manufacturers will gain differentiating capabilities if progress can be made on these priorities and technology advancements are delivered to the manufacturing floor.

These advancements have the potential to reduce waste and rework, increase productivity of joining and forming operations, shorten product development cycles, and allow the manufacture of products with material combinations and performance characteristics currently not feasible with existing technology.

Friction stir welding increases the ability to produce products with a wider array of alloys.

If the US leads the development of these technical advancements, manufacturers will reduce or eliminate current gaps in production costs and create opportunities to be first to market with goods that would otherwise be difficult to manufacture elsewhere.

Next Steps

In response to the needs identified and vetted through this roadmapping effort, EWI has created a series of Grand Challenge technical teams to develop multi-disciplinary solutions that will bridge these gaps across broad manufacturing sectors. Current Grand Challenge focus areas include:

- Ensuring first-time quality.
- Enabling greater use of automation.
- Developing and optimising technologies for vehicle lightweighting.
- Maturing additive manufacturing to produce end-use goods.

The First-Time Quality team is aiming to advance development of in-process monitoring and control technology with closed-loop feedback to allow real time adjustment of multi-process manufacturing operations.

The Advanced Automation team is seeking to develop technology that increases flexibility and adaptability of complex, skills-based manufacturing operations that are difficult to replicate.

The Lightweight Vehicles team is seeking advancements that allow improved processing and fabrication with advanced lightweight materials or combinations of advanced materials, while the Additive Manufacturing team is working to move AM from a predominantly prototyping technology to a more mature capability that manufacturers of all sizes can readily implement for the production of a wide array of end-use products.

The specific activities undertaken will be the subject of future papers.

Nexelia – gas solutions for laser

As part of the Nexelia offering for automotive and metal fabrication, Air Liquide has developed a unique set of proprietary nozzles for modern laser welding processes, each adapted to specific applications. *African Fusion* finds out more from package gases manager, Rolf Schluep and international senior expert, Rob Lawrence.

"As today's laser welding technology progresses towards higher production rates, it also has to overcome key challenges," begins Schluep. "Laser power is increasing and the technology is becoming easier to handle. Additionally, solid-state technology has become more affordable, and, as automation progresses, capital expenditure is simpler to contain," he says.

In addition to the type and power of laser source, weld quality and operations are also influenced by choice of shielding gas and how it is controlled at the point of use. "Whatever our customers need to maximise their welding quality and operations, Nexelia for laser welding can offer an optimised solution," he tells *African Fusion*.

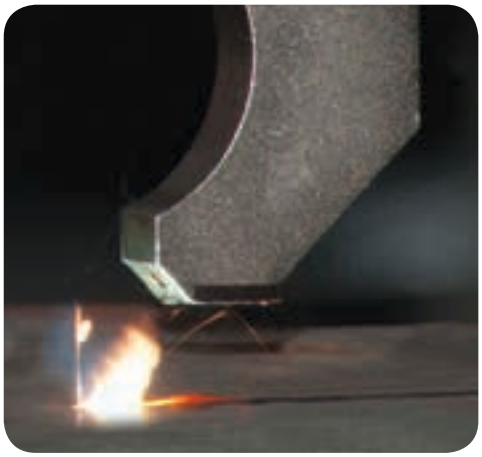
Laser welding is now being widely adopted in the automotive sector by both OEM and first tier suppliers who require welding of dissimilar materials in order to produce a tailored blank. Additionally laser welding of gears and transmission components is becoming ever more popular. Apart from this, tube welding applications also benefit from the inherit advantages of laser welding. "For stainless steel tubing, high-speed and accuracy are essential elements for the manufacturing process," adds Lawrence. "Perhaps surprisingly, laser welding is also now commonly used for carbon steel welding, with the technology having matured to the point where the costs per part are competitive," he says.

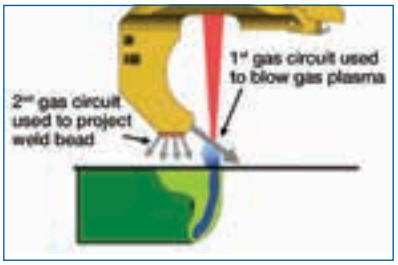
Nexelia – Driving performance to the next level.

"Lasers are ideal for welding dissimilar materials and, due to the very narrow heat affected zones, using lasers to weld zinc-plated materials has now become a mainstream solution for non-critical applications. Zinc-coated thin steel body panels are now routinely being assembled using CO_2 lasers, or increasingly, solid state fibre lasers," Schluep reveals.

While Air Liquide has long been a supplier of both high quality lasing and process gases required for welding and cutting applications. Commonly used gases are N_2 and O_2 for cutting and argon, helium and argon/helium mixes for laser welding. "Our Nexelia offering takes laser welding well beyond simply supplying gas," he continues.

"Nexelia differentiates Air Liquide by not only offering the requisite gas at the highest levels of quality, we also add specialist process services such as audits to help customers optimise process efficiencies and minimise costs. Application knowledge and solutions are offered through our proprietary range of laser gas nozzles that are purpose-designed to suit various application requirements," Schluep explains.





Nexelia's Nozzle-Jet consists of two independent gas circuits: The first argon stream blows any plasma or fume clear of the laser's beam line, while the second 'diffuser' shields the hot weld seam.

"Combined, Air Liquide's Nexelia benefits customers in a number of ways. These include better quality welds with less rework and more efficient gas use, which results in inherent cost savings as well as less post-weld cleaning, to name but a few," Lawrence tells *African Fusion*.

Innovative laser nozzles

From the laser applications perspective, the Nexelia offering is carried via three custom-designed and patented gas nozzles. "The first is our Laser Nozzle-Jet, which has been developed for laser welding metal tubes from rolled sheet, such as the stainless tubes. "The underpinning function of this nozzle is to avoid any gas plasma above the weld pool. Gas plasma and fumes rising up from the molten weld pool tend to diffuse the weld beam, reducing its efficiency," Schluep explains.

"To avoid this, helium has become the gas of choice in these applications, because of it's high ionisation potential, which reduces plasma formation. By using Air Liquide's Nozzle-Jet, the use of helium is no longer required to achieve a quality laser-welded seamed tube," he notes.

Lawrence adds: "Helium is one of the most expensive gases on the market, so if argon can be used in its place, operating costs can be significantly reduced."

Describing how Nexelia's Nozzle-Jet works, Schluep says that it consists of two independent gas circuits. "The first argon stream blows gas forward across the base material contact point of the laser beam. This stream shields the weld pool while blowing any plasma or fume clear of the laser's beam line.

The second argon gas stream is diffused directly onto the solidifying weld pool behind the beam preventing surface oxidation. The combination gives a weld quality and finish that is as good, if not better, than that produced with helium and a conventional gas shroud.

In addition to the lower cost of argon, Lawrence adds that helium is

only available in cylinders, while argon can be supplied in bulk tanks or a compact high-pressure skid. These delivery modes come with further associated cost savings and benefits: "It prevents having to change cylinders or bundles several times a day and reordering cylinders," he adds.

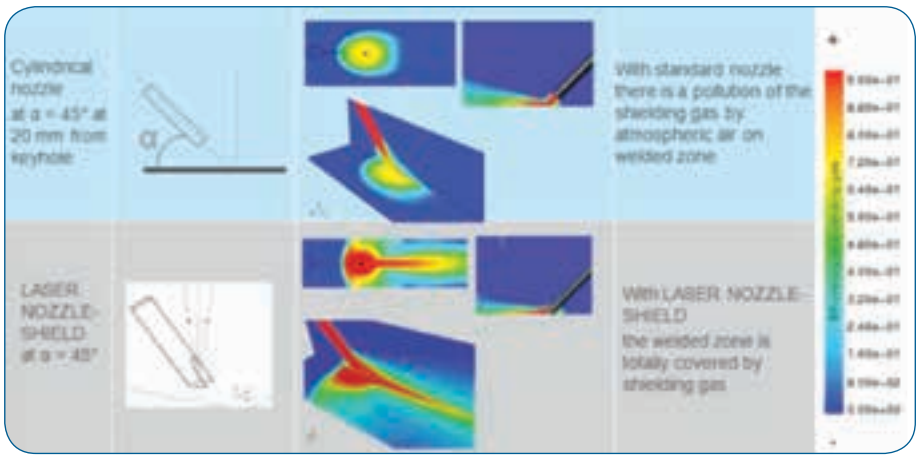
Nozzle-Jet enables 100% argon to be used; even with high-power lasers such as 12 kW CO_2 sources, reducing the associated fume and spatter. The trailing gas shield further enhances weld seam smoothness and brightness.

The second Nexelia application solution for laser welding is the Laser Nozzle-Shield, which avoids atmospheric contamination of the weld seam when using high-powered lasers travelling at high speeds. The Laser Nozzle-Shield is designed for use with argon or argon-helium mixes and allows the gas flow to be optimised to shield the tail of the weld.

Open at the back, this gas nozzle has a patented design with lateral walls that produces a laminar gas stream across the top of the extended weld bead. Emulating the effect of a trailing shroud, the Nozzle-Shield reduces discolouration of the welded seam, which will result if the atmosphere is allowed to come into contact with hot surface metal.

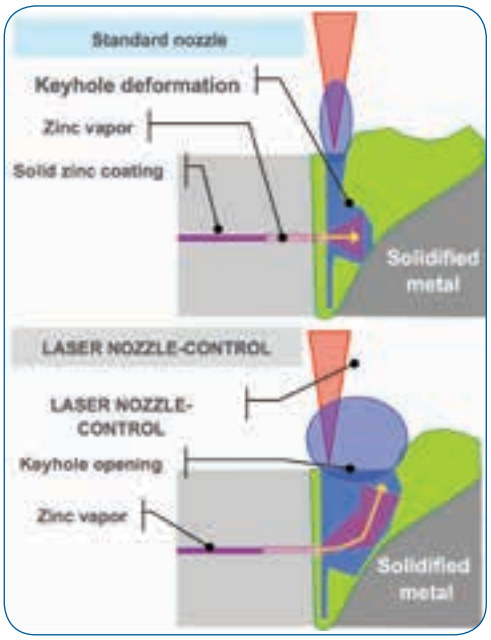
"This keeps the seam bright and reduces downstream cleaning operations. The higher the welding speed, the longer the trailing shield will need to be and the more important this technology is likely to become," Schluep adds.

A third Nexelia application technology has been specifically developed to solve problems associated with welding zinc-coated plate. "Called Laser Nozzle-Control, this technology aims to improve laser keyhole welding of galvanised or zinc coated sheet material. There is a rapid formation of zinc vapours when laser welding these materials which become entrapped in the solidifying welding pool causing porosity," Schluep explains.



***Above:** The lateral-walls design of Laser Nozzle Shield provides a laminar gas flow in the interaction zone for better shielding of elongated seams.*

***Right:** Laser Nozzle-Control produces an elongated molten pool during keyhole welding that enables zinc vapour to escape while still maintaining a narrow weld seam.*

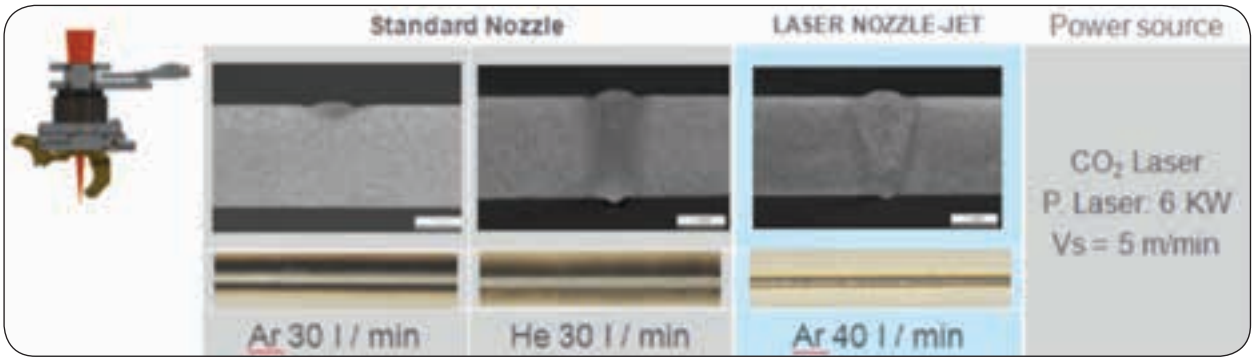


In conventional laser welding, this was overcome by mechanically holding a wider gap width so as to increase the size of the weld pool and keyhole. This allows more time for the zinc vapour to escape from the weld pool before the molten pool solidifies. It also increases equipment and set up complexity, slows down welding speeds and increases the heat affected zone size.

"Nozzle-Control allows the keyhole to become elongated, rather than widened, allowing the weld pool to remain liquid for a longer period of time without any additional clamping aids. As the keyhole becomes elongated it allows the zinc vapour to escape, without sacrificing penetration or weld speed," he says.

"So our Nexelia offering for laser welding includes three nozzles, offering different features – Nozzle-Jet, Nozzle-Shield and Nozzle-Control – each of these suits a different application. All of these can also be retrofitted to an existing CO_2 or fibre laser from any of the OEMs," Lawrence tells *African Fusion*.

"All of our Air Liquide Nexelia offerings combine gas, industrial process expertise and application technologies, with a commitment to improve productivity and product quality for customers. Nexelia for Laser Welding is an all-in-one solution designed to optimise laser weld quality and costs by using a combination of inert gases – argon, helium, or a mixture of both – and innovative nozzles," Schluep concludes.



The Nozzle-Jet enables the deep penetration associated with helium to be achieved while using cheaper argon gas.

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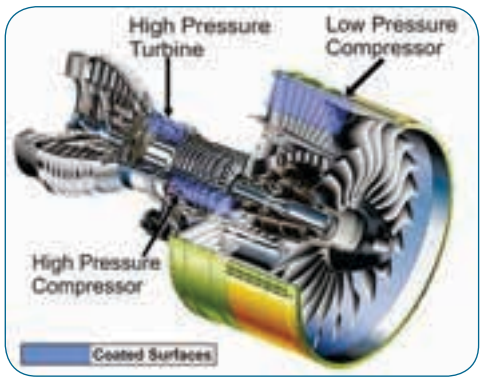
Thermal spray solutions for turbo machinery

Thermally sprayed coating solutions from Thermaspray ensure protection from wear, erosion and corrosion for a wide range of components found in the turbo machinery and rotating equipment industries.



Areas in a gas turbine that can be coated with thermally sprayed abradable materials.

The application of a thermally sprayed coating leads to extended service life, reduced maintenance, increased uptime and production and, ultimately, lower operational and ownership costs.

Corrosion and erosion of components affect a wide range of industrial applications and products in the processing and manufacturing industries, including the turbo and rotating machinery sectors. These types of wear result in a reduction in component service life, eventual failure of components, increased maintenance frequency with associated costs, costly downtime and subsequent production losses.

Thermally sprayed coatings offer a solution; providing excellent protection against abrasion, corrosion and erosion, thermal degradation and high temperature oxidation on components including turbines and compressor rotors spindles, shafts, impellers, sleeves, bushes and pistons, to mention just a few.

Thermal spraying comprises various processes, such as HVOF (high velocity oxy-fuel), flame- or wire-arc spray and plasma-transferred arc (PTA). In these processes, a fine powder – usually metallic or non-metallic powders such as ceramics – is fed through a chamber by a gaseous carrier, which is then ignited. The powder is melted or softened and is then deposited onto the surface of the component being coated.

Thermal spray coatings for the turbo machinery industry includes thermal barrier coatings, wear control coatings, corrosion prevention coatings, high temperature coatings, oxidation resistant coatings and solid-particle erosion resistant coatings. Wear control technologies such as the application of these coatings are essential to modern high performance, high quality industrial turbines.

The ability to 'tailor design' thermal spray powders and spray them onto a surface to achieve a designated hardness range using carefully monitored microstructural control has had a revolutionary impact on the service-life of turbo machinery.

Abradable thermal spray coatings, also known as clearance control/seal coatings, are successfully used in steam turbines and various other types of turbo machinery applications to reduce leakage gaps between stationary and rotating parts.

The abradable thermal spray coatings readily and sacrificially wear away when in contact with a rotating part. The resulting debris created by the abraded coating is soft (relative to the rotating surface) and fine enough to exit the system without causing erosion on other components of the engine. Abradable coatings can be applied by the flame (combustion) spray process or the plasma spray process. The key performance criteria for abradable seal coating systems include:

- Rub compatibility against blades, knife fins or labyrinth seals under various conditions.
- Coating cohesive strength.
- Oxidation resistance at high temperatures.
- Corrosion resistance in aqueous or chemical fluid or gases.
- Resistance to corrosive attack at elevated temperatures.
- Sintering resistance at elevated temperatures.
- Thermal shock resistance, and.
- Resistance to solid particle erosion.

Applied to components such as labyrinth seals, impeller eyes, boss landings and balance drums, abradable coatings can be tailored to provide the required resistance to temperature (oxidation) and corrosion while adding clearance control for optimised efficiency.

Abradable thermal spray coatings are highly effective in reducing emissions and fuel consumption in turbomachinery. These coatings must satisfy two conflicting requirements. They must be abradable (porous), but equally mechanically stable in the harsh operating conditions of a gas turbine. Therefore, the ideal solution for gas turbines – and, more recently, steam turbines – is abradable coatings that allow rotating compressor or turbine blades to cut their own gas seal inside their casings, minimising losses and improving fuel efficiency.

Thermal barrier coatings can significantly increase turbine efficiency by allowing higher firing temperatures while reducing component thermal fatigue, warpage, oxidation and cracking. Wear control coatings can prolong the life of critical turbo machinery parts up to ten-fold, and corrosion prevention coatings can dramatically reduce corrosion damage while providing a smooth aerodynamic surface on compressor blades and stator assemblies.

Turbine components exposed to corrosion at temperatures greater than 538 °C not only degrade faster than at lower temperatures, but are also subjected to cracking due to thermal fatigue and cycling. High temperature-resistant coatings diffuse into the substrate, creating a nearly impenetrable surface that can reduce scaling and cracks due to thermal cycling. High temperature oxidation, a typical condition found in gas turbines, is mostly responsible for premature failure of 'hot section' components.

Oxidation resistant coatings impede oxygen penetration while providing a sacrificial layer capable of protecting the part between overhauls. Solid particle erosion is most responsible for premature turbine failure and solid particle erosion coatings are specifically designed and tested for this environment and have proven effective in extending the life of critical steam turbine parts.

The full range of these coatings is available from Thermaspray's well-equipped facilities in Olifantsfontein, Johannesburg, and joint venture company, Surcotec in Cape Town.

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3D printing enabled by Fronius' CMT

At the BED stand at Machine Tools Africa (MTA), which was held during May 2017, Fronius demonstrated the 3D-printing/additive manufacturing capability of its CMT welding process. *African Fusion* talks to BED's welding product manager, Craig Bister, and Thomas Hiermayr, Fronius' sales manager for the Middle East and Africa.

Among the demonstrations of Fronius welding equipment taking place on the BED stand at MTA this year, was a Kuka robot programmed to create 3D-printed metal vases using Fronius' cold metal transfer (CMT) welding process.

"While what we are doing here is an 'eye catcher', it demonstrates a very real metal-printing capability. We are making vases in interesting shapes by building up 204 layers of CMT-deposited weld runs on top of one another," says Hiesmayr.

"But globally, we now have industrial customers using the process to manufacture complex components and shapes such as propellers and wind tower blades," he adds.

The process can be done with any industrial robot capable of manipulating a CMT welding torch. Welding starts on a flat metal sheet, but no complex moving bed is required. The shape is simply programmed into the robot and, because the CMT process is relatively cold, the welding can often be done as a continuous layer-on-layer process.

"When milling intricate shapes such as lattice structures where material has to be removed for lightweighting, 80 to 90% of the expensive base materials is wasted. Modern 3D printing techniques puts the materials exactly where they are needed, minimising waste and its associated cost," says Hiesmayr.

Most metal 3D printing systems are complex and expensive, based on laser sintering using machine beds that index downwards during the build. The CMT process with a robot, while not nearly as accurate, enables a rough shape to be established at a much lower cost. This can then be final-machined – to the accuracy and finish required – quickly and with minimal material loss.

"Cranfield Institute of Technology in the UK, for example, is using our CMT process with ABB robots to manufacture titanium components for the aerospace industry – and confidence in the technology is developing quickly," Hiesemayr tells *African Fusion*. "These are real components that are machined after 3D-printed and then ready for use in aircraft," he says, adding that quantities from one-offs to production runs can be accommodated.

"What you see here is just the beginning. 3D printing and additive manufacturing are part of a modern trend that is here to stay and we are actively looking for opportunities. All that is needed to get started is a Fronius welding system with a CMT capability and a small robot. We believe this could be the most cost-effective way to adopt this new manufacturing trend," Hiemayr suggests.

At Machine Tools Africa 2017, an industrial robot and Fronius' CMT welding process was demonstrated manufacturing a 3D-printed steel vase.

Also on show was the new Fronius TPSi MIG welding system, which is now CMT ready. "A CMT module can be added, along with the CMT pull torch with its wire buffer, to add full CMT functionality to the system," continues Bister.

"These machines are excellent for engineering companies, fabricators and welded component manufacturers," he says. "With an array of modern features such as pulse multi control, penetration stabiliser, arc length correction and the modern digital displays and input controls, Fronius' TPSi offers unparalleled welding performance. After a short basic training session, most welders are easily able to manage the machine and they quickly come to enjoy its unique feel," Bister adds.

He adds that the new Fronius TPS 270i MIG/MAG machine has also now become very popular with automotive panel beaters that are now having to do more and more aluminium welding.

"Fronius is very strong in the automotive industry in South Africa. CMT has been specified for the manufacture of the new BMW XT line, with production starting in October this year, and for component suppliers such as Benteller, which now has a total of 22 Fronius CMT Advanced systems spread between its PE and Alrode South plants," he concludes.

Advanced orbital TIG welding

Having recently become the southern African distributor for Polysoude orbital welding systems, on May 19, 2017, Renttech SA held an orbital welding open day at its Secunda branch. *African Fusion's* Peter Middleton attends and talks to welding specialist, Eduan Naude.

Renttech SA, according to Naude, has been looking at how to help clients to implement more automated solutions for several years. "To improve productivity and quality, we know that out fabricators have to adopt automation to remain competitive against imports," he begins. "For several years now, we have been looking for new opportunities and partners that could help us improve our offering and the capabilities of our local industries," he says.

Hence the signing in November 2016 of a partnership agreement with Polysoude, an acknowledged global leader in orbital TIG welding technology.

"While orbital TIG welding is not unknown in South Africa, systems have generally been supplied from overseas and most have remained locally unsupported. In Polysoude, we have found a state-of-the-art equipment developer willing to train our local Renttech team and to offer continuous and ongoing welding and technical support," Naude adds.

Why is orbital welding important? "We have seen a serious shortage of the number of skilled welders required in the tube and piping market, which is currently being filled by importing OCN (other country national) welders." Naude responds.

"We believe it will be far better to put in some automation and then upskill our own people to operate these. Orbital welding systems take the manual manipulations skills out of welders' hands, but the technical skills to prepare the joint and set up the equipment 100% correctly remains an essential aspect of the process," argues Naude. "This requires a sound knowledge of the process and ongoing attention to the finer details," he adds.

Naude has significant experience in orbital TIG welding, having spent years producing joints for the reheaters and superheaters for the Medupi and Kusile new-build projects. "This work involved producing 132 000 orbital welds over a six to seven year period. And while this work is now completed, the project highlighted the value and possibilities available from the process," he notes.

"We now have the experience and can offer training, procedure development, welding support and technical services from our nationwide footprint of branches, and we can reference some high-level successes from the past. In addition, Polysoude has a massive amount of global experience that it is willing to share with us, and an R&D capability that we can access for customised solutions and/or procedure development," Naude assures *African Fusion*.

Outlining the key principle of Polysoude orbital welding solutions, Naude says that a TIG welding torch travels around the tubes to be joined, guided by an orbital welding head clamped onto the pipe.

Systems are available for tube-to-tube; pipe-to-pipe; and tube-to-tube sheet welding; and butt welds, fillet welds, flange joints, bends, T-fittings and valves on a comprehensive range of tube and pipe material types can be accommodated.

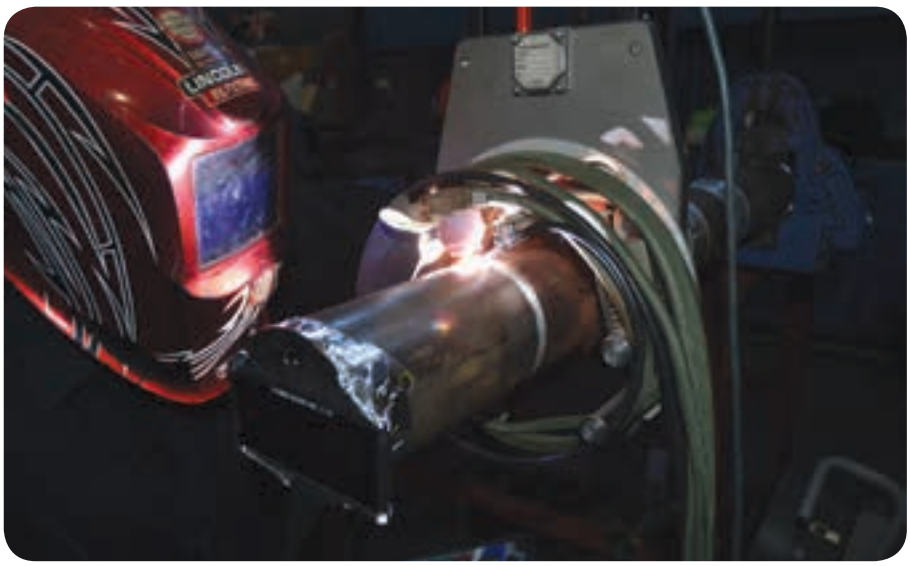
For thick-walled piping the use of narrow-gap technology, which reduces the total amount of weld metal required by reducing the pipe-end preparation – in some cases to 3.0° – makes the technology attractive with regard to weld speed and quality.

"As a company strong in the petrochemical industry, we see significant opportunities there, but in respect of orbital TIG welding particularly, our current focus is on power generation on the repair and maintenance side. This work typically involves joining new to old piping, which comes with issues such as pitting corrosion, out-of-roundness and fit-up mismatch, all of which require robust welding systems and procedures for success," Naude tells *African Fusion*.

He cites a current trial involving new-to-old boiler pipe of varying sizes. "Here, the challenge is to develop a program and procedure robust enough to handle misalignment and ovality," he reveals.

For pipes of this size, Polysoude's open welding heads are used. "Open welding heads are equipped with a TIG-torch with a gas shroud, so the gas shielding is limited to the area around the weld pool, as it would be if manual welding. Polysoude open heads can accommodate tube and pipe sizes of up to 275 mm and down to 8.0 mm," he notes.

By utilising various weld heads this range is extended from as small as



Eduan Naude demonstrates a Polysoude orbital welding solution at Renttech's Secunda premises. A TIG welding torch travels around the tubes to be joined, guided by an orbital welding head clamped onto the pipe.

arrives in SA

1.6 mm tubes to heavy-walled vessels several metres in diameter.

"As with most pipe-to-pipe welding, for this trial we are using a J-J preparation for the weld joint. This reduces the amount of fill needed and it provides a landing nose for the root. The nose makes it easy to butt the pipes together where mismatch is common on the root fit up. The nose of the J-prep provides material for the root, while a small amount of wire is added, smoothing out the mismatch," Naude explains.

"Once the root is established, we increase filler wire and weave for subsequent passes, with the J-prep reducing the amount of filler metal needed to complete the joint," he explains.

The heart of the orbital system for this application is Polysoude's P6 TIG welding power source with its integral orbital welding control system. These units are high-precision power sources with guaranteed precision of within 1.0 A at currents below 100 A and 1.0% thereafter. Depending on the applications, unpulsed, low frequency thermal pulsing (up to 10 Hz) and arc stabilising higher frequency pulsing of up to 10 kHz is available. The combination of all of these options offers almost unlimited waveform control.

Wire feed, gas and orbital head controls are also built into the P6 and directly linked to the welding current. Due to the different welding positions experienced as the torch goes around the pipe, different sectors are programmed with different sets of parameters. "Across the top of the weld, 45° either side of the crown of the pipe, welding is in the flat position. We generally start the weld before the crown and travel up and over. The second sector will then be in the vertical down position, the third will be overhead and the fourth sector will be vertical up," explains Naude.

"In the first flat sector, before the heat builds up, a little more current and slower travel speeds might be needed. In the overhead position on the opposite side, however, the pipe will have heated and the weld pool will tend to fall out of the joint, so the current might need to be backed off to ensure the weld pool does not get too fluid," he explains.

The Polysoude system can be programmed for multiple sectors. Parameters can be changed four or eight times

Parameters can be changed four or eight times per cycle so that they perfectly match the welding position, the penetration requirements and the prevailing heat in the pipe.

per cycle so that they perfectly match the welding position, the penetration requirements and the prevailing heat in the pipe.

"Also on high-level piping such as P91, the QC (quality control) function built into the P6 power source is being very well received. The parameters of every weld performed in each sector are automatically saved along with a time stamp and a unique traceability number," says Naude.

"A QC controller can take his flash drive, plug it into the USB port in front of the unit and download the data of all welds performed. He can then go back the office and evaluate each segment of each weld to check for possible out-of-spec incidents.

"By flagging these and linking the information to an exact sector position around the weld, NDT inspectors can be directed to the most likely problem areas," he adds.

Naude warns, however, that process success is not guaranteed by the use of Polysoude equipment alone. "Previously people would buy a system and then start to work out how to prep the pipe, purge the inside seam, position and clamp the pipes together and manipulate the orbital heads onto the weld seam."

Renttech can offer the whole solution, starting with the development of a repeatable welding procedure to produce the joint quality required. "We will also supply or develop: the equipment to cut the J-preps on pipe ends quickly and accurately; the clamping systems to align the pipes to be welded; mandrels or any external systems necessary to

The heart of the orbital system for this application is Polysoude's P6 TIG welding power source with its integral orbital welding control system.

mount the orbital heads; and, through Huntingdon Diffusion Techniques (HFT), the internal gas purging systems that protect the inside seam," Naude informs *African Fusion*.

"We also offer separate tacking systems from our Uniarc range to improve the usage factors of the orbital equipment. Rather than tie up an expensive orbital head for tacking, a separate team can be preparing and tacking joints ahead of the orbital system to minimise joint cycle times," he explains.

"We also offer the full consumable range, from the tungstens to the feed wire spools. Polysoude wire feeding systems use from 0.5 kg to 15 kg spools, so we can access the full range of MIG wires for use with the process – and as part of program development, we can perform consumables' tests according to individual customer specifications and requirements.

"For high-integrity applications that are currently completed using manual TIG welding – using welders with very high-level skills – the labour costs often make up to 80% of the total project costs.

"By using orbital technology and redeploying the welders to operate these systems, the total welding time can be significantly reduced, while the rework percentages almost eliminated. Total project costs are, therefore, radically reduced, directly benefitting the bottom line," Naude concludes.

Sky Hill boldly expands local

African Fusion's Peter Middleton visits Hydra Arc's Sky Hill engineering, fabrication and machining facilities in Secunda and talks to engineering manager Ewan Huisamen and Gert Swanepoel, the superintendent of the state-of-the-art machine shop now being finalised in Bay 4 of the facility.

From its roots as a supplier of specialised welders into the local petrochemical industry in Secunda, Hydra Arc has grown into a leading South African provider to South and southern Africa's petrochemical, power, mining and minerals processing industries. Services offered include: plant refinery maintenance and specialist turnaround contracts; the fabrication of heavy equipment, modular plant, pressure vessels and water tanks; and turnkey onsite construction services and repairs.

In addition, in spite of current lean times with respect to new investments in plant development, which is particularly acute in the heavy fabrication sector, Hydra Arc is currently undertaking a massive expansion to its Sky Hill facility to position the company as the 'can-do' destination for local and regional work that can currently only be accommodated overseas.

"From a machining perspective, we know of several cases where large components had to be sent to China for machining after being fabricated here," Huisamen tells *African Fusion*, adding that the lack of large machining capacity also results in whole fabrication contracts being awarded overseas – in spite of the huge associated transportation costs.

The Sky Hill Heavy Engineering facility was opened in October 2009 to service the growing need for replacement and new plant components. Notable completed projects include five 446 t, 59 m propylene bullets manufactured in 2013 and heat treated as a single piece in the company's purpose-built 66 m furnace; and the fabrication of 24 interconnectable plant modules for Sasol's Coal Tar Filtration East (CTFE) project, several of which have mass of over 400 t.

"We have pioneered the local fabrication of a new approach to plant design and construction, an approach that strives to maximise the amount of factory-based fabrication and minimise onsite construction time," explains Huisamen. "We were able to complete the fabrication of all five bullets, under factory conditions, in a little over six months," he claims, "a task that has historically taken up to several years to complete if undertaken onsite," he points out.

With a length of 500 m and a 23 m width, the near-complete Bay 4 of Sky Hill features a hook height raised to 19 m and a total lifting capacity of 1 500 t. Most notably, a state-of-the-art, machine shop is currently being installed to complete the company's factory-based manufacturing capability for heavy modules and plant equipment.

The centrepiece of the new bay is a tandem horizontal boring mill from TOS Varnsdorf, the first machine of its kind in the world.

This machine consists of two milling stations that travel along opposite ends of a 33 m common rail, allowing two independent machining operations to be completed on the same equipment simultaneously. A floor-level bed 36 m long by 8.0 m wide sits in front of the rail and incorporates two rotary platforms that can handle 60 and 40 t workpieces, respectively.

"Setup times will be halved on very big fabrications, as we have the capacity to machine both ends at the same time. Machining of 33 m in the x-, 5.0 m in the y- and 1.0 m in the z-direction can be accommodated on fabrications of up to 5.0 m high," says Swanepoel.

"From years of experience on boring mill work, we know the challenges and where the time constraints are. With this machine, along with the work flow and capacities of the supporting machines, we aim to provide a cost-effective and time-saving service that is at or above international quality standards," Swanepoel explains.

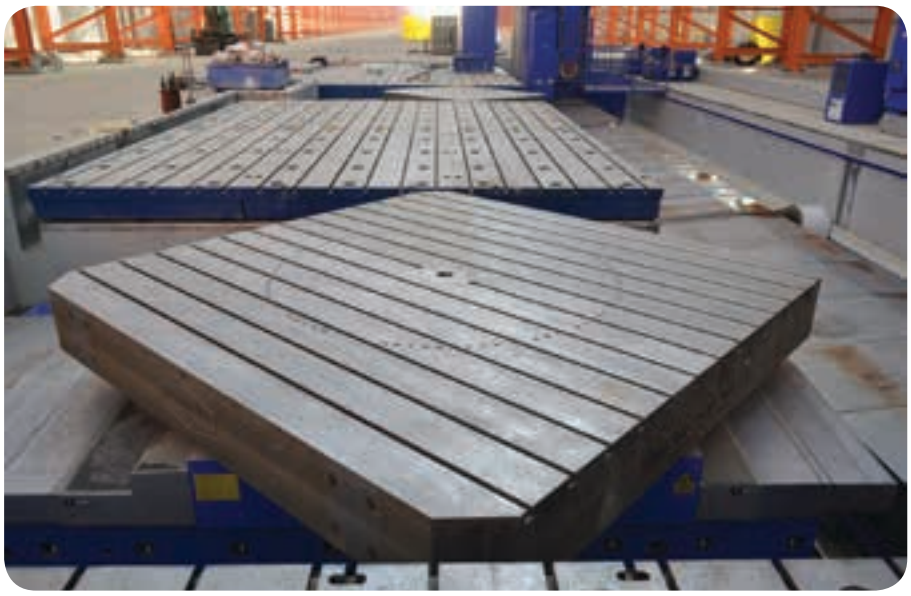
Critical to the modular plant approach is that, once onsite, interconnectivity with other modules is seamless and precise. In spite of jigging and accurate clamping, machine tool tolerances are impossible to achieve through fabrication alone. "This tandem TOS Varnsdorf boring mill allows us to machine heavy plant modules, pressure vessels, columns or heat exchangers to the precise tolerances required. It gives us a capability previously unavailable anywhere in Africa," Swanepoel says.

In addition to the new Bay 4 and its machine shop, Bays 1 to 3 at Sky Hill are also being extended to the full 500 m length. "We have to move our heat-treatment furnace to accommodate the expansion and, in the process, we intend to upsize it to 15×15×80 m," Huisamen reveals.

Maximising local skills

True to its original roots, Hydra Arc prides itself on skills development and the use of local skills. On the opposite side of the road to the Sky Hill facility is the company's Mshinwami Training

capability



Above: A floor-level bed 36 m long by 8.0 m incorporates two rotary platforms that can handle 60 and 40 t workpieces, respectively.

Right: One of the two milling stations that travel along opposite ends of a 33 m common rail.

Left: The world's first TOS Varnsdorf tandem mill being installed at Hydra Arc's Sky Hill facility just outside Secunda.

Below: In addition to the new Bay 4 and its machine shop (left), Bays 1 to 3 at Sky Hill are also being extended to the full 500 m length, with the heat-treatment furnace being moved and upsized to 15×15×80 m.

Academy, with the capacity to train up to 1 000 artisans every year. "This highly successful business, which feeds the needs of the Hydra Arc Group as well as the country's fabrication industry, is a vital component for economic growth," Huisamen suggests.

Mshiniwami offers practical skills development in boilermaking, pipefitting, welding and grinding, with the more competent trainees having the opportunity to complete their trade tests and to become fully-fledged qualified artisans.

"We are striving to become self sufficient with respect to local skills within the next four years," predicts Huisamen, "which means that we will no longer need to use any OCNs, even for the higher level welding skills," he says.

He cites several ongoing and in-house projects used to give trainees opportunities to develop experience: the TIG and stick welding of 3CR12 water tanks and their carbon steel support structures; the manufacture of the structural steelwork for the bay expansions; the modification of shipping containers for use as site offices; and the fabrication of skids for the company's in-house diesel generators, to name but a few.

"In lean times, we deliberately strive to find in-house work for our people so that we don't have to lay them off," he explains. "In the long term, this not only leaves us with a stronger infrastructure, it also ensures we develop loyal, skilled and experienced employees," he says.

"While current work is mostly related to shutdowns or turnarounds at Sasol, SAPREF and Chevron, our current investments in Sky Hill clearly demonstrate our faith in the future of South Africa, its fabrication industry and the economy in general," Huisamen concludes.

The Hydra Arc Group is striving to become self sufficient with respect to local skills within the next four years.

Fluxofil, Fluxocord and the seamless advantage

African Fusion's **Peter Middleton talks to country business developer, Eduardo Poblete of Air Liquide Welding France about Oerlikon seamless cored wires for flux-cored (FCAW) and submerged arc (SAW) welding.**

Oerlikon first patented seamless cored wire technology back in 1966, a technology that has come to be globally known as tubular flux-cored wire technology. "There are still only two broad groups of flux-cored technologies today, which are all based on either Oerlikon's seamless patent or Chemetron's open seam manufacturing technology," says Poblete, adding that the original patents have now lapsed, so many different cored wire manufacturers use these technologies.

The production of Oerlikon tubular (seamless) flux-cored wires begins with the welding, using an HF process, of tube from flat sheet consumable material. The sealed tube is annealed before the blended, agglomerated and heat treated flux constituents are added. After further annealing, the tube is drawn down to the wire size required, surface coated with copper and then spooled onto reels or drums.

The end result is a damage-resistant cored wire with excellent feedability. "Chemetron's folded seam technology does not produce wire solid enough to remain round. Our tubular technology produced perfectly round wire that is as robust as solid wire. This results in easy wire feeding with no risk of the drive rollers causing the seam to open," says Poblete.

In addition, the final mix and the flux constituents are tightly sealed into the wire, making it very similar in terms of physical characteristics to solid wire. The spiralling, bending or torsion effects that can cause seamed wires to open are not a problem. Feeding through extended torch lengths becomes possible and, due to the smooth copper coated surface, the electrical contact and arc stability are much better than seamed cored wires, resulting in a tight arc with excellent metal transfer.

Due to the heat treatment of the final flux mix immediately before filling the tubes, Oerlikon can guarantee low hydrogen levels in the final weld metal and the sealed outer sheath prevents moisture ingress after manufacture. "This means that our tubular technology can be stored and packaged as easily as solid wires. There is no need for baking or wire reconditioning processes to remove moisture before use," Poblete adds.

From a metallurgical perspective, Oerlikon's patented high-precision filling process results in good homogeneity and compositional accuracy across the full length of the wire. "Compared to solid wires, tubular technology offers better control of the weld metal composition and up to 30% better deposition rates.

Along with the feeding advantages, these features make tubular technology ideal for automatic welding applications such as those used at car plants and shipyards.

HD flux-cored wires

As well as offering high deposition rates Oerlikon tubular flux-cored wires have long been renowned for their all-positional welding capability: due to the use of a rapidly solidifying rutile slag. "The Oerlikon Fluxofil 16 (71T1) welding wire was very well known in South Africa for these capabilities. Now, however, a new higher deposition version of these wires is available with all of the same features but with the added advantage of significantly better productivity," Poblete reveals.

With the Fluxofil HD range of tubular cored wires, filling factors have been further increased at the expense of a reduction in the sheath thickness. The end result is a tubular flux-cored wire that, at 200 A for example, can produce a deposition rate over 25% higher than folded flux-cored wires.

Quoting a comparative test result for a weld 22.5 m long on a plate 25 mm thick welded using a 60° groove angle at 200 A, Poblete says that when using the Oerlikon Fluxofil 19 HD wire, the joint was completed using fewer passes and up to 16.6% less time than when using an equivalent folded cored wire.

The SAW advantage

"Compared to using solid wires, the advantages of our tubular HD range are even more dramatic," Poblete reveals, citing the Fluxocord 31 HD as one of Oerlikon's seamless tubular cored wires for submerged arc welding.

For the SAW process, metal-cored

With the Fluxofil HD range of tubular cored wires, filling factors have been further increased.

wires are known to offer higher deposition rates, but the flux constituents can also help to improve wetting, the fusion profile and to reduce the amount of submerged arc flux required. "The Fluxocord range has been developed to further improve deposition rates in the middle to high thickness range (20 to 40 mm and greater), in particular for narrow gap SAW applications," Poblete tells *African Fusion*.

The 4.0 mm Fluxocord 31 HD wire was compared to a solid wire of the same size to determine deposition and productivity advantages. Oerlikon's OP 121 TT flux was used for both welds, which were conducted along a 1.0 m length of 30 mm plate with a 60° V prep. The current (650 A) voltage (28 and 32 V) and travel speeds (60 cm/min) were held at the same levels for each wire with the only variable being the wire feed rate.

Using the solid wire, the joint was filled by 19 weld beads, while only 13 were required when using Fluxocord 31 HD. Welding time was reduced by 30% and, based only on the reduced number of beads, 30% less flux was used.

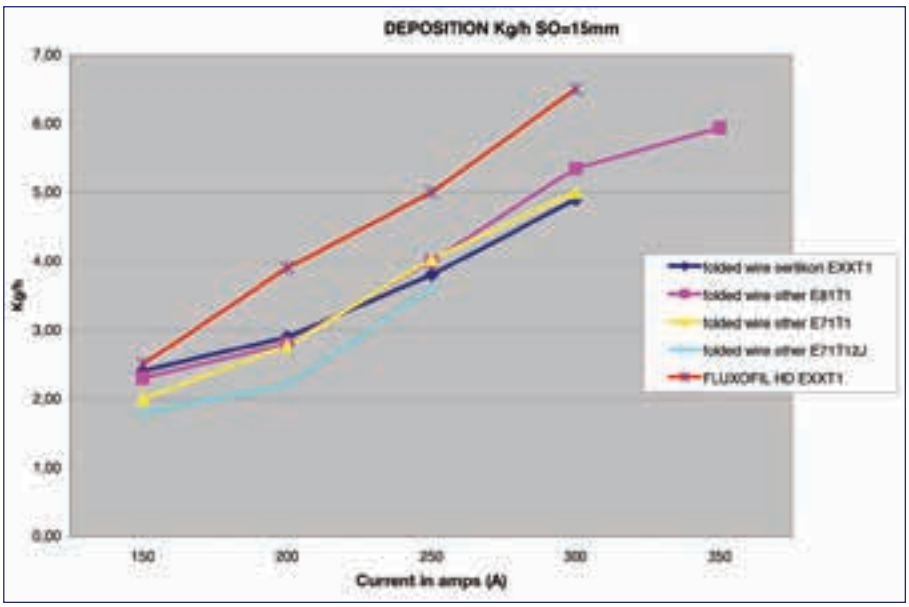
With respect to the total deposition rate, the 31 HD wire was deposited at an average of rate of 11 880 kg/h, while the rate for the solid wire was 8 100 kg/h: the Oerlikon Fluxocord 31 HD gave a 46.7% greater weld deposition rate.

"Our HD submerged-arc wire offers advantages in four key areas," Poblete suggests. "Deposition rates are, typically, 30% higher than when using solid wires; the total welding speeds are similarly higher, which translates into better productivity; the seam quality is better and, unlike other high productivity submerged arc processes, changing the wire does not require an additional investment in new or different welding equipment," he says.

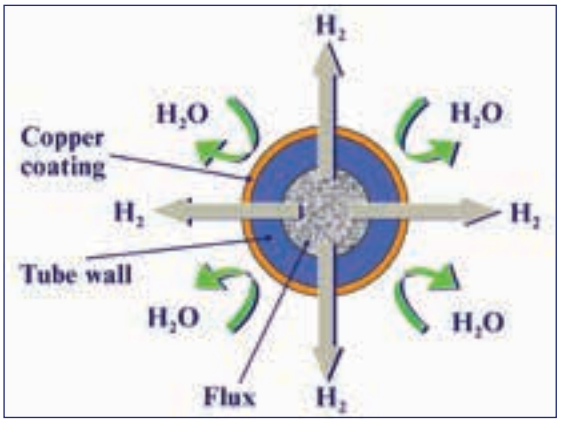
He goes on to cite the welding of offshore wind-turbine bases as another successful application for the new Fluxocord HD consumable. "The 30 mm plate seams are currently being welded using only six runs using the 31 HD seamless wire with OP 121 TT flux. Good wetting, easy slag removal, good inter-pass penetration and Charpy values of 149 J at -20 °C and 126 J at -40 °C are being achieved," Poblete reports.

While in a narrow gap welding trial using identical welding parameters and travel speeds on 110 mm thick plate, using the tandem SAW process with a dc+ lead arc and an ac trailing arc, the 31 HD wire filled the gap 25% faster than with the SD3 solid wire.

"We offer Oerlikon seamless flux cored wires covering steel grades with yield strengths from 360 MPa up to 690 MPa: and even if a fabricator is already equipped with high-deposition process systems, changing to Oerlikon seamless technology can offer a further significant improvement – and the quality of the weld seam is likely to improve too," Poblete concludes.

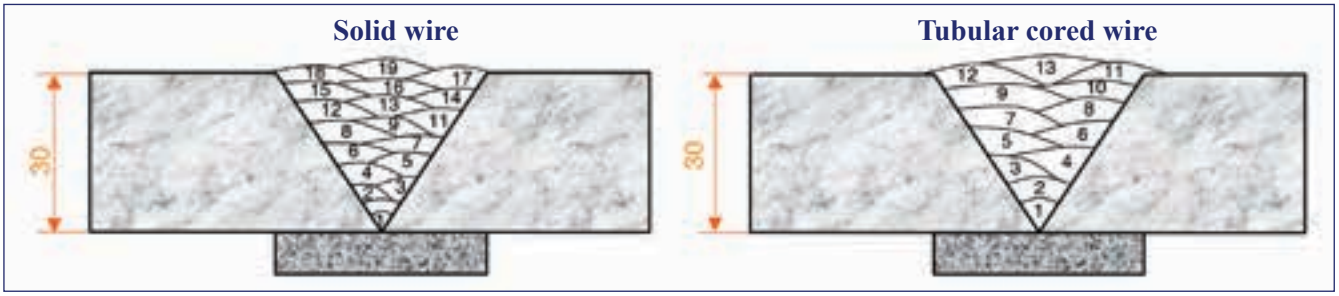


Fluxofil HD range of tubular cored wires with increased filling factors can produce deposition rates over 25% higher than folded flux-cored wires.



Oerlikon's seamless cored wire has several advantages: Hydrogen diffuses out during heat treatment; the sealed tube prevents further ingress of H_2O; and the copper coating improves feedablity and electrical contact.

In a narrow gap welding trial using identical tandem SAW welding parameters and travel speeds on 110 mm thick plate, the Fluxocord 31 HD wire filled the gap 25% faster than with the SD3 solid wire.



A 30 mm V butt joint was filled using 19 solid-wire SAW beads, while only 13 were required when using Fluxocord 31 HD.

Cost per part fabrication solutions

At Machine Tools Africa during May, global laser and bending specialist, Bystronic, represented in South Africa by First Cut, presented its holistic approach for fabricators. *African Fusion* talks to Philipp Burgener, the company's MD, and Andrew Poole, MD of First Cut.

Although Bystronic is renowned as a laser-cutting specialist, "Fabrication starts with design," begins Burgener in introducing the company's approach. "From the design, the material required goes for cutting, then for rolling or bending of individual components, before the welding, joining and product assembly begins.

"Our 'total solutions' approach is striving to help fabricators to do every stage of the process better – more cost-effectively, at higher quality levels and much faster – so that the cost of every part is minimised with production costs dropping for each process involved. The end goal is to achieve the best margins possible for fabricators, enabling them to either reinvest for growth or generate better profits for shareholders," he explains.

'So we are no longer simply selling capital equipment such as laser cutting systems, we are now offering fabrication solutions," he adds.

This 'total solutions' approach starts with the design of the individual parts. "By deliberately designing parts in a modular way to suit each of the downstream fabrication processes, by the time the welder gets to see the job, the fit up is easier, the amount of welding is reduced – by up to 30% in many cases – and a high quality end-result can be routinely achieved," Burgener points out.

"Incorporating more complicated shapes at the cutting stage – chamfered ends instead of straight cuts, built-in bending relief, cut-outs to reduce weight or welding requirements, or interlocks to assist with fit up – does not add significantly to the cutting costs or time. By incorporating these principles, however, significant amounts of time can be saved when welding, better accuracy can be achieved and reject rates can be drastically reduced," he continues.

"Adding a tiny nose to ensure perfect alignment, for example, might add one second to the cutting time, but it could save hours downstream through reduced jigging and error avoidance," he adds.

He shows an example of a simple part that requires bending and then welding. By incorporating slots along the weld path, the net welding seam length is significantly reduced, while the fit up is made easier via the slots. By incorporating easy to teach, design-for-fabrication techniques when developing the laser cutting program, less bending force will be required and the overall weld length can be reduced. We can typically reduce the total production costs of parts by 30% using cutting methodologies such as these," he tells *African Fusion*.

"When designing for fabrication, this is the way we need to start thinking," he argues. "We deliberately seek to simplify the way the joints work, even if it means incorporating more complex cutting paths."

BySoft 7 software

Developed to make it easy for designers to include design-for-fabrication principles, Bystronic now incorporates its Boft 7 software at the starting point. The software runs on the Solid Works platform and shares the same interface, so designers need not learn something completely new.

"BySoft 7 supports part construction within the Solid Works 3D-CAD environment and provides the tools needed to enable 3D models of parts to be prepared for cost-effective fabrication," Burgener explains. "If a part is created for manufacture by bending, for example, the software will automatically cut the relief edges to enable the part to be accurately bent. This is a significant time saver for the designer."

Following finalisation of the part's 3D model, cutting plans and programs can be developed, followed by CNC bending sequences, both of which can be downloaded to their respective production machines. In addition, planning and monitoring routines are also available to track production progress. "This functionality is a built-in MES (manufacturing execution system). BySoft 7 automatically plans, initiates and monitors part production and offers immediate access to all relevant production and machine data, which guarantees maximum traceability," he says.

Adds Poole: "Bystronic fibre lasers now come with BySoft software and no additional Solid Works licenses are required. All upgrades and training is also done directly by Bystronic. So the purchase of a fibre laser now comes with its own design office package," he says.

The ByStar fibre laser

"Power-wise, we are foremost in the laser cutting market with our unique 10 kW ByStar fibre laser," continues Burgener.

Explaining, he says: "10 kW of power via a fibre laser enables us to cut up to 12 mm carbon steel sheet using nitrogen gas. When using oxygen, combustion of the metal along the cut line occurs. This tends to overheat the metal plate, which limits the maximum power that can be used.

"With nitrogen, the process involves only melting, with gas pressure being used to blow material away from the cut line. So by using 10 kW and nitrogen, we are able to cut four times faster than with oxygen."

Compared to CO_2 lasers, the ByStar also offers significant advantages. "A CO_2 laser using nitrogen is limited to a cut depth of around 3,0 mm. This is due to its wider beam angle, which means that more metal has to be melted to penetrate the thickness, so more energy is required. Fibre lasers have a sharper beam focus, so they produce a narrower and deeper kerf," Burgener says.

"Of every ten lasers we now sell, nine of them are fibre lasers," adds Poole. "Not only do they use less energy but they are at least two to three times faster; and they are also more cost-effective

Bystronic press brakes sense the pressure required by each component and adjust to ensure that the angle required is achieved.

Bystronic's 10 kW ByStar fibre laser offers three times better productivity along with downstream fabrication advantages.

to run in terms of direct input costs."

"To pierce a hole in 15 mm stainless steel, for example, a fibre laser can do it in less then 1.5 sec, while a CO_2 laser might take 10 sec to do the same job," he says.

In addition to the significant speed advantages, the use of nitrogen has a direct advantage for welding. When cutting with oxygen, cleaning is required before welding to remove the oxides, while with nitrogen, no post-cut cleaning is required. "We call this a mill finish. This makes fibre lasers ideal for cutting weld preparations, because no additional processes are required to clean the joint," notes Burgener.

Summarising the advantages of the ByStar fibre, he says: "The cut is clean and oxidation-free and, using the 10 kW machine with nitrogen, we can cut carbon steel of up to 12 mm; stainless steel up 30 mm; and aluminium, also at up to 30 mm thicknesses.

"Even if paying more for a full-feature ByStar fibre laser, three times better productivity along with all of the downstream fabrication advantages make the machine highly cost-competitive," he assures.

Bystronic press brakes

Once cut, fabrication often moves to the press brake to bend the parts. "Traditionally, designers knew not to bend across parts with holes or cavities. But today, bending across holes is very common.

"If bending across a complete length of material, then the press brake might require 30 t of pressure. But if 80% of the material has been removed, for lightweighting or for weld joint design purposes, then only 6.0 t of pressure might be required to make the same bend. If the two components are bent using the same total bending brake pressure, then the component with less material will be over-bent," Burgener explains.

Bystronic press brakes employ a system that automatically compensates regardless of the true length of material being bent. "Our machines sense the pressure required by each component and adjust to ensure that the angle required is achieved, regardless of the true bend length," he explains, adding: "This is of significant benefit when it comes to welding, since all of the fit up angles will be perfect."

The process, known as dynamic crowning, relies on pressure feedback to continuously monitor and compensating for spring back. "If the quality or the thickness of the steel varies, spring back will be different and over or under-bending inevitable, so a machine that compensates for these issues is ideal for use here in South Africa," adds Poole.

As the exclusive agent for Bystronic in South Africa, "First Cut's challenge is to keep pace with the speed of technology developments, but we are determined to support these new products. We are running on a treadmill. You can neither run too fast nor too slowly. We are keeping pace with the speed of the advancements while focusing on keeping our customers up to speed at the same time.

By adopting automation through systems such as these, high standards of fabrication can be achieved, even if the actual welding is still being done manually. The machines take quality to an international level, because overseas companies are using the identical systems," Poole concludes.

Optimising SAW deposition rates using Long Stick Out

At an SAIW evening meeting earlier this year, Thulani Mngomezulu, technical manager at Lincoln Electric South Africa, presented a talk about submerged arc welding and highlighted a simple and cost-effective way of achieving higher deposition rates.

Describing the submerged-arc welding (SAW) process, Mngomezulu says that the process involves solid or cored wire electrodes that are externally shielded via a granular flux. "DCEP (dc+), DCEN (dc-) or ac polarity can be used, with each option being associated with different deposition rates and penetration characteristics," he says.

SAW relies on an electric arc or arcs between one or more wires and the weld pool. The arc and molten metal are shielded by a blanket of granular flux, deposited while welding onto the workpiece and into the weld joint. "The process is used without gas and with filler metal from the consumable electrode – and sometimes from a supplemental source," explains Mngomezulu.

The advantages over other welding processes include: high deposition rates; typically deep penetration; high operating factors, due to the mechanised nature of the process; and low hydrogen levels in deposited weld metal.

"SAW does have its limitations, though," he confirms, citing portability, since external shielding flux and a flux delivery system is required; the process can only accommodate downhand welding, because the flux is gravity fed; and relatively tight fit-up is required.

"SAW welding finds ideal applications in pipe mills and pipelines, for longitudinal, spiral or orbital seams; offshore for cans, topsides and decks; in the process and power generation industries for pressure vessels, nuclear containers, wind tower structures and hardfacing; and in the construction industry for fabricating oil, water or LNG tanks as well as beams and girders. "Being ideal for thick section welding, SAW is also widely used in heavy fabrication; shipbuilding; for rail car vehicle chassis, hoppers and tanks," he says.

Lincoln's range of advanced SAW process options includes single arc; Tiny Twin arc – a process that feeds two wires from the single power source to increase deposition rates; and multiple arc options, such as Tandem, Tandem Twin and Triple Arc systems, which all require more than one welding power source.

"Today, I am going to introduce a way of significantly increasing SAW deposition rates with a single arc, one wire and one power source," says Mngomezulu. "Deposition rate is calculated from the amount of weld metal deposited per unit of time. The deposited weld metal is generally equal to the volume of the groove plus some overfill above the weld seam. Deposition rate is easily calculated from the wire diameter and wire feed speed.

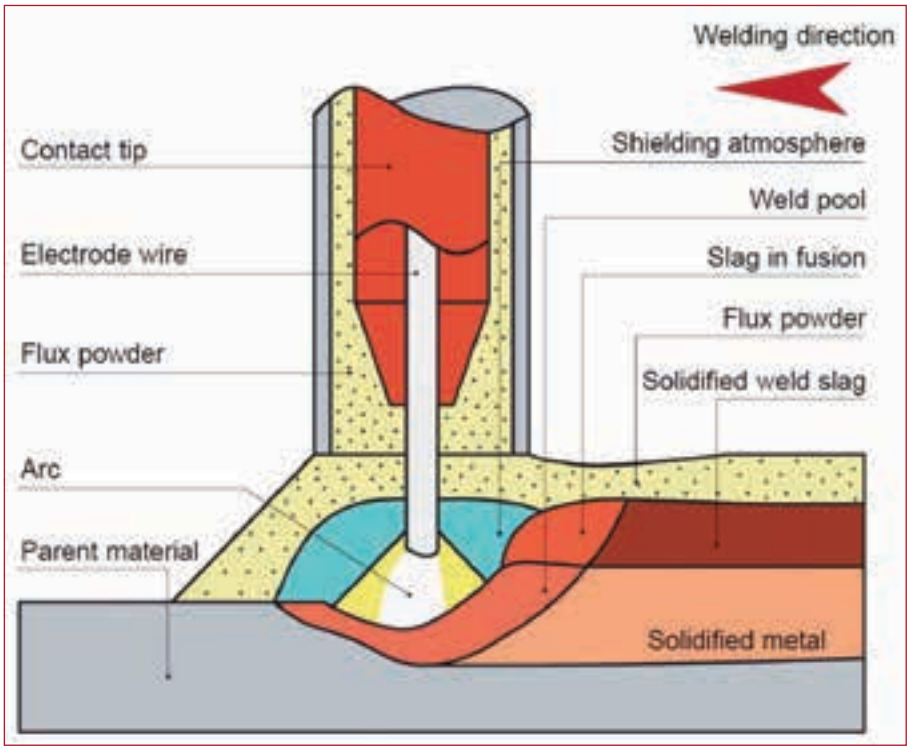
Showing a table for deposition rates at different amperages for different feed wire diameters, Mngomezulu points out that, for the same arc current, deposition increases with decreasing wire size. At 500 A, for example, the deposition rate for a 2.0 mm wire is 6.7 kg/h, while a 4.8 mm wire will be deposited at 4.7 kg/h at the same current.

This is due to resistive or I2R heating effect, which caused thinner wires to melt faster than thicker ones if the current is held the same.

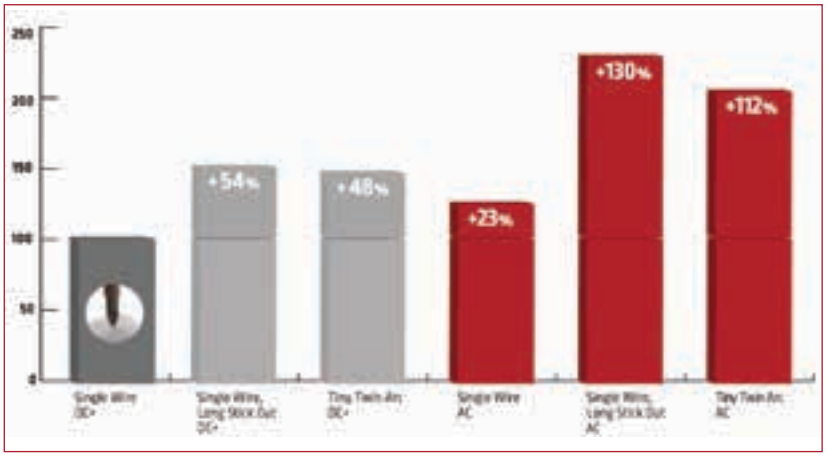
Moving on to describe how Lincoln SAW users can take advantage of this effect, Mngomezulu says that Lincoln's Long Stick Out process takes full advantage of the resistive heating in order to drive depositions rates up.

By extending the electrical stick-out length during welding, the Long Stick Out process preheats the electrode above the welding arc. This significantly increases the I2R heating and, therefore, the total melt-off rate. "Deposition rates using Long Stick Out can be increased by up to 100% without having to increase the current setting," he suggests.

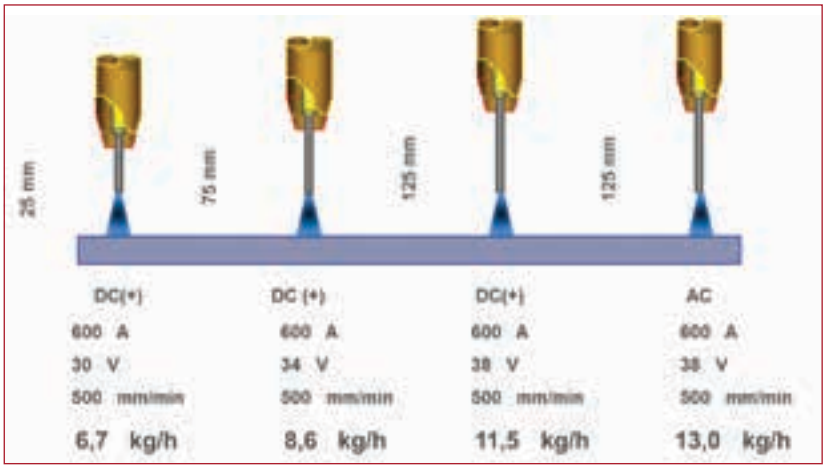
Critical to the success of this process, however, is the arc striking sequence. "The arc characteristics, as well as the specific arc strike sequence used on Lincoln Power Wave AC/DC 1000



SAW relies on an electric arc or arcs between one or more wires and the weld pool.



A comparison of deposition rates from Lincoln's advanced SAW processes.



By extending the stick-out length during welding, the Long Stick Out process preheats the electrode above the welding arc.

machines overcome this disadvantage and gives reliable and steady results in all welding modes: dc+; ac; or dc−," says Mngomezulu.

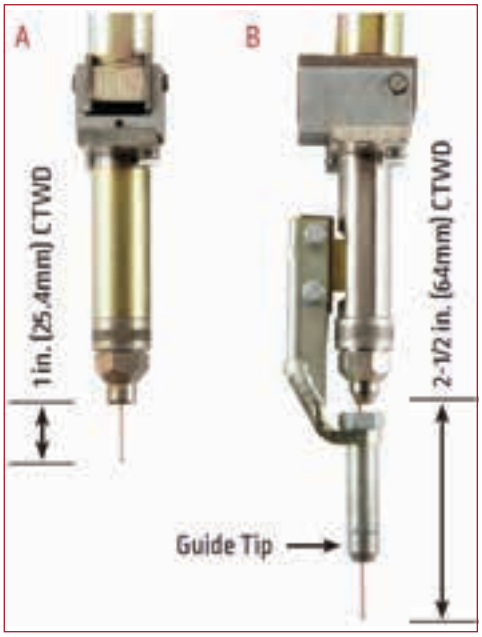
Showing a slide comparing submerged arc welds being done using a 4.0 mm wire at 600 A with the stand-off distance increased from the traditional 25 mm up to 125 mm, we see that the deposition rate can be increased from 6.7 kg/h to 11.5 kg/h using the dc+ process. And if ac power is applied with a 125 mm stand off, a deposition rate of 13.0 kg/h is possible.

Citing a case study performed for a customer in Europe who was welding a 40 mm plate with a 60° V-prep using a single 4.0 mm electrode with dc+ polarity at 700 A, Mngomezulu says that, at 25 mm electrode stick-out (ESO), the joint was being filled at rate of 8.3 kg/h. "By adopting Lincoln's Long Stick Out system with a 125 mm ESO, this was increased to 15 kg/h," he points out.

The Power Wave AC/DC 1000 power source from Lincoln is the essential enabler for this process, and it can be used in either dc or ac mode. "The inverter-based control technology, which synchronises the wire feed rate, the arc ignition currents and ramp up to full welding current, secures the arc striking.

Larger wire sizes (3.2 or 4.0 mm) are preferable and Lincoln has developed range guide tips that are bolted onto the torch to guide the wire below the electrical contact tip. These keep the extended length of heated (and softening) wire on the weld seam.

Concluding with the net advantages of this solution, Mngomezulu points to some calculations relating to welding time and associated labour cost savings. "Increasing the deposition rate from 8.3 to 15 kg/h reduced the arc time and, therefore the labour costs – from €54 966 to €30 415. This represents a cost saving for this weld of 44.67%, from a simple switch to Lincoln's Long Stick Out SAW welding process," he says.



Lincoln has developed a range guide tips that are bolted onto the torch to guide the wire below the electrical contact tip.

The advantages of SAW over other welding processes include: high deposition rates; typically deep penetration; high operating factors, due to the mechanised nature of the process; and low hydrogen levels in deposited weld metal.

Process	Deposition rate (kg/h)	Welding arc time (hours)	Labour cost (€)	Labour cost saving (€)	Labour cost saving (%)
Single electrode dc+	8.3	916.1	€54 966		
Long stick out ac	15	506.9	€30 415	€24 552	44.67%

A comparison of the use of Lincoln's Long Stick Out (CTOD: 125 mm) process with conventional stick out (CTOD: 25 mm) SAW welding. Plate thickness: 40 mm. Weld prep: 60° V. Weld length: 1 000 m. Hourly labour rate: €60.

SKS robotic welding laboratory services

The production of high-quality weld seams, especially if automated and robot-assisted, requires the expertise of competent welding technologists. At its headquarters in Kaiserslautern, Germany, SKS Welding Systems provides its customers with a team of experts in a first-class and fully equipped welding laboratory. The basic services of the lab include the further training and qualification of users and the implementation of feasibility studies.

In line with the expansion of their global customer service, SKS is also expanding this offering to the welding laboratories of subsidiaries in Czech Republic, Turkey and China, which have already proved successful. Additional labs are under construction in Mexico and the United States.

Following the example in Germany, the welding test laboratories of the subsidiaries are already supporting customers in the use of SKS systems.

Production-related feasibility studies with a wide range of inert gases and filler materials, process and product training as well as the determination of process parameters, all in cooperation with customers, are among the core activities. In this context, customer service includes not only the selection of the arc welding process, but also recommendations concerning welding consumables, inert gases and suitable component and torch positions.

As well as in Germany, SKS has already expanded its robotic welding laboratory offering to its subsidiaries in the Czech Republic, Turkey and China.

An example from the welding laboratory in the Czech Republic for a major producer of control cabinets illustrates the benefits for SKS customers. The requirement of the customer was to produce a fillet weld on the corner connection of the control cabinet with as little spatter as possible and without weld reinforcement. The challenge was to reduce expensive rework such as edge grinding and the removal of weld spatter.

The customer's requirements were met through a short series of tests on the original components with a Front-pull torch system and the application of the microMIG process. Based on the recommendation of the team, the vertical-down position (PG) was selected as the preferred welding direction. The filler material used was 0.8 mm steel wire with 92% Ar+8% CO_2 shielding gas.

With the subsequent transfer of knowledge into the actual production, a welding speed of 130 cm/min was achieved and the high quality of the joint confirmed.

In preparation for the future production of aluminium cabinets, further test welds were performed on prototypes. Here, too, the selected method and the recommended welding position delivered convincing results.

Following the example of SKS Welding Systems GmbH in Germany, the welding laboratories of the subsidiaries are equipped with robot rotary tilting table combinations that allow almost any conceivable component positions to be simulated.

Different torch and wear part geometries allow for accessibility studies on the actual workpiece. The in-house metallurgical department provides micro sections to review customer requirements and irregularities within the weld seam and a high-speed camera is also available to establish the best process parameters for special applications.

The results of these investigations are discussed in detail in test reports and made available to the customers. In addition to the process recommendation and the simple transfer of the results into series production, these trials also help saving time and costs since less staff and time is required to optimise the process parameters required on site.

www.sks-welding.com.

Reveal the secrets of your welding process

Achieving high image quality in the visualisation of welding is a formidable challenge due to the powerful radiation generated by the process. To overcome this challenge, Cavitar Ltd. has developed a welding monitoring solution based on pulsed high power diode laser illumination.

High quality images from the core of the welding process provide information that can be utilised, for example, for process development and optimisation as well as for troubleshooting.

High quality images also enable reliable and accurate online image processing. In addition to seam tracking, features such as keyhole and melt pool properties can be analysed. Numerical process data can be utilised.

The monochromatic nature of laser light enables efficient filtering. The use of short high power light pulses accurately synchronised with camera exposure time further suppresses the effects of thermal light. As a result, high-quality images showing both hot and cold regions simultaneously can be obtained.

Cavitar is represented in South Africa by Horne Technologies.

www.hornet.cc

Customer service in action

Air Products, which prides itself on outstanding customer service, highlighted this at the Machine Tools Africa 2017 exhibition in Johannesburg. The sales and marketing teams provided support to key customers, the majority of them being original equipment manufacturers (OEMs).

These customers make use of Air Products gases for laser cutting processes. The team from Air Products was on hand at the show to answer technical questions and explain processes to visitors. The team also ensured that its customers remained motivated during the exhibition by providing them with a creative gift for every day of the exhibition.

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.

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

ESAB wins award for WeldCloud

At the Industrie Lyon 2017 Innovation Awards are, from left: Vincent Ferreiro, global business manager, AddUp; and from ESAB: Florent Dourlens, analyst programmer, Nadine Masurier, European marcom assistant, and Antony Fernandes, technical and marketing manager.

ESAB France has won the Innovation Award in the Digital Tools category at Industrie Lyon 2017. Prevailing over 160 innovations presented, ESAB's WeldCloud™ online data management system took the winning spot for its ability to provide digital solutions that optimise welding and associated manufacturing activities.

"ESAB is extremely grateful for this prestigious award, as it recognises our commitment to Industrial IoT innovation," says Antony Fernandes, technical and marketing manager. "This innovation was driven by our need to help customers automate activities that surround the welding processes and enable them to drive continuous improvements in productivity, quality and machine efficiency."

WeldCloud includes a communication module connected to welding power sources that sends welding parameters and machine data to a server or a PC. Using any device with a web browser, WeldCloud provides users with a wealth of analytical tools and customisable dashboards.

With WeldCloud, customers can:

- Facilitate traceability from single welds to the complete product because the core of the system is a comprehensive database containing key information of every weld seam.
- Develop weld schedules on a single machine, move them into the cloud and then push them out to other welding systems.
- Remotely manage welding parameters, set limits and set alarms for deviations.
- Monitor and act upon various productivity reports across operations in disparate locations.
- Increase responsiveness of repair and maintenance operations by instantly receiving alerts from WeldCloud-enabled machines in their fleet, effectively lowering overall machine down time.
- Share and analyse data by teams across multiple data collection sites, using any computer, tablet or smart phone connected to the same internal network as the welding systems and database.

"There are many worthy offerings in the welding community that provide Industry 4.0 capabilities, but we believe WeldCloud has several key, customer-driven benefits that set it apart from other systems," says Roul Kierkels, Global Product Manager DDA & WeldCloud™, ESAB.

www.esab.ae

Purge monitor for food and bev

HFT's PurgEye 100 eliminates any guesswork about oxygen levels, providing accurate readings from atmospheric level down to 100 ppm.

When tubes and pipes in the food and beverage Industry are welded, it is vital that they are free from oxidation and discolouration. Welds that are not free from heavy oxidation may protrude into the pipe and create traps where product may build up over time and which could contaminate the product moving through the pipe. Measuring the oxygen level before, during and after welding, therefore, is vital to prevent these occurrences.

One way to measure the oxygen is to use a Weld Purge Monitor® and one of the leading instruments for this is the low cost PurgEye® 100 designed and manufactured by Weld Purging Experts Huntingdon Fusion Techniques HFT®. The PurgEye 100 eliminates any guesswork about oxygen levels, providing accurate readings from atmospheric level down to 100 ppm.

The PurgEye 100 has a clear, easy to read LCD screen, with a 24 mm high display, which has a low battery icon. When the monitor is not in use, an automatic sleep mode activates to conserve battery life. The PurgEye 100 is IP65 rated and comes with leak-tight push buttons, auto calibration features, vacuum-sealed leak-tight probe assembly, wrist/neck strap and tripod mount.

A customer in the UK recently said: "We use our PurgEye weld purge monitors twice a week on our five automatic dome welding machines for calibration purposes. I have to say that they are highly reliable and robust. If we need more or replacements we know where to go."

The extra long life sensor provides approximately 18 months life before it requires changing. A low sensor indicator will appear on the screen, warning that a new sensor is required. Once that icon appears, it provides the user with adequate time to obtain a new sensor, which is fitted similarly to changing a battery, and the monitor can be re-calibrated easily by using the push button provided.

The weld purge monitor was invented by HFT in the 1970s and with over 40 years of innovation, design and manufacturing experience, the company now has a family of monitors to measure oxygen levels from atmospheric content (20.94%) down to 1.0 ppm.

Ron Sewell, chairman for HFT says: "All HFT's weld purge monitors and inflatable tube, pipe and pipeline weld purging systems are manufactured in the UK. We do not sacrifice on quality. We guarantee to help you achieve zero discolouration on welds, time and time again," he concludes.

www.huntingdonfusion.com

Handheld XRF for positive material identification

At an SAIW evening meeting at the Institute's City West premises, Stuart Bateman of Innov-X Africa presented the new Olympus Vanta XRF handheld analyser for positive material identification (PMI).

Established in February 2007 Bedfordview-based Innov-X Africa is a service company to the metals, welding and fabrication industries that offers sales, training, service and support for Olympus X-ray Fluorescence (XRF) analysers and the Belec high-precision spark optical emission spectrometer (OES) range.

"Today I am going to be introducing the new Olympus Vanta XRF analyser," says Bateman, before introducing the role of positive material identification (PMI) in the metals industries.

PMI enables the determination "with certainty" of the composition of the alloy in use on a product. Analysers are typically able to identify the individual constituents and their percentage composition and, if a standard alloy is being inspected, use the result to identify the specific alloy grade, code or ID.

X-ray fluorescence is a 100% non-destructive method. When testing an alloy, an X-ray beam is fired at a material sample. This beam has enough energy knock electrons from the inner orbitals of the atoms that make up the alloy.

The new Olympus hand-held XRF Vanta analysers are among "the toughest devices Olympus has ever made".

The electrons of these atoms immediately rearrange their electrons to fill their inner orbitals and, in that process, they emit element-specific fluorescent energy signatures. By detecting these fluorescent signatures, the quantity of each element present can be accurately determined.

Why is PMI important? "From a fitness-for-purpose perspective, it is essential that we know for sure that we are using the correct alloy in the correct place for the correct job," says Bateman. Alloys with different compositions are deliberately designed to exhibit specific mechanical properties and corrosion resistance.

Hundreds of alloys are available and it is almost always impossible to identify the exact alloy in use simply by looking at it. "And any error in the alloy choice and use can have huge consequences in terms of safety, maintenance costs, facility down time and equipment life," he points out.

The Olympus Vanta XRF

Ideally suited for use at petrochemical plants; oil refineries; power plants by inspection or service engineering companies, the Vanta XRF range of handheld PMI analysers is the ideal on site inspection tool. It can be used to analyse the alloy composition of weld metal; forgings; claddings; for quality control of incoming parts such as pipes, flanges and valves; and for testing replacement components.

"How does one guarantee that an untested pipe is compatible with a pipe that is tested?" asks Bateman.

The Olympus XRF offers a very rapid way of testing the material composition of components. This can be done without having to shut down the equipment being tested and the instruments have a rugged design to suit field-testing in harsh environments.

With a memory for thousands of readings, data traceability is assured using the Olympus' PC-based Delta software, with downloaded data able to generate individual test reports.

Testing all type of alloys is possible, including ferrous and non-ferrous metals such as stainless steel and aluminium alloys. Typically, the composition of 25 elements including Mg, Al, Si, P, S, Ti, V, Cr, Fe, W and U can be identified at accuracies from parts per million to 100%.

Particularly noteworthy is the new Olympus Hand-Held XRF Vanta, which are among "the toughest devices Olympus has ever made". These are IP 65/64 rated; drop tested to MIL-STD-810G; have Eyelid detector protection and Kapton mesh; and have been purpose designed for improved reliability and serviceability.

"Exceptionally fast testing times down to 5.0 s enable better productivity while the reliability and low damage risk results in higher uptime and availability," adds Bateman.

The device can also come with a built in camera, which provides a surface image to assist with accurate positioning of the measurement spot. In addition, a small spot collimator option enables small features of a sample to be tested in isolation.

"With Smart Phone-like capabilities and a new easy to use interface, the new Olympus XRF Vanta offers an ideal PMI testing solution for the broadest range of metal identification tasks," concludes Bateman.

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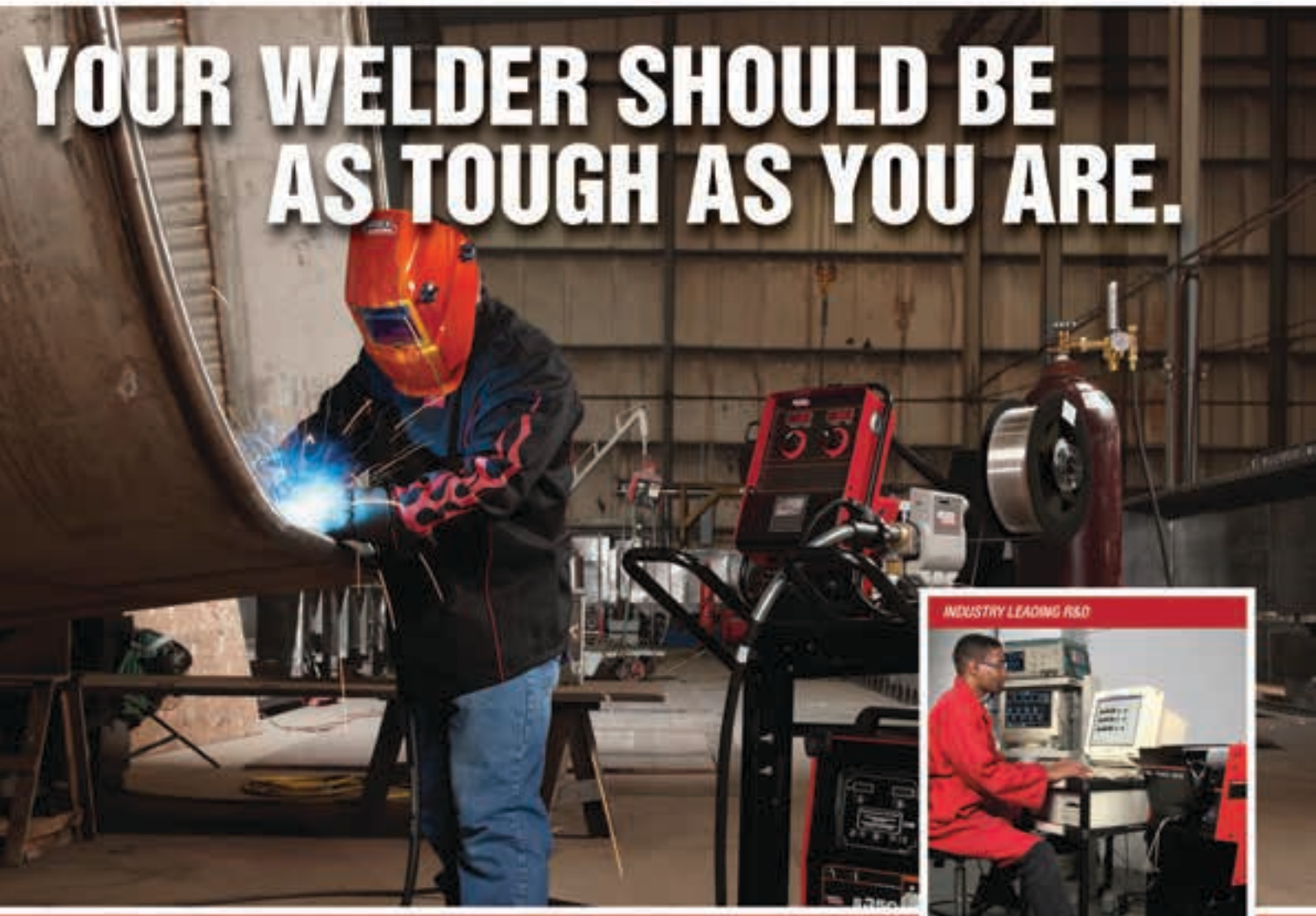

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