Fusion

SAIW 1948 – 2018

Newsletter of the Southern African Institute of Welding

February/March 2018

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SAIW Foundation in Revolutionary Apprenticeship Scheme

Industry partners invited to participate

The SAIW foundation has decided to run an apprenticeship programme for 20 students and is looking for industry partners to invest in the scheme.

“This is no ordinary exercise,” says programme convener SAIW’s Etienne Nell. “It is a ‘dual system’ apprenticeship programme that combines technical education and simulated practical training at the SAIW with authentic work experience in a fabricator’s workshop.”

Nell adds that these workshops typically belong to SAIW industry partners and the simple equation is that the SAIW Foundation, the students and, in the end, the country, need your participation in the programme to make it successful.

“This is not a straightforward hand-out system,” Nell says. “A company will be reimbursed R165 000 per annum per student it employs in addition to getting the relevant tax rebate, BBBEE points and the productive value of the apprentice’s work.

He adds that there are further advantages for the company after the training including: skilled employees trained to industry standards & acculturated to the company; enhanced employee retention and lower recruitment costs. “All in all, it’s an ideal win-win arrangement,” Nell says.

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Message from Sean Blake

Welcome to the first Fusion of 2018, the SAIW’s 70th anniversary year.

It is certainly a poignant moment for this Institute to have been in business for this long. Over the years we have made a difference to thousands of people whom we have taught the skills to get proper jobs in a wide variety of industries. This is something we can be truly proud of.

A recent survey shows that over 75% of the people who graduate from the SAIW gain employment within a few months of graduation, which is a truly remarkable statistic, especially in the tough economic times that we have been facing in the past decade or so.

Moreover, the research showed us that the overwhelming majority of our students are satisfied with the way in which the SAIW relates to them and how we conduct our business in general.

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SAIW Foundation in Revolutionary Apprenticeship Scheme

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The programme aligns itself with the Quality Council for Trades and Occupations (QCTO) Artisan Welder Curriculum which is aimed at producing: a skilled and capable welding workforce to support economic growth; an increased availability of intermediate welding skills and an increased delivery of properly qualified artisan welders.

You may ask what's new about this training model? A cursory glance at the differences demonstrates just how revolutionary it is.

Current System: Public providers and TVET colleges offer welder training; Qualifications are not linked to occupational competence; many curricula outdated; trade theory front-loaded, with long intervals between theory and practice; most college students get no practical training or work experience; most students selected by college without reference to employers; few linkages between public colleges and industry.

The growing efficiency of your investment*

Year	Wage	Productivity
First	28%	35%
Second	32%	65%
Third	41%	85%

*The figures represent the percentage of a qualified artisan

Source: "Final Report of Cost-benefit-Quality Project." MerSETA & University of Bremen; June 2016

New System: New qualification reflects occupational competence; new, industry-designed curricula; trade theory, simulated practice and work experience tightly interwoven; all students will now get practical training and work experience; employers select and manage their own apprentices; *close interaction between the SAIW and employers.*

So, what do you have to do in order to get this going? Commit to the QCTO curriculum and Dual System approach of apprentice training; secure apprentice contracts; register your apprentice contracts with your SETA and QCTO; apply to your respective SETA for your grants; work with the SAIW to ensure the best possible outcome by helping in quality assuring workplace learning.

The Role of the SAIW Foundation

Among other things the SAIW Foundation will also subsidise the institutional training cost of the 20 apprentices and will remain committed to the QCTO curriculum, together with Dual System Learning for Apprentice's programme.

"In addition to this we will assist in maintaining the required Statements of Results, which is a prerequisite for External assessment, as required by QCTO and we will remain an active member at NAMB in the development of the new Trade Test," says Nell.

Get on board! Help in building a skilled workforce like no other! EVER!!

FOR MORE INFORMATION PLEASE CONTACT ETIENNE NELL ON 082 758 3884

Message from Sean Blake

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Of course, there were some constructive criticisms which we have taken note of and we will be doing our best to continue improving on the world-class service that we provide to our students and to the South African and African welding industries.

Thank you to all those who participated in the survey and congratulations to our prize winners Kevin Xaba and Angelin Mmamosa Mmota.

"AND WE NEED OUR COUNTRY! POLITICAL INSTABILITY, CORRUPTION AND A GENERAL LETHARGY FROM 'THE TOP' HAVE CONTRIBUTED SIGNIFICANTLY TO A LACK OF GROWTH IN SOUTH AFRICA. THIS HAS AFFECTED THE NUMBER OF INFRASTRUCTURE PROJECTS COMING ON STREAM, WHICH HAS, IN TURN, NEGATIVELY IMPACTED OUR WELDING INDUSTRY AND THE SAIW"

Over the years the SAIW has been replete with stories of courage and determination. One of the most recent is SAIW Foundation graduate King Mufamadi who was so determined to succeed he initially offered his services to a local company for no pay. Today he is lecturing at the SAIW. An inspirational story for any young person wanting to get ahead in our country. (see more inside)

On the question of the SAIW Foundation we are undertaking a most exciting project which is the QCTO 'dual' apprenticeship system that combines technical education and simulated practical training at the SAIW with authentic work experience at a fabrication facility. We urge companies to read about the scheme in the article on the left of this one and to respond favourably. Our country needs you!

And we need our country! Political instability, corruption and a general lethargy from 'the top' have contributed significantly to a lack of growth in South Africa. This has affected the number of infrastructure projects coming on stream, which has, in turn, negatively impacted our welding industry and the SAIW.

But the latest developments can give us all hope and we urge President Ramophosa to vigorously put in place the people and the mechanisms to get our economy going so that young people will have more opportunity to get meaningful jobs including, of course, in the welding industry. Welding is an enabling technology which has the ability to provide meaningful work opportunities.

In the meantime, we must all play our part. We cannot absolve ourselves of the responsibility to play our own individual part in South Africa's recovery. Each one of us must contribute, to our fullest potential, in order to succeed.

Finally, please note that as part of our 70-year celebrations we have decided to print a Fusion newsletter every two months. Each edition will be slightly shorter than normal but the idea is that we will increase our overall level of communication with you about the Institute and the welding industry in general. Enjoy your reading!

Sean Blake

Consumable Testing and Diffusible Hydrogen in Weldments

SAIW a one-stop-shop for consumable testing and verification

Confidence Lekoane

Despite it being a subject that has been intensely researched over the decades, Hydrogen in weldments of steel, particularly high-tensile and high strength low-alloyed steels continue to limit the performance of components due to the negative effect on the properties of the metal. Embrittlement, cracking and pore formation are the common effects of hydrogen in steels.

Hydrogen-induced cracking also known as cold cracks is a well-known and dreaded phenomenon. Cold cracks in welded joints can be caused by hydrogen which enters the material during the fusion welding process. Sources of hydrogen may arise from the filler materials' humidity when welding at ambient atmosphere, additives in filler wire or as condensed water near the weld zone.

In SMAW, FCAW and SAW welding process flux is used in the consumable to shield the weld pool from oxidation during welding. The flux consists of several ingredients including chemically bonded water. During welding the water (H_2O) will dissociate to form hydrogen ions H+ which enter the weld pool. At high welding temperatures the solubility of hydrogen in steel increases, allowing large amounts of hydrogen into the weld pool. However during cooling the solubility significantly decreases, faster cooling rates will result in hydrogen entrapment and the weld will become more prone to cold cracking. It is for this reason that the knowledge of the hydrogen content in welds produced is of high importance for the material development as well as for process control and quality assurance.

Nicolene Kgoedi SAIW MTL assistant using the Bruker G4 PHOENIX diffusible analyser.

In 2018 SAIW materials testing laboratory (MTL) has extended its testing scope to include diffusible hydrogen testing of weld seams and welding materials in accordance to ISO 3690 and AWS 4.3. Unlike the traditional mercury method, SAIW MTL's newly commissioned Bruker G4 PHOENIX diffusible analyser uses the carrier gas hot extraction method. The basic principle for the determination of diffusible hydrogen is made using the carrier gas (Nitrogen 99,999%) with hot extraction in a tube furnace and following detection of the evolved hydrogen with a thermal conductivity detector.

Welding consumable testing has for a long time been required by industry with many service providers providing the separate components to the testing required. Over the past few years the demand for consumable testing has increased with industry also requiring EN 10204 type 3.2 inspection certification where an impartial and independent body is appointed to verify the material's chemical and mechanical properties. SAIW has been in the front line of testing welding consumables with a fully equipped material testing laboratory with all the required equipment and skills. With a qualified welder onsite, heat treatment furnace, a NDT and mechanical testing laboratory and a newly commissioned diffusible hydrogen tester SAIW offers a one-stop-shop for consumable testing and verification. Our material testing laboratory is accredited by SANAS as conforming to the requirements of ISO 17025 in order to provide our customers with assurance of reliable consumable testing results.


Executive PA Dimitra Kreouzi.

SAIW's 70th Year... exciting times ahead

Please take note of the important dates in this special calendar year (subject to change).

SAIW 1948 – 2018

MARCH
23 - Joburg Certification Dinner

MAY
10 - Joburg Golf Day
18 - SAIW AGM
18 - SAIW Certification AGM
24 - CT Golf Day

JULY
05 - Durban Golf Day

SEPTEMBER
07 - SAIW Annual Dinner
21 - CT Certification Dinner

OCTOBER
05 - Durban Certification Dinner
12 - Joburg Certification Dinner
26 - CT Annual Dinner

NOVEMBER
02 - Secunda Certification Dinner

For futher information on this year's events contact Dimitra on 011 298 1102.

Focus on Standards

ISO 15614-1 Second edition 2017-06

Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys

The new version of the standard was published during June 2017 as ISO 15614-1:2017 and is in the process of being adopted by the SABS as SANS 15614-1:2017.

The 2017 version differs significantly from the previous version in format, with some major changes in technical content. This article presents some of the most significant differences between the 2017 and the previous version of the standard, explains the rationale behind the changes and provides some practical guidance on how they are to be dealt with.

New: Levels of procedure qualification

The single biggest change is that ISO 15614-1:2017 includes two levels of welding procedure tests, designated by Levels 1 and 2. Level 1 is based on requirements of Section IX of the ASME Boiler and Pressure Vessel Code (ASME IX) and Level 2 is based on the previous issues of ISO 15614-1. In Clause 1 Scope it states:

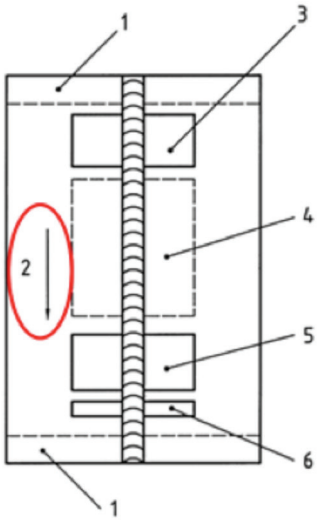
"Two levels of welding procedure tests are given in order to permit application to a wide range of welded fabrication. They are designated

Main technical changes: Figure 5 (below left) represents ISO 15614-1:2004 version and (below right) ISO 15614-1:2017 version

Figure 5 – Location of test specimens in butt joints in plate

2004 Version (not to scale)

Location of test specimens – welding direction top-bottom.

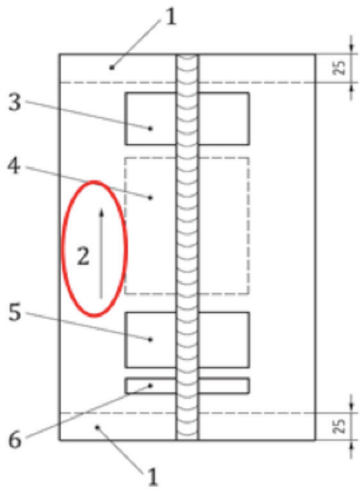


Key

1. Discard 25mm
2. Welding Direction
3. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
4. Area for:
   - impact and additional test specimens if required
5. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
6. Area for:
   - 1 macro test specimen;
   - 1 hardness test specimen.

2017 Version (not to scale)

The welding direction is now from the bottom to the top, but the specimen location is the same. So, the location of test specimen with regard to the start and end of the weld has changed.



Key

1. Discard 25mm
2. Welding Direction
3. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
4. Area for:
   - impact and additional test specimens if required
5. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
6. Area for:
   - 1 macro test specimen;
   - 1 hardness test specimen.

by Levels 1 and 2. In Level 2, the extent of testing is greater and the ranges of qualification are more restrictive than in Level 1.

Procedure tests carried out to Level 2 automatically qualify for Level 1 requirements, but not vice-versa.

When no level is specified in a contract or application standard, all the requirements of Level 2 apply."

Care should therefore be taken in identifying the testing requirements and the range of qualification for the particular welding procedure test level.

Previous welding procedure qualifications

The validity of previous welding procedure qualifications is addressed in different Sections of ISO 15614-1:2017, as follows:

- Introduction: "All new welding procedure tests are to be carried out in accordance with this document from the date of its issue. However, this document does not invalidate previous welding procedure tests made to former national standards or specifications or previous issues of this document"
- Clause 1: "Specification and qualification of welding procedures that were made in accordance with previous editions of this document may be used for any application for which the current edition is specified. In this case, the ranges of qualification of previous editions remain applicable"
- Clause 1: "It is also possible to create a new welding procedure qualification record (WPQR) range of qualification according to this edition based on the existing qualified WPQR, provided the technical intent of the testing requirements of this document has been satisfied. Where additional tests have to be carried out to make the qualification technically equivalent, it is only necessary to perform the additional test on a test piece"

This can be interpreted as the following:

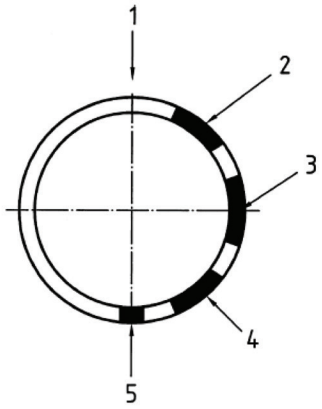
- Previous welding procedure qualifications remain valid and the ranges of qualification stay the same, even when ISO 15614-1:2017 applies.
- When contracts make reference to ISO 15614-1:2017 and a manufacturer wishes to apply an existing WPQR, it is recommended that manufacturers integrate the existing WPQR with an alignment sheet, showing the new ranges of qualification according to ISO 15614-1:2017.

In the next Focus on Standards a comprehensive review of the changes to Clause 8 – Range of Qualification, will be addressed.

Main technical changes: Figure 6 (below left) represents ISO 15614-1:2004 version and (below right) ISO 15614-1:2017 version

Figure 6 – Location of test specimens in butt joints in pipe

2004 Version (not to scale)

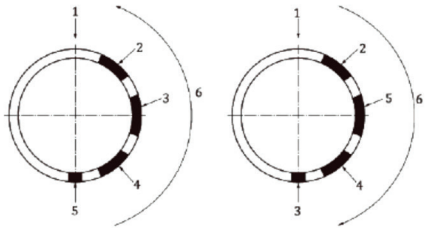


Key

1. Top of fixed pipe
2. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
3. Area for:
   - impact and additional test
   - specimens if required.
4. Area for:
   - 1 tensile test specimen;
   - bend test specimens.
5. Area for:
   - 1 macro test specimen;
   - 1 hardness test specimen.

No welding direction shown. So, specimen locations around the pipe circumference are the same, regardless of the welding progression (vertical-up or down)

2017 Version (not to scale)



This represents Figure 6 split into two diagrams for vertical-up and vertical-down progressions, with specimens in different locations around the pipe circumference.

Key

1. end of weld
2. area for:
   - 1 tensile test specimen
   - bend test specimens
3. area for:
   - impact and additional test specimens if required
4. area for:
   - 1 tensile test specimen
   - bend test specimens
5. start of weld; area for:
   - 1 macro test specimen
   - 1 hardness test specimen (taken from the start of weld)
6. weld direction

NOTE: for the vertical-down progression (right-hand side) the location of area 5 (start of weld, macro and hardness) in the diagram for the vertical-down progression seems to indicate that the start of weld should be at 3 o'clock position. Also, the location of area 1 (end of weld), seems to indicate that the weld ends at the 12 o'clock position. There is a possibility that this is an error and that a Key specific for the vertical-down progression diagram should be added.

Focus on Courses

Visual Testing

You see, but do you observe?

Introduction

Visual testing is the most common and essential of all Non-Destructive Testing (NDT) methods. Unlike other NDT methods which require either special equipment or consumables to reveal an indication, visual testing, in its most common form, only requires one to look at a surface and interpret what one sees. However, to quote Sherlock Holmes: 'You see, but you do not observe'. Herein lies the need for proper training, qualification and certification for visual testing personnel to ensure that they are and remain competent to perform this basic yet powerful non-destructive test.

What is visual testing?

Visual testing can be described as the visual observation of a test surface to identify any discontinuity. Discontinuities include, but are not limited to the following:

- Surface discontinuities related to manufacture, processing, construction (includes component alignment) or operation
- Dimensional conformity
- Structural integrity

What techniques are available?

Basic visual testing method can be separated into three techniques, which are:

- *Direct testing* which refers to the direct observation of the surface with limited equipment only utilised to increase surface lighting or increase the viewing angle. According to ISO 17637 the eye is placed within 600mm of the inspection surface at an angle of not less than 30° to the surface (otherwise it may be regarded as a profile inspection) with magnification not exceeding 10 times.
- *Indirect or remote testing* on the other hand uses mirrors, borescopes, fiberscopes or remote cameras to test areas of interest which are otherwise not accessible. Digital images or videos can be recorded as permanent records.
- *Translucent testing* which refers to the source of light situated behind the material to be tested with detection based on the amount of light that passes through the material. This is very seldom used in general industry due to the opaque nature of most engineering materials.

Basic theory of visual testing

Human vision forms the basis of all visual testing methods and the principles, problems and processes associated with the human eye must be clearly understood. Principles of light, sources of light, colour and visual perception relating to the observation and interpretation of the testing surface are important while a thorough understanding of optical principles and image processing is essential when using additional equipment to capture the surface image.

Applications

There are no limits to the application of visual testing which basically requires a clean surface accessible either directly or remotely. All product sectors such as welds, castings, forgings, tubes, pipes, wrought products, etc. are included with industrial sectors ranging from pre-and in-service testing to rail, power generation, petrochemical, mining, civil, paper and pulp, transport and many others.

As in the case of all NDT methods, visual testing should also be included throughout the manufacturing, construction, operation and maintenance phases. According to ISO 17637 for example, visual inspection of welds should include:

- Visual testing of joint preparation
- Visual testing during welding
- Visual testing of the finished weld
  - Consisting of cleaning and dressing
  - Profile and dimensions
  - Weld root and surfaces as well as
  - Post weld heat treatment
- Visual testing of repaired welds

What is the difference between visual inspection and visual testing?

Visual inspection, as performed by welding inspectors, is the observation of any operation performed on materials and / or components to determine its acceptability in accordance with given criteria, the codes of construction and the assessment criteria in order to decide if a weld is acceptable. Depending on the code of construction and/or the client's requirements, the welding inspection may or may not require that the inspection is undertaken by a qualified and certified Visual Testing Technician who will generate the NDT report. To this extent inspectors should have sufficient knowledge regarding the process.

On the other hand, visual *examination or testing* refers to the actual process of determining the condition of an area of interest by non-destructive means against established acceptance or rejection criteria, i.e. NDT personnel perform the visual test and provide the NDT report. To this extent NDT personnel must be qualified and certified for the visual testing method, to the appropriate qualification level, as stipulated in the relevant certification scheme.

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Qualification and certification

All NDT personnel must be qualified and certified either via company certification, in accordance with the company written practice as required by the American codes such as ASME, AWS, API etc. or via a personal certification body in accordance with ISO 9712 as required by ISO or EN codes.

Please note that ISO 9712 also complies with ASME requirements. Furthermore, ISO 9712 excludes direct unaided visual tests and visual tests carried out during the application of another NDT method as part of the visual testing qualification.

Each of the mentioned qualification and certification processes depends on suitable training as described in the relevant syllabi viz. ASNT CP 105 and ISO TR 25107 respectively. The documents clearly define the relevant theory and specific applications that should be included in the training program.

Latest developments

The use of drones has been a significant development in the field of remote visual testing. Therefore a visual testing qualification and certification should be mandated for all personnel providing drone visual testing services, apart from the statutory requirements of operating drones.

SAIW Comes Out Tops…

…Research shows most students see Institute in positive light

Through a recent Online survey, which was sent out to 9 497 current students, recent graduates and alumni, well-known research company, Meraki Research, set out to gauge perceptions on the SAIW and on the industry as a whole.

A pleasing 13% responded to the survey, which is above the industry standard of 10% participation rate and, according to Meraki, the high participation rate ensured that any conclusions drawn could be generalised to the entire SAIW student, recent graduate and alumni population, with 95% confidence.

There were some interesting and positive findings:

- Both the SAIW lecturers and courses received an excellent overall rating of 8 out of 10.
- The biggest advantage of SAIW courses is that they are career focused and internationally recognised.
- 76% of graduates find some form of employment after graduation.
- More than 60% of graduates would recommend the SAIW to friends and family.

In a separate Social Media survey, Meraki Research found that:

- The SAIW has more than double the number of fans when compared to other welding industry pages.
- The SAIW has the highest number of mentions when compared to the key industry players.
- Towards the end of 2017 the SAIW saw a considerable increase in page likes, increased interactions from fans and higher levels of organic reach.

Kevin Xaba and Angelin Mmamosa Mnota with Sean Blake

In the main the findings from the research were most positive. Of course, there are some issues, like pricing for example, that are challenging for the students.

"Pricing is a perennial problem in education, especially higher education," says SAIW executive director Sean Blake. "The SAIW is a globally recognized educational facility which complies with international course standards. To maintain this level and for the good of our students, we must employ the best lecturers and provide state of the art equipment, which is all expensive," he says.

Sean says that the research has made him and the staff more aware of the areas that need attention and everyone is committed to dealing with these in an open and transparent manner.

He thanked all those who took part in the research and congratulated Kevin Xaba and Angelin Mmamosa Mnota, the two winners of the R2000 Makro vouchers.

SAIW NOTICE BOARD

Hail to the King …

…. SAIW Foundation student on the rise

There are some stories that simply inspire. Nndwakhulu "King" Mufamadi's is one of those! Today he is a Welding Technologist lecturer at the SAIW but just a short while ago he was working for no remuneration at Metal Protection and Engineering (MPE) just to get experience.

"I wanted to get ahead and I had no practical industry experience in welding," King says. "I had the choice to either go back home to Limpopo and scrape by or to do whatever I could to get some experience. I chose to move ahead with my life and volunteered my services for free at MPE."

Nndwakhulu "King" Mufamadi

As it turned out this was a brilliant career move. Not only did it give him the opportunity to gain welding experience but it was one of the deciding factors in the SAIW Foundation giving him a bursary to get his Welding Technologist diploma, which he completed in 2016.

In 2017 King was offered a paid job at MPE where he worked as a welding supervisor and coordinator until the beginning of this year when he took up the position of a Welding Technologist lecturer at the Institute.

"It's an incredible story," says SAIW executive director Sean Blake. "It shows that there's nothing one can't do in life given the right attitude and motivation. Not only has King sacrificed a great deal to achieve what he has, but he has also gone far and beyond everyone's expectations. From such humble beginnings, and in a relatively short space of time, he has become a lecturer in an important subject in a globally recognized institute of learning, the SAIW."

"I am so happy to be teaching here at the Institute," says King. "My main interest in life is knowledge transfer. I get a real kick out of teaching others what I have been fortunate enough to learn. I feel I am making a real difference to other peoples' lives and this gives me a sense of purpose in my own," he says.

King is somewhat of a workaholic but really enjoys keeping fit. "I'm a bit of a gym freak but to give of one's best one has to be in good physical shape."

Well done King. The SAIW is proud of you.

ArcelorMittal's SAIW Foundation Group Excel

The six 2017 SAIW Foundation students from the ArcelorMittal Science Centre in Sebokeng completed the International Welder Programme in record time and all passed with flying colours. SAIW executive director Sean Blake says that this was one of the most successful groups to graduate from the SAIW. "Each one of them applied themselves to the utmost and it was a pleasure being part of their progress. We wish them good luck for the future and look forward to more joint projects with ArcelorMittal," he said.

The ArcelorMittal Science Centre was initially created to assist students to complete their matric and focusses heavily on mathematics and science.

Left to right: Albert Mohale, Mamdlakati Rose Mfabane, Luvuyo Donald Bonkolo, Zelda Kumalo, Princess Mpembe and Tebello Joseph Radebe.

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