



SAIW combination certification for ARCAL™ gases with Ultra-Arc™ wires

Mwali Kawawa and Michael Ashley from Air Liquide, along with SAIW's Shelton Zichawo, discuss a recent collaboration between Air Liquide and the SAIW to qualify and certify Air Liquide's welding gas and filler material combinations, which are designed to make welding consumable choices easier and more certain for South Africa's welding industry.

In collaboration with SAIW's state-of-the-art Materials Testing Laboratory, Air Liquide has begun to qualify and certify specific filler material combinations to enable South African fabricators to match precise welding wires with the most appropriate Air Liquide shielding gas. "The idea is to simplify consumable selection to best suit a particular set of base materials and welding applications," says Air Liquide's Mwali Kawawa.

"For several years, we have been on a campaign to simplify the selection of consumables for the gas shielded welding processes: gas-metal arc welding (GMAW), metal-cored arc welding (MCAW), flux-cored arc welding (FCAW) and gas-tungsten arc welding (GTAW). This began with the introduction of our New Generation ARCAL™ shielding gas range, which consists of four different and carefully developed mixtures. These

premium blends can be confidently used for over 90% of the welding processes that require gas shielding," he tells *African Fusion*.

"We are extending this approach by matching specific welding wires with the most suitable ARCAL™ gas mixtures by qualifying and certifying gas and wire combinations for easy adoption by our clients," he adds.

The initial focus for qualification has been on high strength welding for materials used in heavy metal fabrication; typically utilised in the Witbank and Rustenburg coal mines for repairing mining and earthmoving equipment, for example. "These vehicles are often repaired using GMAW or FCAW using ER100-S solid wire or E71T1 flux-cored wire, respectively.

"These two wires have now been qualified and certified by SAIW for use in combination with our ARCAL™ Force New Generation shielding gas," Kawawa tells *African Fusion*.

The combination, aptly named ARCAL™ Force High Strength, is now listed on a single data sheet and is available as a merged single offer for any fabrication or weld-repair shop needing to join high strength materials while retaining optimal toughness.

Explaining the idea, Mike Ashley says: "While the initiative is new to South Africa, the explicit qualification of wire and gas combinations is commonly used by our subsidiary Air Gas in the

USA. This has long been their approach, which is known to help companies achieve process and cost efficiencies.

"First off, fabricators are able to source gas and wire consumable combinations with ease. By doing so, we at Air Liquide are able to offer a complete technical support service, so clients can rest assured that the intended results will always be achieved.

"As consumable suppliers, it also enables us to target specific market segments where we have application expertise to accompany a qualified gas and wire combination. This takes away the stress of clients having to wade through datasheets to come up with workable combinations themselves," he says, adding that every consumable combination will be delivered with its qualification certificate and weld-material property specifications.

Kawawa explains further: "Typically, when choosing a wire, each manufacturer has a thick data book that lists all of its products. On each page there will be a different wire consumable with the details of the typical properties of the weld metal.

"Qualifying a combination with the welding application as the starting point – for high strength steel base material, for example – removes the need and the anxiety of having to find a suitable wire for the weld material and then having to separately choose a shielding gas that might work with that wire," he points out.

A combination test certificate enables one gas-wire combination data-sheet to cover a wide range of similar welding applications. In the case of the ER100-S wire with ARCAL™ Force gas, for example, a whole range of differing parent material can be accommodated to meet the welding needs for high strength with good toughness," he adds.

So far, the SAIW Test Laboratory has qualified ARCAL™ Force with ER100-S solid wire and with the E71T1 high strength flux-cored wire, but Air Liquide intends to go a lot further: "With ARCAL™ Prime, our high purity (99.999%) argon gas, we are going to qualify combination procedures for most TIG welding appli-

cations as well as for GMAW welding of aluminium, copper, titanium and others, while our ARCAL™ Chrome product is ideally suited to 308 and 304 stainless steel wires and 2205 duplex stainless grades," says Kawawa.

"We intend to start by qualifying wire-gas combinations for most of the commonly used welding wires in the Air Liquid range, which will make choosing our products much easier for our customers," continues Ashley. "We are looking for improvements all the time, firmly focused on our New Generation gases and ever evolving customer requirements. Arcal™ offers efficiencies, improved process optimisation and genuine cost savings, while combinations offer customers peace of mind that they are using the correct gas with their filler materials and, furthermore, the combination is locally qualified and supported," he adds.

"In converting customers to the simplified New Generation gas range, it becomes crucial to ensure that the correct gas choice is being used with the correct consumable and welding application," Kawawa continues, adding that Air Liquide is also looking to develop and add a fifth Arcal™ gas, to be called ARCAL™ Flux, which he hopes will become the go-to gas for the majority of metal-cored and flux-cored applications.

Describing the qualification procedure at the SAIW, Zichawo says the work began when Air Liquide first supplied the ER100-S wire from its Ultra-Arc™ range for testing. "We have been using Air Liquide's ARCAL™ gas range in our welding school and test centre for many years now, so the gas used to perform the qualification was at hand.

"We prepared a weld coupon from a 20 mm plate of S355JR structural steel, which was welded by Dennis Bell, one of our qualified welders, using the Air Liquide gas and wire combination," he says.

The welded coupon was sent to the machine shop, where tensile and Charpy V-notch test samples were prepared for mechanical testing in SAIW's ISO 17025-accredited testing laboratory. "The qualification required tensile and Charpy impact toughness values, along with a chemical analysis, which we do using Spark analysers," he adds.

For certification, the actual results achieved from the real weld need to fall within the minimum and maximum specifications for the wire, which in the case of ER100-S is AWS A5.28: Specifica-

tion for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding.

"Since the samples were cut in the longitudinal direction, only weld metal remains in the machined test samples, and all of the tests results were found to be comfortably within the ranges required," he says. This enabled the combination to be qualified and certified to prove that a sound welding procedure completed with Air Liquide ARCAL™ Force gas and Ultra-Arc™ ER100-S wire will produce weld metal that meets the mechanical and chemical properties of the AWS specification.

A similar procedure followed, resulting in the qualification and certification against AWS A5.36 – the specification for FCAW and MCAW electrodes – of ARCAL™ Force in combination with Air Liquide's Ultra-Arc™ E71T1 flux-cored wire for high strength applications.

"Our qualified High Strength Combination offer with the ER100-S wire is now gaining momentum with Air Liquide customers, who are becoming more willing to look beyond our gas offering and towards the basket of goods Air Liquide can offer," says Ashley, adding that combined product development is also proceeding, starting with stainless steel applications and wires that will be qualified in combination with ARCAL™ Chrome.

When asked why Air Liquide chose to partner with SAIW for this work, Ashley points out that Air Liquide has long been a Corporate Member of the Institute and SAIW is one of Air Liquide's long standing customers. "Also, though, SAIW has one of the few ISO 17025-accredited Test Laboratories in South Africa and the one most dedicated to and knowledgeable about welding. SAIW has a full turnkey welding offering: it has the qualified welders and welding equipment, NDT specialists, the mechanical and chemical testing equipment and the technical



SAIW qualified welding instructor, Dennis Bell, prepares a weld coupon for qualifying Air Liquid's ARCAL™ Force High Strength consumable combination certification of ARCAL™ Force shielding gas with ER100-S wire from Air Liquide's Ultra-Arc™ range.

services consultants to credibly validate test results," he says.

Zichawo adds: "We are currently accredited in four testing methods: tensile, impact, bend and Vickers hardness testing. Our intention is to extend the scope of our testing laboratory to include macro examination. We will then expand the chemical analysis service and accredit our hydrogen analysis offering," he says.

"We already do a lot of welder qualifications, welding consumable testing and welding procedure development – and we also have the high-end expertise to do failure investigations.

"The SAIW has qualified welding personnel available at every level to visit any fabrication site to resolve problems, or to identify opportunities for improvements," Zichawo concludes. ■



ARCAL™ Force High Strength is now listed on a single data sheet as a merged single offer from Air Liquide.

Typical chemical properties

	C	Si	Mn	P	S	Cr	Mo	Ni	V	Cu	Fe
Result	0.078	0.58	1.52	0.005	≤0.005	0.38	≤0.01	<0.01	0.037	0.15	Bal

Typical tensile properties

	Temp. (°C)	0.2% YS (Mpa)	UTS (Mpa)	%EL	Type of fracture
As welded (AW)	23	615	690	32	Ductile

A snapshot of the mechanical and tensile results of the ARCAL Force gas and Ultra-Arc™ ER100-S wire combination as tested and verified by SAIW's ISO 17025 accredited independent laboratory.