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Hydra-Arc, initially established in 1987 to source and supply welding and maintenance skills for Sasol shutdowns, has now established Sky-Hill Heavy Engineering, a facility for the fabrication of pressure vessels, heat exchangers, piping spools, structural steel and mechanical installations.

SA fabrication specialist looks to the global market

Originally founded by Jose Maciel in 1987 to source and supply artisans to the petrochemical industry in the Secunda area to satisfy the project and shutdown needs of local plants, Hydra-Arc has its roots in identifying and training skilled people from all over the country. Hydra-Arc began by creating a database of locally skilled and qualified people for use during maintenance shutdowns. This work continues today via Jomele Labour Hire and Placements, which recruits artisans for placement within the Group and on client sites for the duration of project or maintenance contracts.

In 2002, realising the importance of skills for the future of the South African fabrication industry, Maciel established the Jose Maciel Welding Academy. This has evolved into the Mshiniwami Training 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.

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

Maintenance and shutdown expertise

Today, Hydra-Arc is a group of companies that embrace its expanded suite of services. As well as Jomele and Mshiniwami on the personnel side, the Group began to use its skills and other assets to offer direct maintenance services in the early 2000s. These services, which include the MEIP (mechanical, piping, electrical & instrumentation-subcontracted) side of plant construction, are now offered under the HydraArc name and extend from overall plant maintenance shutdown management and turnaround services to the execution of specific vessel repair, piping replacement, mechanical overhauls, high-pressure cleaning (subcontracted) and routine plant and equipment servicing and new fabrication of pressure equipment.

Regular maintenance and refurbishment expertise includes: maintenance of gassifiers – jacket replacements, pressure vessel repair and the replacement of raw gas outlet nozzles; day to day and maintenance shutdown work on the oxygen plant, which consist of aluminium welding and stainless steel heat exchangers, pressure vessels and cooling boxes; continuous boiler maintenance – structural, boiler tubing and burner repairs; structural and mechanical maintenance on the NATSIF processing plant; and service maintenance on the water purifying plant.

The Ashlock refurbishment facility dominating the front end of Bay 1 at Sky-Hill, has been refurbishing these for nearly six years. These conical vessels are subject to high temperature erosive wear and are continuously being removed from service and refurbished. Bay 1 of Hydra-Arc's Sky-Hill facility has been fitted with purpose-designed systems to machine the internal surface back to sound metal and to re-clad the inner surface to its original thickness. The submerged-arc process is used with twin-wire Lincoln 1000 ac/dc power sources. The manipulators are most impressive, though, consisting of rotators with a capacity of 50 t, each with an internal boom system that is synchronised to deposit a spiral weld of equal thickness and heat input across the varying diameter of the conical vessel.

Bay 1 of this the facility, with two 45 t and two 80t overhead cranes at an under hook height of 9.1 m, is 430 m long and has 12 600 m² under roof. It is primarily used for maintenance and refurbishment projects of existing equipment including: pressure vessels; heat exchangers; piping; and storage tanks. At the end of the bay are a 9×9×15 m heat treatment furnace and sand blasting and painting booth.

Bay 2 of Hydra-Arc's Sky-Hill fabrication facility is also used for refurbishment/maintenance work, but it also accommodates new fabrication projects, mostly on a smaller scale or those that require more exotic materials. Also having a bay length is 430m, Bay 2 has three 20 t cranes under a hook height of 8.0 m. Current work in Bay 2 includes the ongoing construction of water tanks for provincial governments around South Africa. These are made in 3CR12 ferritic stainless steel and we have a developed modular construction that enables them to be easily transported to site, rapidly assembled and welded. We can also supply the tanks in four different volumes, 200 kℓ, 400 kℓ, 600 kℓ and 800 kℓ, simply by adding modular shells between the base and the cap," he says, adding that, "with a design life of 100 years, these tanks will outlast all traditional water tanks including concrete tanks.

Sky-Hill Heavy Engineering

More than half of the Hydra-Arc Group's Sky-Hill facility is dedicate to new fabrication work, which is at the heart of the company's future strategy.

Most notable on the facilities' manufacturing reference list are five propylene storage vessels called bullets that were manufactured in 2013. These vessels, with a mass of over 446 t each, are 59.09 m long with an internal diameter of 6.0 m and a wall thickness of between 45 and 50 mm – and after manufacture, they were heat treated as a single piece in a one-of-a-kind heat treatment furnace 66m long. This was the largest vessel fabrication project ever undertaken by a South African company.

Current work also includes the fabrication of modern plant modules for the petrochemical industries. In the workshop at the moment are the OBL (outside battery limits) modules for Sasol's Coal Tar Filtration East (CTFE) project. This project involves a novel approach to plant design and construction. The whole plant is broken into interconnectable modules, which maximises the amount of factory-based fabrication and minimises onsite construction time. The idea is that each module is fabricated to include all of its equipment, vessels, piping, instrumentation and supporting structures. Then, once the site foundations have been prepared, the modules are simply delivered to site and coupled up to form a functional plant, but these are not skid-based systems. One of the soon to be completed CTFE modules has a mass of over 400 t and includes two pressure vessels and all of the interconnecting piping, flanges and support structures. And the current CTFE plant being built consists of 24 individual modules, which will all be fabricated in this facility. This is the first time a plant has ever been constructed in this way in South Africa.

The bullets and modules were built in Bay 3 of the Sky-Hill facility. With the same length and area as the adjacent bays, Bay 3 is exclusively reserved for new fabrication projects of small to very large scale components in any material type: pressure vessels (drums, columns, thin/heavy wall vessels); heat exchangers (fixed/floating tubesheets, U-tube HEX's, channel/bonnet types); larger bore piping prefabrication; and supported flat-bottom-type storage tanks.

Maximum lifting capacity totalling 5 t under a 9.3 m hook height is provided for by three 160 t overhead cranes with 20 t auxiliaries – and the bay has an additional two 45 t cranes. Heavy submerged arc welding is enabled by five 1 000A submerged arc welding machines; six column and boom systems; along with five driven and 28 support rotators giving a capacity to rotate five 200t weldments.

The company's massive 9×9×66 m heat treatment furnace sits at the end of Bay 3. Soon to be partitioned, this fully automated, gas-scrubber type furnace enables efficient onsite heat treatment of completed projects of almost any size.

With a view to further expansion and to capitalise on its successes in fabricating very large components, Bay 4 is currently under construction, with completion planned for before the end of 2015. "This Bay has been designed for mega-scale projects, such as heavy-walled, large diameter pressure vessels and the large modularised plant fabrications," says Matyja.

With a length: 550 m and a 25 m width, the hook height has been raised to 19 m and the total lifting capacity to 1 500 t. A fully equipped, state of the art, machine shop will also form part of the bay, along with an extended PWHT furnace (12×12×80 m).

In addition to the four bays at the facility, the facility has plasma and oxyfuel plate preparation shop and a dedicated pipe shop, which includes four semi-automatic pipe-welding machines.

The Sky-Hill site consists of, in total, 100 000 m² of fabrication space, of which 75 000 m² is under roof. Support utilities include: Drinking and pressure test water purified to below 50 ppm of particulate; a 1 000 kVA grid-connected electricity supply, supplemented by a total of 3 000 kVA via back-up and standby generators; and 30 t of LPG/butane bulk storage for the heat treatment furnaces. Bulk oxygen, argon and acetylene for welding and pre-heating are also available throughout the facility.

Welding and quality

Underpinning the group's success is Hydra-Arc's commitment to excellence with respect to quality, safety and business practices. "We are a Level 2 B-BBEE contributor with a NOSA 5-Star safety rating and ISO 9001, ISO 3834-2.

On the international front, the company has also won several awards: The Arch of Europe Award – Frankfurt, ESQR Best Quality Leadership award – Brussels, International Quality Crown Award – London, ESQR Quality Leadership Award – Las Vegas, ESQR Quality achievement award – London, ISLQ Diamond Award – Paris

Hydra Arc has ISO 3834 part 2 certified for the past six years and in our annual audit cycles, we have had no findings for the past three years. As a fabricator, welding processes are critical to the end quality of our products and ISO 3834 provides an ideal vehicle for building quality into a component from the first step to the last. This raises quality standards and gives clients' confidence that all our work is in line with the highest international standards. It also enables us to compete globally on an equal footing, most of our work also has to comply with client specifications, such as Sasol, which insist on the most stringent quality requirements in the industry.

ISO 3834 offers business sustainability going forward, but Hydra Arc is currently busy applying for ASME Certifications Marks (ASME VIII Div 1 and Div 2) as well as the CE marking, which falls under the European PED H1 directive. Once we are certified as compliant with these, we can use the CE stamp or the U-stamp on any of our pressure equipment. These two global certifications will allow us to export into Europe and the US and for our equipment to be used on any European- or US-built plant anywhere in the world.

The Hydra-Arc Group is a proudly South African business that has proved that, by developing local skills and paying attention to quality and on-time delivery, it is possible to be successful and competitive in this challenging industry. By taking on the global market, we fully intend to lead South Africa into a better future, one with better job prospects for South Africans and a stronger local economy.