

An introduction to TIG welding/GTAW

Air Products' Welding Specialist, Sean Young talks about the basic requirements of the Tungsten Inert Gas (TIG) welding process – also known as Gas Tungsten Arc Welding (GTAW) – and highlights some of the uses and benefits of this process.

“Welding is a combination of skills, experience and knowledge of the equipment, gases and consumables required for the different processes,” begins Sean Young, Welding Specialist for Air Products in South Africa. “At Air Products, he adds, “we take pride in the quality of our products as well as the technical expertise and guidance we can provide our customers.”

Welded fabrication involves two or more parts of a material being fused together by using pressure, heat or both pressure and

heat. This creates a welded joint or weldment. Each welding process used requires specialised skills, and a whole component or fabrication can be compromised if incorrect gases are used.

During a live demonstration in Air Products South Africa's Welding Laboratory in Kempton Park, Young explains that TIG/GTAW is a process that uses a non-consumable electrode to fuse metallic material, so the different parts of a weldment become permanently connected.

“The range of materials we can weld us-



Air Products Welding Specialist, Sean Young, demonstrates the TIG/GTAW welding process.



Thermamax PRO-TIG 200 AC/DC welding inverter

ing this process starts from mild and stainless steels, which are welded using direct current from a welding machine and a torch with a tungsten electrode connected to the negative welding cable. And, by switching over to using alternating current from the welding machine, aluminium and copper can also be welded using the TIG/GMAW process,” he says.

Highlighting the best shielding gases, he says pure argon is commonly used for welding mild and stainless steels, as well as for thinner section aluminium and copper. “For thicknesses greater than 3.0 mm in aluminium and copper, though, we start to look at using argon-helium gas mixtures to increase the heat being put onto the weld joint. This is because of the high thermal conductivity of these materials, which tends to carry the heat away from where it is needed.

“Adding helium to a gas shielding mixture raises the ionisation potential of the shielding gas, which results in a hotter arc for the same amperage. This helps to ensure that enough heat stays in the weld joint to guarantee proper fusion,” Young explains.

Describing the requirements of the tungsten electrodes needed for TIG/GTAW,

he says that the standard electrode for welding mild steel is a 1.2% thoriated tungsten – with a red tip – while for aluminium or copper in ac current mode, a zirconium impregnated tungsten electrode – with a white tip – is preferred.

Turning attention back to the shielding gas requirements, he says the gas flow rate required depends on the size of the ceramic shroud being used on the torch. “The shrouds have little numbers on them. The one I am welding with is a number six and it needs a shielding gas flow rate of between 6.0 and 9.0 nine l/min for ideal shielding,” he notes.

Why such low flow? “To protect the weld from atmospheric contamination it is very important to have laminar flow of the shielding gas. If we raise the flow too high, to say 15 l/min, we run the risk of turbulence and vortices developing, which will suck air into the gas stream and cause porosity.

On the other hands, a flow rate that is too low might cause the shielding gas to be blown away by a slight breeze, which would also cause contamination of the weld,” he explains, demonstrating how to connect a regulator and flowmeter onto a 200 bar argon gas cylinder, before carefully opening the gas valve, while checking that the con-



The Thermamax PRO-TIG 200 AC/DC welding inverter is a versatile machine that can accommodate aluminium and copper as well as mild and stainless steels.

nection and the piping are sealing properly.

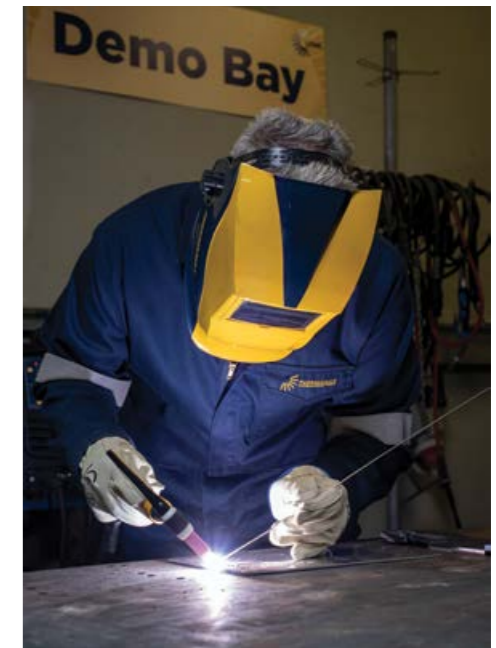
“I am using a Thermamax PRO-TIG 200 AC/DC welding inverter, which is a versatile machine that can accommodate aluminium and copper as well as mild and stainless steels. Currently it is set for stainless steel or mild steel welding using electrode negative direct current.

“I am using a thoriated electrode with a sharp point and will join two pieces of steel strip along their edges,” he adds.

The welding arc is ignited using a high frequency (HF) start function and the Thermamax PRO TIG 200 M ac/dc machine has foot control so the welder can regulate the arc current and heat. “The more you press the pedal, the more heat you have. I am going to fuse these two strips of mild steel without using any additional filler material. This is known as autogenous welding,” he says.

Following the demonstration, Young changes to using ac power from the power source to demonstrate aluminium welding. “We also have to change the tungsten electrode to a zirconiated one and, when I start to weld, you will hear a change in the frequency of the machine due to the ac power being applied,” he says, adding that the positive half cycle of ac current helps to break up the oxide layer on the surface of the aluminium, which would prevent proper puddle fluidity and weld fusion if not removed.

“The TIG/GMAW process is very versatile and can be used to weld a large variety of materials in different settings. On the negative side, as the flow rate is low a slight draft will blow away the shielding gas, and highly skilled welders are needed to get good results. The welding equipment itself is quite expensive and the process is relatively slow



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For TIG welding using a number six shroud a very low shielding gas flow rate of between 6.0 and 9.0 nine l/min is ideal shielding, says Young.

compared to other processes.

“But for use indoors or in well protected environments where we can close the doors and windows, and where high-quality welds are required, this process is ideal.

“We at Air Products South Africa and our subsidiary Unique Welding are proud of the quality of our products and services. We are welding specialists in South Africa, and if you have any technical queries with regards to the TIG/GMAW welding process, the shielding gases we offer, or the equipment and consumables available from Unique Welding, please contact me directly at Air Products South Africa or through one of our distributorships nationwide,” Young concludes.

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